Undercounting Controversies in South African Censuses

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Abstract

South Africa's last three censuses have been controversial due to high undercounting. The accuracy of Post Enumeration Survey, undercount estimates and adjusted counts derived were heavily contested. Within this discourse, our study investigated which counts between adjusted and unadjusted were better estimates of South Africa's actual population. Data were obtained from the country's last three censuses, Mortpark population projections, and Agincourt Health and Demographic Surveillance Site. We compared census counts against respective counts from the outlined data sources. We found that adjusted counts were better estimates of the country's actual population relative to unadjusted counts. This indicates accuracy of Post Enumeration Survey, its undercount estimates and adjusted counts.

Key words: Undercounting, Controversies, Census, Counts, South Africa

Introduction

South Africa's last three censuses recorded high undercount estimates of 10.7%, 17%, and 14.6% for censuses 1996, 2001, and 2011 respectively. The Post Enumeration Survey (PES) was used for estimating, and adjusting for the undercount. However, the high undercount estimates recorded became a source of controversies around these censuses. The controversies were around the adjustment procedures and outcomes of these censuses. Firstly, researchers raised concern on the integrity of the PES in estimating the undercount, and they were of the opinion that the method ushers further bias (Moultrie and Dorrington, 2012). In particular, such researchers have raised concern over the sample sizes used when conducting the PESs. They argue that the sample sizes are too small, and this lead to some statistical uncertainty on the extent of undercounting. The boardroom squabbles at Statstistics South Africa (Statssa) over disagreements on undercount estimates arrived at for census 2011 have strengthened such views. Two top officials at the organization are believed to have insisted that the undercount was 18.3% instead of the 14.6% estimate that was finally published (Ndenze, 2013). A scenario believed to have led to their dismissal. Claims are that Pali Lehohla, the Statistician General had expected a 2% undercount, and he could not agree with the high estimates the two officials presented to him. However the Statistician General argued that the two officials were dismissed for incompetence after presenting wrong results, due to their methodological and computing errors (City Press, 2012). Furthermore other researchers have also questioned the high undercount estimates which contradict the big budgets set for these censuses (Schultz, 2013; Gernertzky, 2012).

The adjusted counts, which are directly linked to undercount estimates drawn from PES, equally became controversial (De Wet, 2012), with some researchers questioning their accuracy (Moultie and Dorrington, 2012). The 1996 adjusted census counts have been criticized as having underestimated children Under 5 years and young male adults, as well as over estimating females adults (Dorrington, 1999). On the other hand, the counts from census 2001 have been criticized for both underestimating children under 5 years and about 400 000 whites (Dorrington, 2002). However, others have countered the latter argument by insisting on the "migration theory'. They argued that these whites had not been underestimated but rather had left the country (Centre for Development and Enterprise, 1999). This is possible as some whites may have felt insecure with a new political dispensation that was ushered in 1994. Census 2011's results have been largely criticized as having been rushed and published prematurely and hence the counts were largely inaccurate (Moultrie and Dorrington, 2012).

For instance as the two researchers pointed out, increase in fertility suggested in census 2011, after numerous decades of fertility decline in South Africa indicated errors in these counts. However, another demographer, Eric Ujo insisted that the 2011 census' counts were a better estimation of reality than models now proven incorrect (De Wet, 2012).

Furthermore Moultrie (2012) noted that population estimates for provinces were also largely inaccurate, because they could not be reconciled with data on births, deaths and migration. This was however countered by Griffith Feeney who stated that independent data, drawn from sources including births and deaths confirm patterns depicted in census 2011.The Statistician General argued that the two demographers Moultrie and Dorrington missed the facts since they decided to exclude themselves from the rest of the panel working on census results, at the processing centre. He noted that the two chose to work from their base in Cape Town. Others have been critical of the suggested increase of white women population aged 20-24 which they felt was untraceable from previous censuses (De Wet, 2012). For example, members of the public also expressed their views through socials media on these issues. Some mockingly twitted. "*Invasion of young white women HAHAHA*" (rnoliphant). Another one twitted "The odd baby boom and the strange influx of young white women" (sarahemilyduff). The statements were said in reference to increase in fertility, and population of young white women suggested in census 2011.

The Mybroadband newspaper (2012) has also questioned another outcome from census 2011, which indicated that more than 15 000 South Africans were aged 100 years and above. This figure is believed to be high for a developing country whose population is just about 50 000 000 people. The criticism has been based on the fact that even a developed country like the United Kingdoms with a population close to the same figure, and has higher life expectancy, but still does not have people aged 100 years and above who are as much as this. However, Statistics Council member Professor Jacky Galpin of the University of Witwatersrand argued that these census counts were consistent with findings from PES (Mybroadband, 2012)

Contributions of researchers in this discourse on controversies around these censuses have therefore largely been two sided. On one side some researchers have argued against reliability of procedures and outcomes from these censuses. Yet on the other side, some have defended these censuses as credible. We therefore noted a gap that has remained unaddressed by researchers who have contributed in this discourse. This is; which census counts between adjusted and unadjusted closely estimate the actual population count? We believe it is very

vital to clarify on this matter. As the Statistician General noted, wrong figures in a country that allocated resources based on population numbers, does not only lead to unfairness and inequity, but also has the potential to create chaos, and instability (Ndenze, 2012). We were aware that in most cases actual counts of any given population remain unknown, as censuses and other data sources can only provide an estimate (Moutrie and Dorrington, 2012). Hence, we investigate which census counts between adjusted and unadjusted closely estimated actual population counts of South Africa using counts from other data sources as proxy.

We therefore treated counts from other data sets as our gold standard on which to compare both the adjusted and unadjusted censuses counts. In particular, we treated Agincourt HDSS counts as more accurate and reliable. Firstly the data is collected at a small areas level, and secondly the counts are regularly updated. Both practices ensure better accuracy of counts obtained. Our argument was that; if adjusted counts closely estimated the counts from other sources of data relative to unadjusted counts, this largely confirms accuracy of PES. In turn accuracy of PES also confirms accuracy of undercounting estimates and respective adjusted counts. For, undercount estimates were obtained using PES, and in turn adjusted counts were arrived at using adjustment factors drawn from the undercount estimates.

