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National and subnational experience with estimating the extent and trend in completeness of birth registration in South Africa

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A. BACKGROUND

The registration of births and deaths is governed by the South African Birth and Deaths Registration Act of 1992 (Act No. 51 of 1992) and is administered by the Department of Home Affairs (DHA). Although the Act has been amended from time to time, probably the most significant modification was the introduction of new birth and death notification forms in 1998. The revision of the forms aimed to bring South African data on a par with international standards, such as recording details of the death on the new death notification form proposed by the International Classification of Diseases and Deaths (Bradshaw, Kielkowski and Sitas 1998). An important initiative to improve the timely registration of births was the highlighting of the registration process at antenatal care visits where mothers were encouraged to obtain identification documents if they did not already have them and by providing the necessary birth notification forms in state facilities at the time of delivery (Bradshaw, Kielkowski and Sitas 1998).

Evaluation of South Africa's civil registration and vital statistics system has tended to focus on the reporting of deaths (Botha and Bradshaw 1985; Darikwa and Dorrington 2011; Pillay-Van Wyk, Laubscher, Msemburi *et al.* 2014). These investigations have found a marked improvement in the timely registration of deaths at all ages particularly since 2000 (Dorrington and Bradshaw 2011). By comparison, the efforts to measure completeness of the birth registration locally and internationally have been minimal.

The methods that have been used to measure completeness of birth registration can be grouped into the following two categories:

1) survey questions which ask the mother if the birth has been registered and possibly to produce the birth certificate (UNICEF 2013; Williams 2014).

2) comparison with estimates based on

   - an independent estimate of births on age-specific fertility rates and the female population of reproductive age (Nannan, Bradshaw, Mazur *et al.* 1998)
   - demographic models assuming a stable population (Williams 2014)
   - population projection models (Dobbie, Masebe and Nhlapo 2007; Stats SA 2013)

In South Africa, there have been some national household surveys that have included questions to mothers eliciting information about birth registration. The National Income Dynamics Survey (SALDRU 2008), for instance, found that 11% of children under the age of three did not have a birth certificate while an analysis of the General Household Survey by the Children's Institute (Berry, Dawes and Bierstecker 2013) also suggests that in 2011, 11% of children under the age of three had not had their births registered. No proof of registration was sought in either household survey.

The completeness of birth registration has not been calculated against independent estimates of the number of births. However, alternative assessments have been reported. The Department of Home Affairs (2012) monitors the proportion of new babies registered within the year of birth, which in the 2011/2012 financial year, was 90%. In the report "Every Child's Birth Right" evaluating individual country and regional trends in birth registration, UNICEF relies on Stats SA's annual birth registration report and claims that in 2011 South Africa achieved 95% completeness of births registered within the first year of life (UNICEF 2013). It appears

however, that by utilizing Stats SA's definitions of 'current registrations in 2012' and 'birth occurrences in 2012' UNICEF have calculated the proportion of births registered up to mid-2013 that were registered within the 'current year' (which in recent years has included registrations up until 28th February of the year following the year of birth). These indicators report on the timing of registration rather than the completeness.

The aim of this study is to examine the completeness of births registered on the National Population Register, provincially and nationally and to identify a method for annual assessment.

B. METHODS

The World Health Organisation defines completeness as, "a measure of the extent to which births and deaths that occur in a country in a given year are registered by the civil registration system" (WHO 2010). A requirement of the measure of completeness therefore, is an independent estimate of births or deaths occurring in year. This analysis of completeness relies on the body of work undertaken to estimate fertility in South Africa and provincially using survey and census data by Dorrington and Moultrie (2015).

1. Registered births

In South Africa the Department of Home Affairs (DHA) captures information about births on the National Population Register (civil registration) which is then submitted to Statistics South Africa (Stats SA) for statistical purposes. Stats SA defines 'late registration' as a birth registered after the calendar year of birth. However, as data capturing for a given year is actually closed at the end of February of the year following the calendar year of birth, births registered to this point are recorded as occurring in the calendar year of birth. We refer to births registered by the end of February of the calendar year following the calendar year of birth as the cumulative total in the year of birth +1, and so on for births registered in the following registration years.

