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Mid-year estimates

2003

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1. Key findings

The 2003 mid-year population for South Africa is estimated to be 46.4 million. Africans are in the majority (nearly 36.9 million). Fifty-two percent (approximately 24.3 million) of the population is female. The provincial estimates show that KwaZulu-Natal has the largest share of the population (21%) followed by Gauteng (20%) and the Eastern Cape (14%). The Northern Cape has the smallest share of the population (2%). These estimates have been derived using the 2001 South African census as base population.

The report presents results at the national level and several other levels of disaggregation, namely: five population groups and nine provinces. For each of these levels of disaggregation, the results are shown separately for males, females and total. The results of the mid-year estimates are shown in Tables 1 through 3. Details on the methods used and the assumptions made are given in the explanatory and technical notes.

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Statistician-General: Statistics South Africa

2. Introduction

The quality of population projections is determined by their internal validity, i.e. whether they accurately and consistently model relations among demographic variables. One obvious criterion for choosing a projection method is that it should have internal validity, i.e. obeying demographic accounting principles. We should also select a model that incorporates as many relevant relationships as possible with due consideration as to the purpose of the projection.

3. Projection Methodology

The choice of projection methodology implies a set of necessary projection inputs and achievable outputs. One should select a projection methodology that will provide the desired level of detail in the output. One should also select a methodology whose data requirements can be met. This criterion might conflict with the goal of incorporating relevant relationships. More sophisticated projection methodologies will typically be more demanding of data. The gains in using a more realistic model of population dynamics might sometimes be outweighed by the loss introduced by error in the additional data required.

In a projection, the size of the future population of an entity, such as a country is estimated. Although there are crude estimation methods, such as inflating the total or subpopulations at one date by an assumed overall mean annualized growth rate, most serious estimation efforts such as the mid-year estimates produced by Bah in 2001 and 2002 use a cohort- component approach. In such approach, agreed fertility, mortality, and migration schedules are used as inputs to the data.

These inputs for a cohort-component method of estimation are derived from detailed substantive analyses of the trends in fertility, mortality and migration. This requires an intensive interrogation of the data and depends on the availability of professional personnel and the quality of the data. Often life tables are generated through this process. For example, this approach adjusts for reported fertility and transforms the parities to ASFRs, which in turn is used as input for estimating the average annual number of births. The estimation of mortality and additional deaths due to HIV also requires multiple iterations and would be time consuming, as controls for the adjustment of sero-prevalence data are needed to make the data applicable to the whole population.

In the absence of reliable estimates on fertility, mortality and migration schedules and information from the 2001 census, many issues remain. The next best projection method is to use intercensal growth rates. This method assumes that the population growth rate will remain constant over time so that the population at another time T is given by: $N(T) = N(0)\, e^{rT}$.

The procedure followed in this report will therefore produce provisional estimates but offers reasonable results if the projections or interpolations are made for dates close to the census dates. Statistics South Africa will embark on a second phase of a detailed substantive analysis of census data that would more adequately inform the production of population projections and mid-year estimates.

4 Explanatory and Technical Notes

Several data sources may be used in preparing mid-year population estimates. As data become available, these are incorporated in the exercise as independent controls or input data. Further details on the data and methods are given below.

Given the current data deficiencies, we have produced a crude mid-year population estimates for 2003 with the specific proviso that the estimates are provisional, and that the estimates would be re-worked once the agreed upon fertility, mortality and migration schedules are available.

4.1 Base Population

For constructing the projections data from the 1996 and 2001 South African population censuses were used. Both dataset were adjusted for under-enumeration. For the projections, the base population used was the actual 2001 census data adjusted for under-enumeration by the Post Enumeration Survey. The reported ages were used without adjustments made to them.

To construct the mid-year estimate projections the extrapolation method, which estimate values outside the range of given values. It estimates the size of population at points of time in the future on the assumption that the growth rates are constant. It should be noted that the method has limitations in that there is no guarantee that the past will have a strong bearing on the future. But without any guide to what the future conditions are the only guide is past and current condition and the experience of other similar areas.

A small number of persons in the 1996 census had not reported their age. To accomplish the arithmetic distribution of the unknown ages, it was assumed that those of unknown age have the same percent distribution by age as those of known age. The application of this assumption simply involves multiplying the number reported at each age by a factor equal to the ratio of the total population to the number whose age was reported. The application is a follows:

$$\frac{P_a + P_u}{P_a} \times P_a$$

where P_a represents the number age reported and P_u the number who ages not reported. The adjustment factors obtained in this way are given in the table below.