Data Sources

Adjusted 10% Census samples

The 10% samples for censuses 1996, 2001, and 2011 were used to provide estimated counts for respective censuses at national level. Coverage error i.e. either undercount or over count was measured using Post Enumeration Survey (PES). The PES replicates the census in sampled Enumeration Areas (EAs), and the assumption is that the two are independent of each other. The percentages of population missed in both PES and census are used to arrive at the undercount estimate, which in turn is used to create an adjustment factor i.e. a reciprocal of the undercount rate. The adjustment factor is multiplied with the enumerated count to arrive at adjusted census count. Only 10% sample of the adjusted counts are availed by Statistics South Africa (StatsSA) for public use, and the data is available on their website. The 100% census data is only available in SuperCross form, where the analyses are restricted to tabulations.

Agincourt Health and Demographic Surveillance Site's counts

Also Agincourt Health and Demographic Surveillance Site' data (HDSS) was used. This is a longitudinal population registration system in South Africa. Its base census was conducted in 1992 from 20 villages in the rural district of Bushbuckridge, Mpumalanga Province. It was established mainly for the purpose of understanding health, population and social dynamics among rural populations in South Africa. The villages under surveillance have increased over time e.g. to 22 and 28 by years 2001 and 2011 respectively. Consequently population has also increased over time. The population composition is largely made of natives and Mozambican migrants. Data is annually updated, through censuses conducted each year, and very high response rate have been reported during each update. For instance in 2011 only two households refused to participate. Another type of population characteristic of this site is temporary migrants. These are labor migrants working elsewhere but maintaining their rural ties; specifically these are people who stay in their rural homes for less than 6 months a year.

Mortpark projected counts

Thirdly, data also came from Mortpark population projections. The projection provided counts at national level. Mortpark was designed by the United Nations, and provides various categories of population projections suitable for countries of varying fertility, mortality and migration levels. The counts projected were firstly for 2001 using 1996 census as the base population, and for 2011 using census 2001 as the base population.

Reconstruction of unadjusted counts

Firstly 10% samples from respective censuses were weighted to estimate actual censuses' counts. Estimates of enumerated counts were then reconstructed from the former counts. The adjustment factor was used to obtain the proportion of counts enumerated. This proportion was multiplied against respective adjusted counts to produce the estimates of enumerated counts. The reconstructed counts are referred to as unadjusted counts in this study, and census counts refer to both adjusted and unadjusted counts. The reconstruction of these counts was necessitated by the fact that Statssa does not avail enumerated data for public use.

Full adjusted censuses' counts for area covered by Agincourt HDSS

Actual counts from each of South Africa's three censuses for the area covered by Agincourt HDSS area were retrieved from SuperCross using ArcGIS. We overlaid the digital boundary

of Agincourt HDSS on the area covered by the surveillance site. Secondly, we then overlaid Small Areas, whose boundaries fell within the area covered by the surveillance site, and these contained South Africa 100% census counts. For 1996 we used Enumeration Areas as the census did not use Small Areas. Finally we overlaid Agincourt HDSS villages' boundaries coinciding with Small Areas boundaries. The overlays matched Small Areas (in the cases of 2001 and 2011 censuses) and Enumeration Areas (in the case of 1996 census) with coinciding villages from Agincourt HDSS. The villages contained Agincourt HDSS counts. We then extracted counts for the respective censuses for Small Areas and Enumeration Areas whose boundaries had coincided with Agincourt HDSS' villages.

Analysis Plan

We compared 2001 and 2011 censuses' counts from 10% samples with respective counts from Mortapak population projections, at national level. For comparisons at small area's level, firstly temporary migrants were excluded from Agincourt HDSS counts to make them comparable to census counts. The methodology for South African censuses differed with that for Agincourt HDSS in that the former excluded temporary migrants, whereas the latter included them. We then compared the three censuses 'counts with respective counts from Agincourt HDSS. The compared counts were disaggregated by age and sex.

Results

Comparison of census and projected counts

Adjusted counts for both males and females were very close to projected counts for all age groups. For males, the difference between adjusted counts ad projected counts were less than 3% for most age groups, for 2001 comparisons. Yet for 2011 comparisons, only the open age group had a double digit difference. For females' 2001 comparisons, widest differences between adjusted and projected counts were for age groups 80 years and above, 0-4 years, and 75-79 years respectively. These were also in double digits. However, the differences for other age groups between these were also generally minor. The difference between total adjusted counts compared to total projected counts for males was 1.17% for 2001 comparisons and 0.82% for 2011 comparisons. As for the female counts, the differences were 3.17% and 0.4% respectively.

However, wider differences were noted between unadjusted counts and projected counts for comparisons of both males' and females' counts. For males 2001 comparisons, except for age

groups, 5-9 years 80 years and above, compared counts for the rest of the age groups had differences that were above double digit. Also for 2001 comparisons of the differences between unadjusted and projected counts for females were also generally wider across age groups. The same patterns were noted for both males and females from the 2011 comparisons. The difference between the total counts for unadjusted and projected, for 2001 comparisons were 17.4% for males and 14.4% for females. For 2011 comparisons they were and 13.6% and 12.8% respectively. [Table 1 & 2 here]

Comparison of undercount estimates

The comparisons of overall undercount estimates from PES against those from projections for males, females, and the combined sexes were almost the same. For instance, the widest difference was just 3.3% for males 2011. Yet for females' comparisons, the undercount estimates missed each other with only 0.6%. [Table 2 here]

Matching of small areas and village boundaries for Agincourt HDSS

The 1996 matching of enumeration areas' and villages' boundaries for the area covered by Agincourt HDSS produced two scenarios. Firstly, there were instances when enumeration areas' boundaries overlapped coinciding villages' boundaries. Such a scenario should have inflated 1996 adjusted census counts relative to respective counts from Agincourt HDSS. Secondly, there were also instances when village boundaries overlapped coinciding small areas boundaries. This scenario should have inflated Agincourt HDSS counts relative to respective adjusted census counts for 1996. The matchings of small areas' and villages' boundaries for both 2001 and 2011 mainly resulted in a scenario where the former's boundaries overlapped boundaries of the latter. This should also have led to inflating of adjusted census counts relative to respective counts from Agincourt HDSS. [Fig 1 here]

Comaprison of census and Agincourt HDSS counts.