2. Number of births

a. Census and national surveys

Since the new democratic dispensation in 1994 South Africa has conducted Censuses in 1996, 2001 and 2011, and a large Community Survey in 2007 from which estimates of fertility were produced by the P/F ratio method. Household surveys in the form of two Demographic and Health Survey's conducted in 1998 and 2003 (Department of Health 2002; Deptartment of Health 2007) and the South African National HIV Prevalence, Incidence and Behaviour Survey 2012 (Shisana, Rehle, Simbayi *et al.* 2014) conducted by the Human Science Research Council collected cohort-period information from which it is possible to produce age-specific fertility, however, only the 1998 DHS data were considered useable for purposes of fertility estimation. The fertility estimates required to produce the numbers of births against which to evaluate the completeness of birth registration were calculated from the analyses of the three censuses and two surveys shown in table I.

These estimates of births were used to frame and validate provincial estimates of recent births derived by reverse survival of the enumerated population in the 2011 Census allowing for inter-provincial migration for the period 2001-2011. A national trend was obtained for the period 1996-2011.

Table I: Data sources and references used to calculate the number of births based on age-specific fertility rates and the number of women by age

Data source	*Derivation of the ASFR's*	*Distribution of women*
1996 Census	(Moultrie and Dorrington 2004)	http://interactive.statssa.gov.za/superweb/ Community profiles/1996 Census/
1998 SADHS	(Department of Health 2002)	http://interactive.statssa.gov.za/superweb/ Community profiles/1996 Census/
2001 Census	(Moultrie and Dorrington 2004)	http://interactive.statssa.gov.za/superweb/ Community Profiles/2001 Census
2007 Community Survey	(Darikwa 2009)	http://interactive.statssa.gov.za/superweb/ Community Profiles/2007 Community Survey
2011 Census	(Dorrington and Moultrie 2015)	http://interactive.statssa.gov.za/superweb/ Community Profiles/2011 Census

b) Routine health statistics

The District Health Information System (DHIS) is the routine surveillance operating in South Africa's nine provinces and collects an array of health information from public sector health facilities. Births collected through the DHIS would therefore require an adjustment for the proportion of births occurring in the private sector and those occurring at home in order to be nationally or provincially representative.

c) Adjustment to the District Health Information System births

Three household surveys provide information about the 'place of delivery' within the period 1998 to 2010. During this time important policy changes such as the free health care for mothers and children up to six in 1994 lead to substantially increased numbers of births taking place in the public sector (Gilson and McIntyre 2007), complicating an adjustment to account for non-public sector births, particularly on a provincial basis.

Exploration of the 1998 and 2003 South Africa Demographic and Health Survey's (Department of Health 2002; Deptartment of Health 2007), and the South African National HIV Prevalence, Incidence and Behaviour Survey 2012 (Shisana, Rehle, Simbayi *et al.* 2014) revealed the proportion of non-public sector births more than halved between 1998 and 2010. It also showed that the richer, more urban provinces have proportionally more births in private facilities (Gauteng and the Western Cape) than the poorer, more rural provinces, which account for a greater proportion of home-births (the Eastern Cape, Mpumalanga and Limpopo). Lastly, although the decrease in home-births was accompanied by an increase in public facility-births, the proportion of missing data in the 2003 DHS limited the usefulness of the relative proportions of each by province and necessitated a review of other potential data sources which might serve as a proxy measure of home-births and births in private facilities.

A second source of data is the proportion of children under-1 year of age covered by medical aid schemes reported to the General Household Survey (GHS) as a proxy for the proportion of births that occurred in the private sector. The average from 2004 to 2012 was 11.9%.