4.2 Growth Rates and Interpolation

The demographic literature distinguishes between different types of growth rates. The intercensal growth rate is obtained from data from two consecutive censuses. For this exercise, intercensal growth rates between 1996 and 2001 were calculated separately for sex and population group. An overall intercensal growth rate of .098 was obtained for the period 1996 to 2001. Using backward projections of the 2001 census to the 1996 census, demographers could also infer growth rates from these totals. This is called the inferred growth rate. The intrinsic rate of growth is another growth rate commonly referred to in demographic literature. The intrinsic rate of growth is the growth rate of the stable population, which is determined by the age specific death rates, and the age specific fertility rates of the population of interest.

The extrapolation method was used to project the population for 2003. The populations were projected using the growth rate obtained between 1996 and 2001 dataset. The interpolation referred to is, in essence, making use of a growth rate (either linear, geometric, compound or exponential). Table 1 shows the mid-year population estimates by population group and sex for South Africa as a whole. Table 2 shows the mid-year estimates by age, sex and population group.

Using the census totals for 1996 and 2001, exponential growth of the population was assumed and the intercensal growth rate, *r,* was obtained using the equation below:

$P_{t2} = P_{t1} {}^{*}\exp[r^{*} (t_2 - t_1)]$

where t_1 is the initial time and t_2 is the final time.

Hence, $r = 0.2^{*} \log_e (P_{2001}/ P_{1996})$

4.3 Estimating Sub Populations

In preparing mid-year estimates for the total population and for some of its components, demographers could use one of three approaches namely a "bottom-up" approach, a "top-down" approach, or a "hybrid" approach. In the bottom-up approach, national figures are obtained by aggregating sub-national figures. In this case, the problem of reconciling discrepancies does not arise. However, when national estimates are obtained independently of sub-national estimates, there may be some discrepancy between the sum of the initial estimates of the components and the total population. Thus there may be a need to adjust for the differences to arrive at the final estimates. Hence, the top-down approach is used to force the sub-national totals to sum up to the national totals. This approach is also used when the national totals are presumed to be more reliable than the sub-national ones. The procedure is known as iterative proportional fitting, or rim weighting. The hybrid approach attempts to combine the advantages of the top-down and bottom-up approaches.

For the 2003 estimates, it was assumed that the proportion of the population by gender in each province corresponds to that of the national population. Where reconciliation was necessary, it was done separately for males and females. The

software used for reconciling the totals was CTBL32 in Population Analysis Software (PAS) by the US Bureau of the Census. Table 3 shows the provincial mid-year population estimates by age.

5. Estimating the economically active population

The reader is referred to statistical releases of the 2002 General Household Survey and forthcoming releases of the 2002 Labour Force Surveys for up-to-date estimates of the economically active populations of South Africa.

6. Preparing special population estimates

A) If a user needs to estimate the population of a given population group at the provincial level for a non-census date, one option is as follows. Make the assumption that the national growth rate for that population group applies at the provincial level and proceed with applying that rate on the provincial total of that population group. Other options are possible.

B) If a user needs to estimate the population at sub-provincial level for a non-census date, one option is as follows. Estimate the ratio of that sub-provincial total to the province total and apply that ratio on the provincial estimate at the desired date. Other options are possible.

7. Software used

Several software programs were used in the course of preparing this report. Specifically, the following have been used:

Population Analysis System (PAS) from the US Census Bureau. The product is shareware and can be downloaded from the following site: http://www.census.gov/ipc/www/pas.html.

Several linked Excel programs and FORTRAN based programs originally developed by Dr Sulaiman Bah at Stats SA.

Table 1.: Mid-year population estimates for South Africa by population group, 2003

Race	Male	Female	Total
African/Blacks	17 562 179	19 352 105	36 914 284
Coloured	1 979 934	2 151 162	4 131 096
Indian/Asian	556 278	583 819	1 140 097
White	2 051 917	2 192 429	4 244 346
Total	**22 150 308**	**24 279 515**	**46 429 823**