Comaprisons of counts for males by age groups for 1996, 2001, and 2011 indicated that adjusted counts were close to Agincourt HDSS counts than unadjusted counts. For the 1996 comparisons, the only age groups when uandjsuted census counts where closer Agincourt counts than adjusted counts were for age groups 5-9, 10-14, 65-69, 70-74, and 75-79 years. For 2001 comparisons, only four of the age groups also had unadjusted counts being closer to Agincourt HDSS counts than adjsuted counts. The 2011 comaparisons had a substantial number of the age groups indicating that uandjsuted counts were closer to Agincourt HDSS

than adjusted counts i.e.age groups 20-24, to 70-74 years. However, just like in the 1996 and 2001 comparisons males total counts from adjusted census data were closer to total counts from Agincourt HDSS data relative to counts from unadjusted census data. Comparisons for females' counts also indicated same patterns observed among males comparison. Adjusted census counts were closer to respective Agincourt HDSS counts than unadjusted counts, for most age groups. [Tables 2 & 3 here]

Distribution of counts by age groups

The distribution of counts by age groups for males' 1996 comparisons indicated that adjusted and unadjusted census counts were much closer to each other than to Agincourt HDSS. Between the two, adjusted counts were however closer to Agincourt HDSS counts compared to unadjusted counts. For females, adjusted census counts were generally closer to Agincourt HDSS counts than what was observed from males. Again unadjusted counts were further away from Agincourt HDSS counts compared to adjusted counts, for most age groups. The distribution of counts for 2001 for both males and females was clear on that adjusted counts were almost the same with respective counts from Agincourt HDSS, compared to unadjusted counts. The 2011 comparisons also indicated that adjusted counts were closer to Agincourt HDSS counts compared to unadjusted counts. This trend was particularly clearer from the the comparisons of females' counts. [Figs 1 & 2 here]

Comparisons of Population Age sex structures

The 1996 population pyramids for adjusted and unadjusted census counts were both similar to Agincourt HDSS population pyramid. The two population pyramids from the census counts just like the Agincourt HDDS population pyramid indicated; a decline in fertility, significant reduction of population counts after age group 20-24 years, and that there a more people aged 65-69 years compared to those aged 60-64 and 70-74 years. However, the two pyramids from census counts share a further similarity with each that is not evident from Agincourt HDSS's. The two indicate highly depreciating males' counts relative to respective females' counts from age group 25-29 years onwards, and this is not well pronounced in the Agincourt HDSS population pyramid. The three population pyramids for 2001 are very similar to each in virtually all the characteristics. For 2011, the adjusted population pyramid is more similar to Agincourt HDSS population pyramid than the unadjusted one. The population pyramids for adjusted census counts and Agincourt HDSS counts are different from the one based on unadjusted census counts in that they both suggest a rise in fertility.

Yet, the population pyramid from unadjusted counts suggest decline in fertility [Figs 4, 5 & 6 here]

Discussion

The objective of this study was to investigate which census counts between adjusted and unadjusted closely estimated counts from other data sources. We treated counts from other data sources as our standard measure for estimating actual population counts for South Africa. For, the true counts for any given population are hardly known (Anderson, 2004). We find this approach making a vital contribution in this discourse of undercounting controversies in these censuses. Firstly because it is an unpursued research gap, and secondly because users of census data need to be informed of which data between the two is more reliable. The criticisms, and counter criticisms around PES, its undercount estimates and adjusted counts had created uncertainties as to what is more ideal to adjust or not to adjust. This is a predicament similar to one in the United States of America were census stakeholders have failed to agree on whether to adjust census counts or to use unadjusted counts, often leading to protracted legal battles (Schirm, 1991).This is because census counts are used by governments to plan and ensure that expectations of the general population are adequately addressed.

This paper made a major contribution towards addressing the research gap, as its findings were clear as to which census counts where more reliable for use. Precisely the findings were that; adjusted counts were very close to respective counts obtained from other data sources, yet unadjusted counts were generally further away. In particular, adjusted counts were almost exactly the same with counts from Mortpark population projections. Indirectly, the similarities between the counts from the two data sources were further confirmed by their undercount estimates which also closely approximated each other. With regards to comparisons of census counts against Agincourt HDSS counts, again adjusted counts were generally closer than unadjusted counts. This was particularly evident among age groups between 15 and 60 years, for both sexes. There were exceptional cases where unadjusted counts were closer to Agincourt HDSS counts than adjusted counts; e.g. males' counts for age groups within the range of 30 to 59 years, for 2011comparison. But still this could have been due to such internal inconsistences like age misreporting. This is likely so because the totals for adjusted counts for either males or females were always close to Agincourt HDSS counts compared to respective unadjusted counts.

A further finding was that at old ages i.e. 60 years and above, both adjusted and unadjusted counts equally approximated counts from Agincourt HDSS. This was also suggested by findings from the comparisons of censuses counts against projected counts. Suggestions are therefore that at old ages under enumeration is lower in these censuses. This finding was consistent with those observed from other studies (Anderson, 2004; O' Hare, 2009). This means, at old ages adjusting or not adjusting for census undercount seems not to make any difference.