To estimate the proportion of home-births by province over the years the association between the proportions of each province living in rural areas and the proportion of home-births was used. The correlation between the proportion rural by province from the 1996 Census and the proportion of home-births by province from the SADHS 1998 resulted in an R^2 =0.74 indicating

a strong enough correlation to project reasonably accurately the proportions of home-births over time from the changes in the proportion rural. Thus the ratio of the number of home-births in a province to the number of home-births nationally was assumed to be a linear function of the ratio of the proportion rural in the province to the proportion rural nationally. The relationship resulting from this regression equation and an estimate of the proportion of home-births nationally in 2010 (for which the HSRC survey based estimate of home-births is available) can serve to predict the proportions of home-births for each province as follows:

$$hb_i = HB\left(a\frac{r_i}{R} + b\right)$$

where hb_i=% home-births in province i, and HB =% home-births nationally, and r_i=% rural in province i, and R= % rural nationally.

C. RESULTS

1. Registered births

We report births according to the year of occurrence. Unit record data was used to create tables of year of occurrence vs year of registration from the Stats SA website. The number of births registered up to 2012 by year of birth increased from 924,207 in 1995 to peak at around 1,080,000 between 2006 and 2008 before falling off (figure I). The slight but continuous decline in recent years is the result of a higher proportion of late registrations, missing from the data. From 1997 up until 2005 there is substantial improvement in the timely registration of births up to 2008 after which it has remained stable.

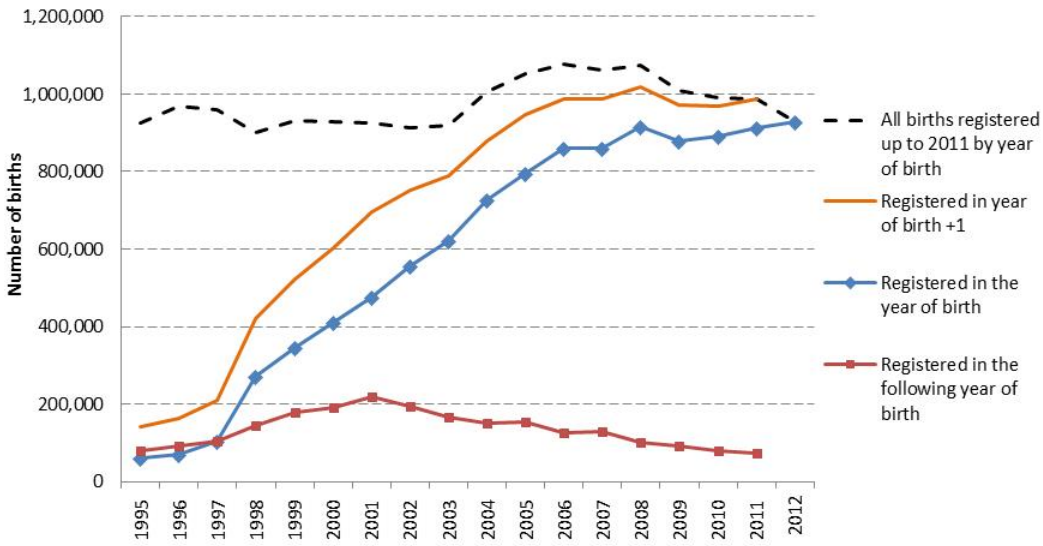

Figure I: Trends in birth registration by calendar year of birth, Stats SA 1995-2012.

a. Number of births

Investigation of the actual number of births (figure II) shows five point estimates based on the number of births implied by fertility rates reported by women which imply a fairly level trend ranging from 1,130,571 in 1996 to 1,124,000 in 2011. The estimate of the number of births from the reverse survival of the population count (red circles) is very similar to the reverse survival estimate from the count of the South African-born (blue line), although the difference is greater earlier in the period (due to the higher migration at older ages). The DHIS data (orange line) when adjusted to allow for births occurring in private health facilities and births delivered at home (resulting in an overall 16.3% adjustment) give the adjusted DHIS (orange dotted line), which by 2008 is practically identical to the reverse survival and plateaus through to 2012. The births registered in the vital statistics by year following the calendar year of birth (VR+1) (black line), illustrates the remarkable improvement in registration over the seventeen year period, and simultaneously highlights the persistent under registration, and is similar to the unadjusted DHIS in more recent years.