Table 2.: Mid-year population estimates by age, sex and population group, 2003

Group Age	African			Coloured			Indian			White			Total population		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 - 4	1 873 926	1 882 656	3 756 582	197 087	195 764	392 851	35 837	34 836	70 673	109 990	106 587	216 577	2 216 840	2 219 843	4 436 683
5 - 9	2 066 273	2 080 025	4 146 298	206 861	204 447	411 308	43 054	42 767	85 821	130 751	124 522	255 273	2 446 939	2 451 761	4 898 700
10 - 14	2 164 486	2 193 529	4 358 015	216 637	216 259	432 896	49 142	47 608	96 750	154 173	148 171	302 344	2 584 438	2 605 567	5 190 005
15 - 19	2 137 320	2 213 076	4 350 396	220 551	224 772	445 323	57 421	56 054	113 475	179 439	174 641	354 080	2 594 731	2 668 543	5 263 274
20 - 24	1 789 865	1 870 776	3 660 641	174 292	180 521	354 813	51 740	49 633	101 373	140 783	134 747	275 530	2 156 680	2 235 677	4 392 357
25 - 29	1 616 489	1 744 481	3 360 970	163 610	174 728	338 338	52 616	51 842	104 458	146 375	150 275	296 650	1 979 090	2 121 326	4 100 416
30 - 34	1 260 084	1 383 725	2 643 809	159 023	177 398	336 421	48 039	49 612	97 651	166 152	178 077	344 229	1 633 298	1 788 812	3 422 110
35 - 39	1 133 296	1 325 598	2 458 894	155 958	177 616	333 574	45 202	49 218	94 420	157 725	171 900	329 625	1 492 181	1 724 332	3 216 513
40 - 44	963 250	1 109 688	2 072 938	135 553	154 976	290 529	40 569	44 223	84 792	165 827	180 205	346 032	1 305 199	1 489 092	2 794 291
45 - 49	743 763	901 819	1 645 582	103 271	123 041	226 312	34 805	40 346	75 151	140 513	154 418	294 931	1 022 352	1 219 624	2 241 976
50 - 54	582 173	666 684	1 248 857	81 892	96 654	178 546	32 504	35 329	67 833	137 157	146 832	283 989	833 726	945 499	1 779 225
55 - 59	374 758	451 717	826 475	54 972	65 827	120 799	24 904	27 386	52 290	120 351	129 512	249 863	574 985	674 442	1 249 427
60 - 64	315 423	459 942	775 365	43 803	54 836	98 639	17 556	21 943	39 499	101 923	111 721	213 644	478 705	648 442	1 127 147
65 - 69	190 637	351 391	542 028	30 776	42 594	73 370	10 593	14 310	24 903	72 120	83 231	155 351	304 126	491 526	795 652
70 - 74	162 248	333 043	495 291	18 947	28 720	47 667	6 600	9 404	16 004	57 915	74 556	132 471	245 710	445 723	691 433
75+	188 188	383 955	572 143	16 701	33 009	49 710	5 696	9 308	15 004	70 723	123 034	193 757	281 308	549 306	830 614
Total	**17 562 179**	**19 352 105**	**36 914 284**	**1 979 934**	**2 151 162**	**4 131 096**	**556 278**	**583 819**	**1 140 097**	**20 51 917**	**2 192 429**	**4 244 346**	**22 150 308**	**24 279 515**	**46 429 823**

Table 3.: Provincial mid-year estimates by age, 2003

Age Group	South Africa	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo
0-4	4 436 683	412 909	625 854	78 847	253 138	1 020 957	356 147	748 669	354 438	585 723
5-9	4 898 700	417 583	811 203	80 731	271 970	1 147 636	381 019	701 353	371 858	715 347
10-14	5 190 005	434 847	896 082	83 053	306 242	1 177 173	412 945	717 957	393 767	767 940
15-19	5 263 274	482 480	836 979	84 579	317 684	1 197 717	402 449	816 656	395 972	728 758
20-24	4 392 357	441 623	539 303	69 218	254 631	915 561	345 705	1 043 005	299 689	483 623
25-29	4 100 416	442 164	427 908	66 680	228 762	823 155	327 436	1 128 109	275 153	381 049
30-34	3 422 110	407 451	359 293	63 362	204 540	641 538	290 919	926 924	225 387	302 696
35-39	3 216 513	386 638	352 859	59 099	195 296	611 007	281 786	822 744	216 299	290 786
40-44	2 794 291	333 059	347 988	53 366	168 987	518 166	252 787	705 762	174 334	239 843
45-49	2 241 976	254 828	290 961	46 070	141 684	415 268	197 413	542 424	147 233	206 095
50-54	1 779 225	206 330	232 905	36 364	110 655	364 801	143 089	407 452	110 772	166 857
55-59	1 249 427	149 286	167 553	27 936	79 731	249 907	113 350	277 289	72 778	111 596
60-64	1 127 147	125 470	196 072	22 917	64 311	229 258	92 440	209 589	68 741	118 350
65-69	795 652	90 824	145 942	17 949	53 324	154 530	67 500	133 230	42 432	89 921
70-74	691 433	69 184	128 438	12 244	38 292	138 712	53 049	102 168	44 806	104 539
75+	830 614	86 306	143 863	16 434	48 984	155 646	73 949	131 900	53 070	120 463
Total	**46 429 823**	**47 40 981**	**6 503 201**	**818 848**	**27 38 231**	**9 761 032**	**3 791 984**	**9 415 231**	**3 246 729**	**5 413 586**