With regards to the discourse at the center of this research, our findings suggested that the PES was largely an accuracy method of estimating undercounting, as well as of adjusting for the error. There is a direct link between PES results, undercount estimates, and adjusted counts. The PES is used to measure undercount estimates. To carter for missed people, an adjustment factor is computed from the undercount rate. This adjustment factor is applied on enumerated data to correct for the undercount. Therefore, since part of our findings were that adjusted counts were closer estimates of counts from other sources compared to unadjusted data, this largely confirmed accuracy and reliability of PES. In turn this also largely confirmed accuracy of undercount estimates and their adjusted counts.

Conclusion

We conclude that it was better to adjust enumerated counts from South Africa's last three censuses than not to adjust. The conclusion is drawn from findings that adjusted counts closely approximated counts from other data sources compared to unadjusted counts. We also conclude that adjustment of counts at old ages did not make any significant difference. At later ages both adjusted and unadjusted counts were almost the same with counts from Agincourt HDSS as well as counts from projections. With regards to the discourse underpinning our study; i.e. undercounting controversies in South African census; our findings largely confirm views from researchers who argue that the processes and outcomes from these censuses are largely accurate.

References

Anderson, B, A. (2004). "Undercount in China's 2000 census in comparative perspective."

City Press Weekly Newspaper (2012) "2011 census row grows."
www.citypress.co.za/news/2011.census-row-grows

Center for Development and Enterprises (1999)

De Wet, P (2012) **"**Is Census 2011 accurate? Still depends on who you ask" Mail & Guardian http://mg.co.za/article/2012-11-01-is-census-2011-accurate-still-depends-who-you-ask 28-09-2015

Dorrington, R (2002) "Did they jump or were they pushed? An investigation into the apparent undercount of whites in 1996 South African census." SA Journal of Demography, 8 (1), p 37-46

Dorrington, R. (1999) "To count or to model that is not the question: Some possible deficiencies with 1996 census results." University of Cape Town

Gernetzky, K (2012) "Census: Undercount still double digit." Mail & Guardian

Schultz, D (2013) "Was census 2011 successful?" Mail & Guardian

Mybroadband (2012) "15000 South African more than 100 years old" http://mybroadband.co.za/vb/content.php/5558-15-000-South-African-more-10...15-06-2013

Moultrie, T and Dorrington R. (2012) "The census: Some more questions."

Ndenze, B (2013) "Census: why two were fired" IOL News http://www.iol.co.za/news/south-africa/census-why-two-were-fired-1.1556165#.VgmIt0Ypp2A 28-09-2015

O' Hare, W, P. (2009) "Why are young children missed so often in the census?" The Annie E. Casey Foundation, Kids count working paper: p 1-15

Schirm, A, L. (1991) "The effects of census undercount adjustment on congregational apportionment." The Journal of the American Statistical Association, Vol. 86, No. 414, p 526-541.

Tables and Graphs

Table 1 Males' Mortpark projected and census counts

Age group	Projected (Proj) 2001	Adjusted (Adj) 2001	Unadjusted (Unadj) 2001	% Diff (Proj-Adj)	% Diff (Proj-Unadj)
0-4	2576368	2214369	1837926.27	14.1	28.7
5-9	2121494	2423906	2026385.416	-14.3	4.48
10-14	2300693	2510361	2103682.518	-9.11	8.57
15-19	2276139	2454284	2044418.572	-7.89	10.2
20-24	2011466	2100064	1631749.728	-4.4	18.9
25-29	1880342	1893200	1471016.4	-0.68	21.8
30-34	1642258	1596760	1253456.6	2.77	23.7
35-39	1435825	1438418	1129158.13	-0.18	21.3
40-44	1252592	1230423.1	965882.1335	1.77	22.9
45-49	993390	962657.87	787454.1377	3.09	20.7
50-54	770009	770704.03	630435.8965	-0.09	18.1
55-59	557036	551102.11	450801.526	1.07	19.1
60-64	431450	447549.3	366095.3274	-3.73	15.1
65-69	297386	305168.98	256647.1122	-2.61	13.7
70-74	238491	230192.45	193591.8505	3.48	18.8
75-79	134067	136967.29	115189.4909	-2.16	14.1
80+	118299	139578.25	117385.3083	-18	0.77
Total	21037305	21405705	17381276.42	-1.75	17.4

Age group	Projected (Proj) 2011	Adjusted (Adj) 2011	Unadjusted (Unadj) 2011	% Diff (Proj-Adj)	% Diff (Proj-Unadj)
0-4	2703556	2867584.9	2431711.995	-6.07	10.1
5-9	2423016	2425181	2151135.547	-0.09	11.2
10-14	2074582	2344275	2091093.3	-13	-0.8
15-19	2355025	2498572	2178754.784	-6.1	7.48
20-24	2473008	2694646	2349731.312	-8.96	4.98
25-29	2462557	2542681.7	2217218.442	-3.25	9.96
30-34	2124380	2036206	1643218.242	4.15	22.6
35-39	1877162	1709346.5	1379442.626	8.94	26.5
40-44	1544284	1402328	1131678.696	9.19	26.7
45-49	1351880	1195740	1017574.74	11.6	24.7
50-54	1121600	1011349	860657.999	9.83	23.3
55-59	842490	811949.96	690969.416	3.63	18
60-64	633820	612363.96	521121.73	3.38	17.8
65-69	412380	401548.2	356574.8016	2.62	13.5
70-74	289910	297144.509	263864.324	-2.5	8.98
75-79	159747	163690.73	145357.3682	-2.47	9.01
80+	133704	174182.94	154674.4507	-30.3	-16
Total	24983200	25188790.9	21584779.77	-0.82	13.6