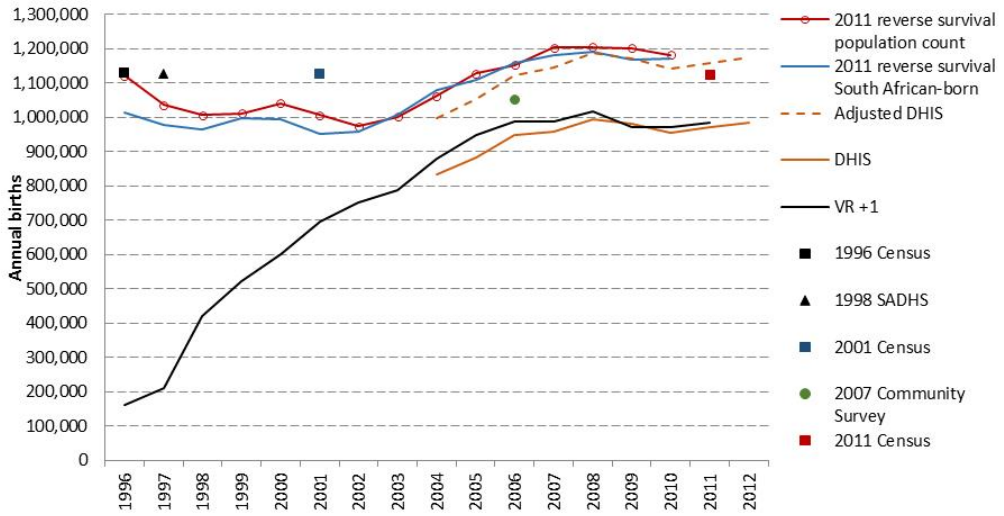

Figure II: Comparison of empirical estimates of births and births registered in the year following the calendar year of birth (VR +1), 1996-2012.

b. Completeness over time

Examination of the pattern of completeness by the number of years since birth over time implied by comparison with the estimate of births derived from back-projecting the census counts is shown in figure III and demonstrates substantial improvement in registration between birth and the fifteenth birthday, which up to 2004 occurred mostly under age one. Against the estimate of the total number of births from the Census, the comparison suggests that in 1996, about 25% of registrations took place before the first birthday and 33% took place by the second birthday. By 2008, these proportions had improved to 76% and 84% respectively, and in 2011, 77% of children under age one and 83% of children under age two were registered.

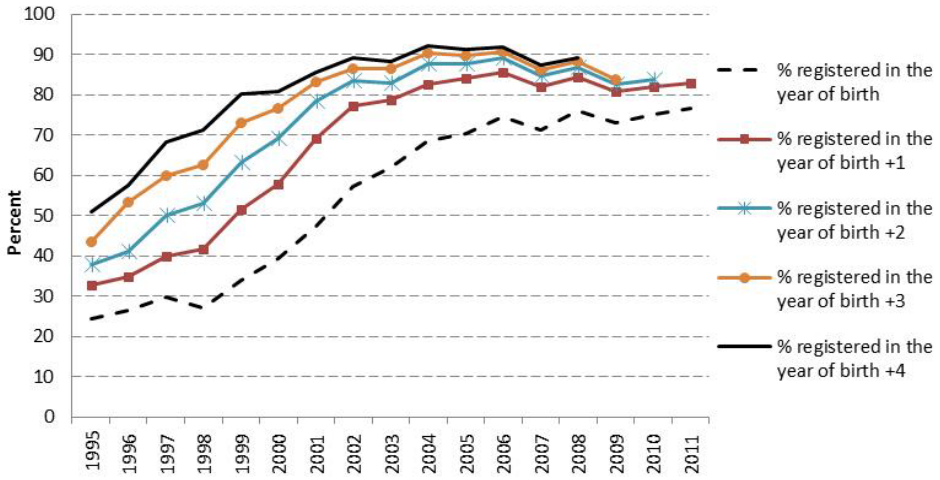

Figure III: Trends in the completeness of birth registration by age measured against an estimate of births derived from 2011 Census, 1995-2011.