Table 2 Females Mortpark projected and census counts

Age group	Projected (Proj) 2001	Adjusted (Adj) 2001	Unadjusted (Unadj) 2001	% Diff (Proj-Adj)	% Diff (Proj-Unadj)
0-4	2661248	2215008	1840671.648	16.77	30.8
5-9	2152354	2425994	2032982.972	-12.7	5.55
10-14	2301008	2541811	2135121.24	-10.5	7.21
15-19	2333691	2527782	2108170.188	-8.32	9.66
20-24	2109469	2189344	1766800.608	-3.79	16.2
25-29	2039131	2034172	1641576.804	0.243	19.5
30-34	1765191	1741231	1426068.189	1.357	19.2
35-39	1591068	1635554	1339518.726	-2.8	15.8
40-44	1346155	1376879	1127663.901	-2.28	16.2
45-49	1074626	1125861	949100.823	-4.77	11.7
50-54	831704	870990.94	734245.359	-4.72	11.7
55-59	630896	650859.78	548674.7962	-3.16	13
60-64	541570	622622.77	524870.9951	-15	3.08
65-69	473983	483069.23	415439.5378	-1.92	12.4
70-74	372964	396651.2	341120.032	-6.35	8.54
75-79	207343	231978.27	199501.3122	-11.9	3.78
80+	213367	293171.17	252127.2062	-37.4	-18
Total	22645766	23362979.1	19383654.34	-3.17	14.4

Age group	Projected (Proj) 2011	Adjusted (Adj) 2011	Unadjusted (Unadj) 2011	% Diff (Proj-Adj)	% Diff (Proj-Unadj)
0-4	2786569	2817867	2398004.817	-1.12	13.9
5-9	2523789	2394570	2119194.45	5.12	16
10-14	2096320	2250611	1996291.957	-7.36	4.77
15-19	2365610	2504905	2189286.97	-5.89	7.45
20-24	2506685	2679896	2342229.104	-6.91	6.56
25-29	2517076	2516635	2199538.99	0.02	12.6
30-34	2176850	1992804	1703847.42	8.46	21.7
35-39	1984577	1758420	1503449.1	11.4	24.2
40-44	1669206	1546291	1322078.805	7.36	20.8
45-49	1541761	1424543	1274965.985	7.60	17.3
50-54	1274931	1206940	1080211.3	5.33	15.3
55-59	1014969	985458.39	881985.2591	2.91	13.1
60-64	751621	773404.01	692196.589	-2.9	7.91
65-69	520820	556256.456	505637.1185	-6.8	2.92
70-74	438134	453343.42	412089.1688	-3.47	5.94
75-79	275563	317675.03	288766.6023	-15.3	-4.8
80+	137093	402149.69	365554.0682	-193	-167
Total	26681574	26581769.3	23275327.7	0.374	12.8

Table 2 Mortpark and PES undercount estimates

Census	Source	Undercount estimates (%)	% Difference
2001 Males	PES estimates	18.6	1.2
	Mort park projection estimates (1996-2001)	17.4	
2001 Females	PES estimates	16.9	2.5
	Mort park projection estimates (1996-2001)	14.4	
2001 Totals	PES estimates	17	1.2
	Mort park projection estimates (1996-2001)	15.8	
Males 2011	PES estimates	15.9	3.3
	Mort park projection estimates (2001-2011)	13.6	
Females 2011	PES estimates	13.4	0.6
	Mort park projection estimates (2001-2011)	12.8	
2011 Total	PES estimates	14.7	1.4
	Mort park projection estimates (2001-2011)	13.2	