c. Provincial differences

The number of births estimated by back-projecting the provincial population counts according to the province of birth revealed interesting differences in fertility levels and trends over time. Four provincial trends are contrasted in figure IV. The total number of births over the last decade ranged from 25,000 in the Northern Cape to around 250,000 in KwaZulu-Natal. Evaluation of the completeness of VR in the year of birth and in the year of birth +1 shows considerable improvement over the past decade and also that the differences in completeness by geographical setting have narrowed over time. For instance in 2001, 33% of births in the Eastern Cape were registered in the calendar year of birth vs 77% in the Western Cape, but by 2011 these proportions were 79% and 80% respectively. A surprising finding was that the Free State and the North West attained higher proportions of completeness of births than the national average. Gauteng province is the least complete. Completeness in the North West exceeds100% in the year of birth +1. These anomalies are perhaps the result of migration from the province of birth to the province of birth registration before the birth is registered.

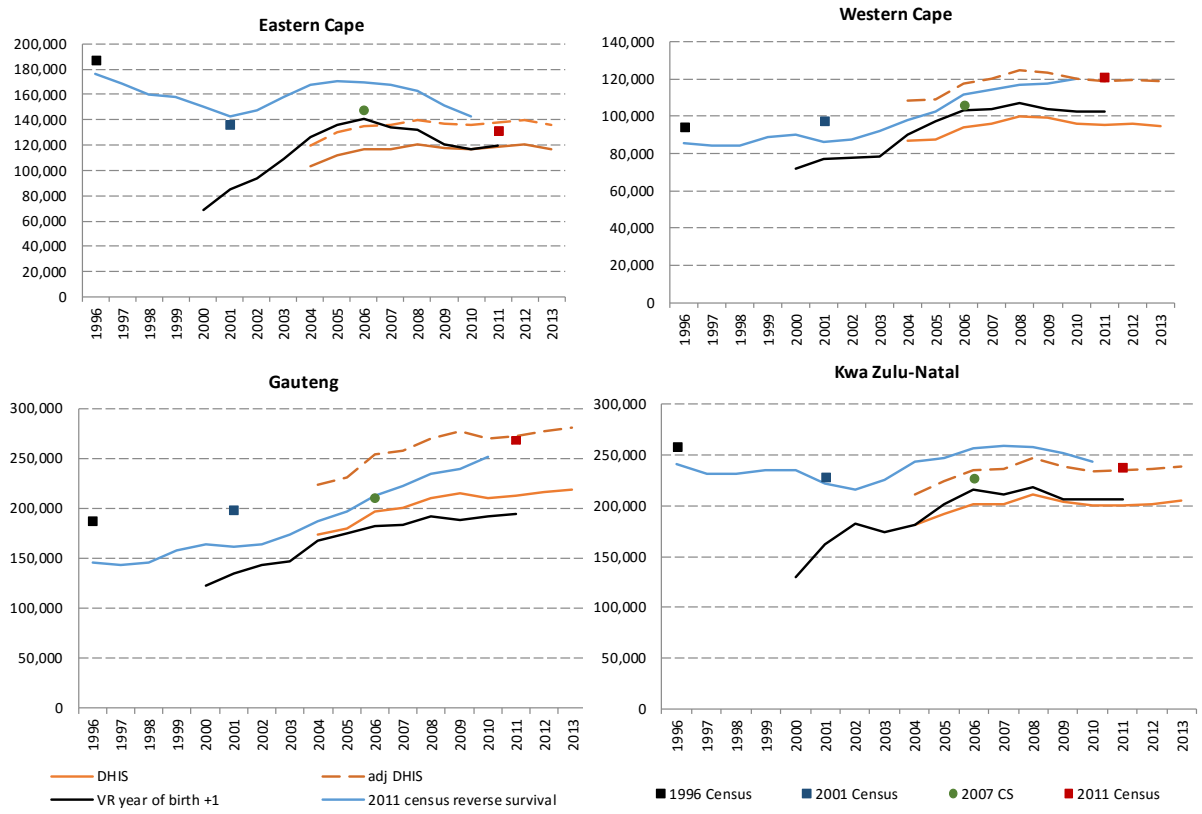

Figure IV: Provincial comparisons of empirical estimates of births and VR birth registered in the year of birth +1, 1996-2012.