Fig 1 Agincourt HDSS villages and Small Areas boundaries overlays

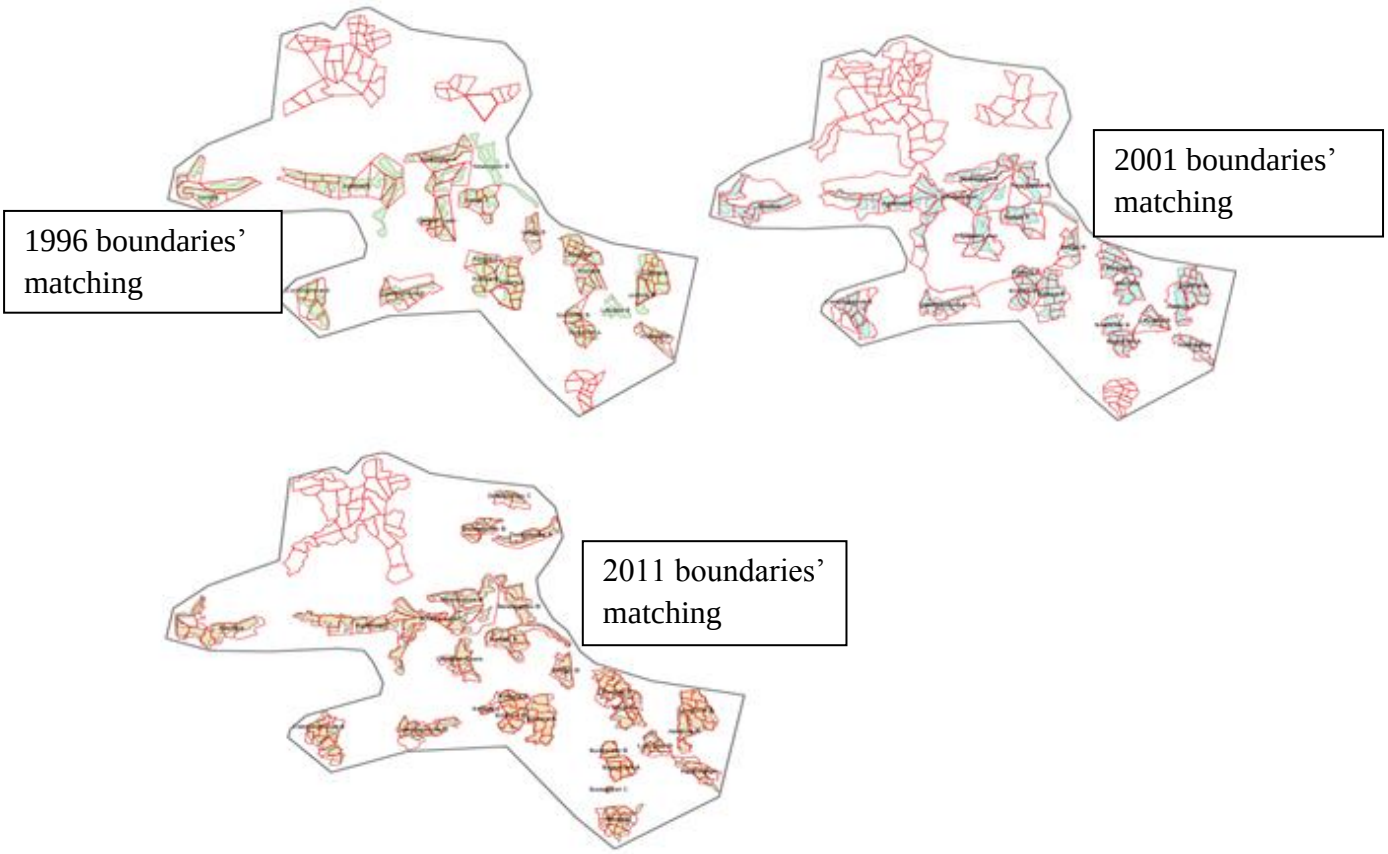


Table 4 Comparison of Agincourt HDSS and census counts, Males

Age grp	Agin HDSS 1996	Census Adjasted 1996	Census Unadjasted 1996	Differences	
				HDSS-Adj	HDSS-Unadj
0-4	4785	4724	4100	61	685
5-9	5148	5592	4999	-444	149
10-14	4513	4827	4359	-314	154
15-19	3880	3889	3492	-9	388
20-24	3136	2536	2201	600	935
25-29	2417	1453	1261	964	1156
30-34	2050	1053	930	997	1120
35-39	1526	809	714	717	812
40-44	1203	677	598	526	605
45-49	992	542	492	450	500
50-54	669	395	358	274	310
55-59	669	379	344	290	325
60-64	372	291	264	81	108
65-69	400	414	384	-14	16
70-74	272	295	274	-23	-2
75-79	239	269	250	-30	-11
80-84	82	86	80	-4	2
85+	62	59	55	3	7

Age grp	Agin HDSS 2001	Census Adjasted 2001	Census Unadjasted 2001	Differences	
				HDSS-Adj	HDSS-Unadj
0-4	4125	4135	3432	10	-693
5-9	4404	4759	3979	355	-426
10-14	4777	5267	4414	490	-363
15-19	3926	4248	3539	322	-387
20-24	2320	2417	1878	97	-442
25-29	1432	1444	1122	12	-310
30-34	1026	1111	872	85	-154
35-39	823	1057	830	234	7
40-44	557	608	477	51	-80
45-49	487	531	434	44	-53
50-54	432	470	384	38	-48
55-59	314	384	314	70	0
60-64	448	485	397	37	-51
65-69	251	272	227	21	-22
70-74	275	307	258	32	-17
75-79	166	178	150	12	-16
80-84	145	162	136	17	-9
85+	73	62	52.142	-11	-21

Age grp	Agin HDSS 2001	Census Adjasted 2001	Census Unadjasted 2001	Differences	
				HDSS-Adj	HDSS-Unadj
0-4	5466	5014	4252	-452	-1214
5-9	4929	4880	4329	-49	-600
10-14	4907	5123	4570	216	-337
15-19	4855	5058	4411	203	-444
20-24	3501	3754	3273	253	-226
25-29	1811	2275	1984	464	173
30-34	1260	1568	1265	308	5
35-39	948	1171	945	223	-3
40-44	810	996	804	186	-6
45-49	706	877	746	171	40
50-54	507	623	530	116	23
55-59	504	631	537	127	32
60-64	471	541	461	70	-11
65-69	341	383	340	42	-1
70-74	384	426	379	42	-6
75-79	168	165	147	-3	-22
80-84	169	172	153	3	-16
85+	143	125	111	-18	-32

Table 4 Comparison of Agincourt HDSS and census counts, Females

Age grp	Agin HDSS 1996	Census Adjasted 1996	Census Unadjasted 1996	Differences	
				HDSS-Adj	HDSS-Unadj
0-4	4757	4843	4208	-86	549
5-9	5074	5513	4951	-439	123
10-14	4573	4920	4438	-347	135
15-19	3686	4164	3739	-478	-53
20-24	3333	3193	2819	140	514
25-29	2709	2469	2180	240	529
30-34	2388	2011	1808	377	580
35-39	1761	1560	1402	201	359
40-44	1518	1229	1105	289	413
45-49	1017	941	869	76	148
50-54	852	744	687	108	165
55-59	751	747	689	4	62
60-64	716	765	706	-49	10
65-69	828	882	825	-54	3
70-74	379	410	383	-31	-4
75-79	368	319	298	49	70
80-84	98	107	100	-9	-2
85+	104	115	107	-11	-3

Age grp	Agin HDSS 2001	Census Adjasted 2001	Census Unadjasted 2001	Differences	
				HDSS-Adj	HDSS-Adj
0-4	4171	4265	3544	94	-627
5-9	4383	4790	4014	407	-369
10-14	4601	5191	4360	590	-241
15-19	3996	4282	3571	286	-425
20-24	2858	3104	2505	246	-353
25-29	2351	2466	1990	115	-361
30-34	1888	1928	1579	40	-309
35-39	1614	1744	1428	130	-186
40-44	1195	1251	1025	56	-170
45-49	1037	1128	951	91	-86
50-54	787	914	771	127	-16
55-59	720	763	643	43	-76
60-64	680	706	595	26	-85
65-69	638	698	600	60	-38
70-74	724	852	733	128	9
75-79	277	283	243	6	-33
80-84	252	218	187	-34	-65
85+	112	118	102	6	-11

Age grp	Agin HDSS 2001	Census Adjasted 2001	Census Unadjasted 2001	Differences	
				HDSS-Adj	HDSS-Unadj
0-4	5465	5052	4299	-413	-1165
5-9	4928	4864	4305	-64	-623
10-14	5037	4996	443	-41	-606
15-19	4918	5147	4498	229	-420
20-24	4012	4075	3561	63	-450
25-29	3101	3430	2997	329	-103
30-34	2277	2492	2131	215	-146
35-39	1996	2223	1901	227	-95
40-44	1718	1842	1575	124	-143
45-49	1509	1719	1538	210	30
50-54	1202	1308	1170	106	-31
55-59	1053	1147	1027	94	-27
60-64	811	898	804	87	-8
65-69	744	794	722	50	-22
70-74	652	697	634	45	-18
75-79	528	569	517	41	-11
80-84	597	559	508	-38	-89
85+	310	331	301	21	-9

Fig 2 Distribution of counts by age groups, Males

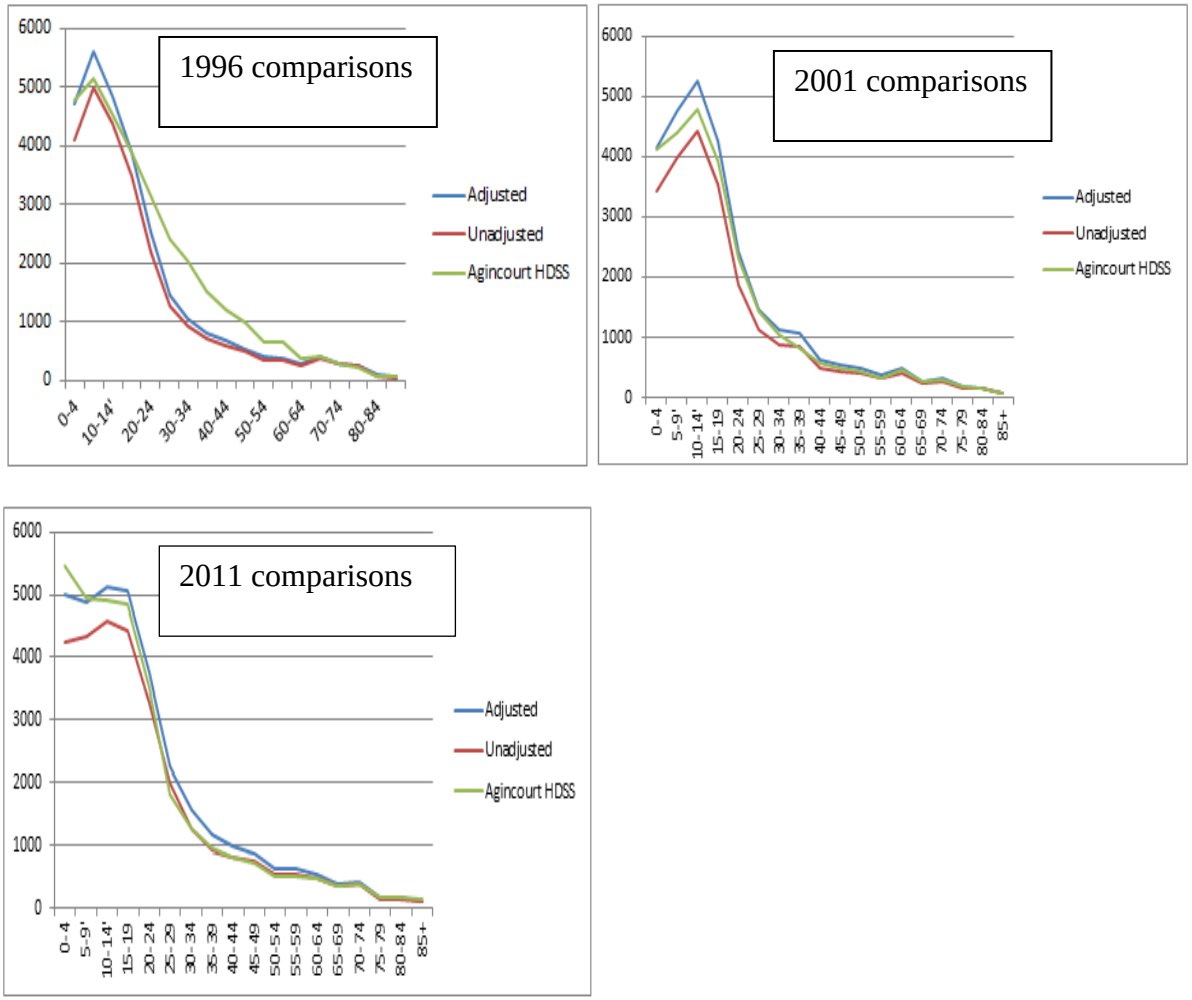
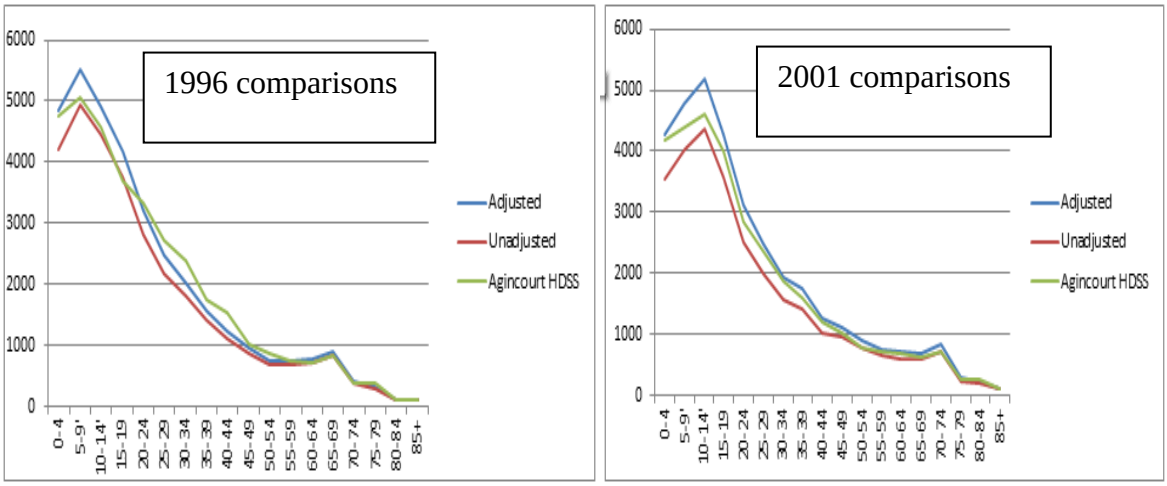


Fig 3 Distribution of counts by age groups, Females



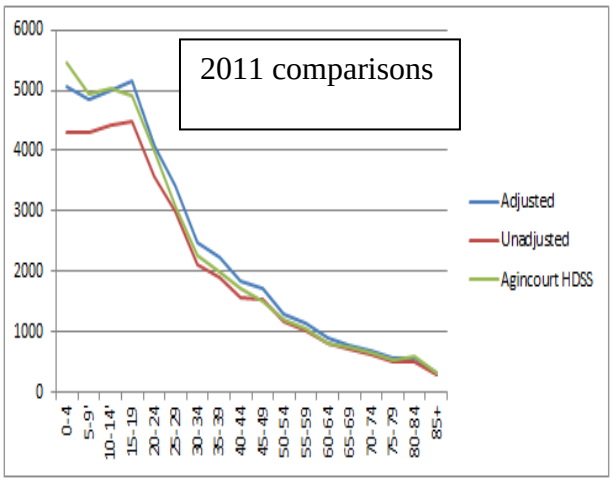


Fig 4 Agincourt HDSS and Census counts age sex structures, 1996

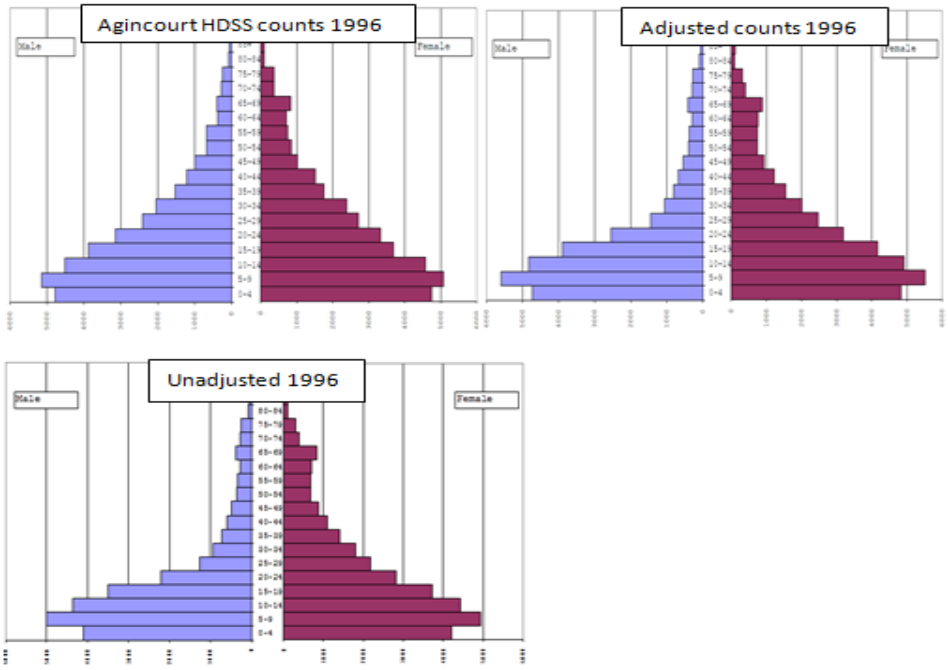


Fig 5 Agincourt HDSS and Census counts age sex structures, 2001

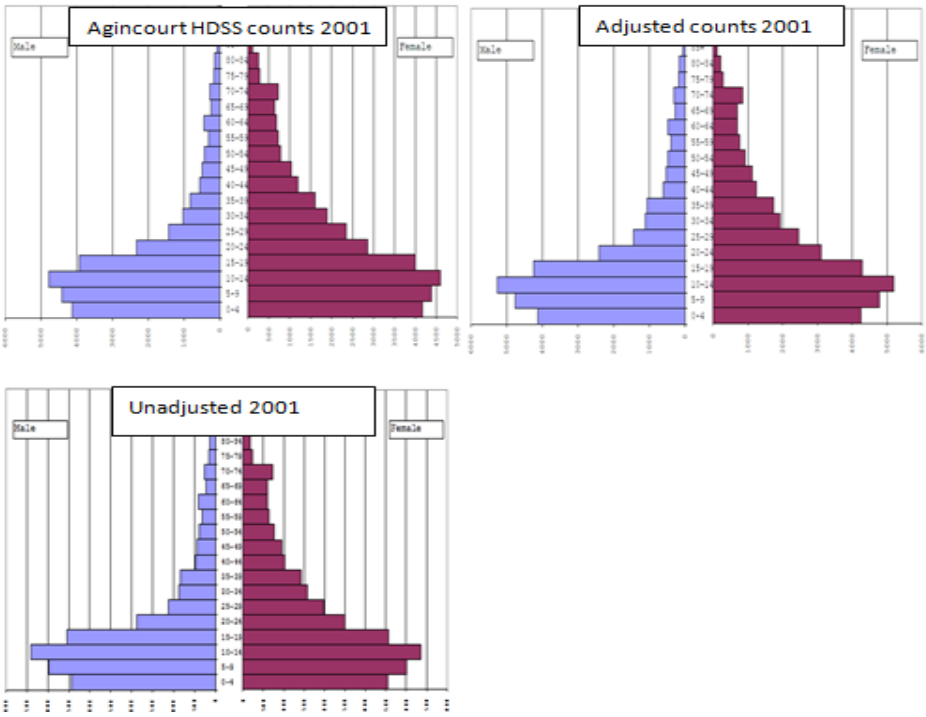


Fig 6 Agincourt HDSS and Census counts age sex structures, 2011