Squares – number of births implied by the TFR's calculated from the 1996, 2001 and 2011 Censuses; green circle – number of births implied by the TFR calculated from the 2007 Community Survey; orange line – reported DHIS; orange dotted line – adjusted DHIS; blue line- reverse survival 2011 Census; black line – VR births +1.

D. DISCUSSION

1. Key findings

South Africa has experienced a rapid increase in birth registration. In 1996 at a national level only 33% of birth registrations occurred before the second birthday. However, by 2011, 83% of registrations take place between birth and the second birthday and the estimate of births derived from back-projecting census numbers suggests that about 90% of registrations occurred by the fifth birthday. The provinces also experience the same cumulative pattern of registration over time and the relative differences in completeness between the provinces has narrowed markedly, so that in 2011 the range of completeness was 70% in Gauteng to 88% in the North West.

The significant increase in birth registration after 1995 is associated with the amendments to the Birth and Deaths Registration Act (1992) to include the former homelands, accompanied by efforts to strengthen vital registration. In addition, the introduction of the child support grant in 1998 is relevant to the process of birth registration because the primary requirement in assessing eligibility for the grant is a birth certificate (Hall and Monson 2006).

This analysis estimates that in 2011 South Africa achieved 77% completeness in the first year of life and 83% by the 2nd year of life, in contrast with UNICEF's finding of a 95% registration rate within the first year of life in 2011. The main reason for this difference is the criteria used for completeness of registration. In our assessment we have compared the number of births registered by a given age relative to an independent estimate of the total number of births for that year. In the case of UNICEF, the completeness reported for South Africa was taken as the proportion of registered births that were registered within the 1st year of life. UNICEF often uses national survey based estimates of the proportion of children under 5 years of age who have their birth registered. It is important that global comparisons of individual countries use defined assessment criteria and methods of evaluation.

This assessment of completeness of birth registration has identified confusing terminology relating to the timeliness of registration and year of occurrence used by different government agencies. It is essential that all interested parties agree on key definitions of timeliness. There is scope for mis-interpretation, for instance, when using Stats SA's definitions of 'current birth registration' and 'birth occurrences'. These only include the births registered up to mid-year of the current year which in recent years has included registrations up until the end of February of the year following the calendar year of birth, and therefore does not include any late registrations.

In recent years, the cut-off period for routine reporting of births has changed. This will affect the apparent completeness of registration, even though there might not have been a change in registration. It is important for the routine statistical systems not to change arbitrarily.

2. Limitations

Although improvement in provincial registration and the utilization of births collected through the DHIS affords real opportunity to monitor provincial registration, migration of young children since birth to a different province of residence makes interpretation of provincial completeness of birth registration challenging. Inter-provincial movement of pregnant women to provinces with better health services and movement of children means that the reverse survival technique based on children living in a particular province, does not necessarily correspond with the births registered in that province.

This analysis has identified two important considerations around monitoring provincial births.

1) the challenge of estimating the total number of births in an environment where provincial numbers of births are influenced by the migration causing children to live and acquire birth registration in provinces other than the ones they were born in. Although this is a limitation of the reverse survival provincially, it is possible to mitigate this uncertainty using additional independent data sources for purposes of corroboration.

2) the challenge in the interpretation of provincial completeness of birth registration is the movement between the province of birth and the province of birth registration, suggesting migration of young children since birth to a different province of residence, although this is more acute in some provinces than in others.

3. Future research

Despite the concerted effort of government to improve the systems of civil registration and vital statistics, there remain obstacles to approximately twenty percent of parents or caregivers preventing them from registering the births of their children. Insight into what these obstacles are and which communities are most affected would inform interventions designed to aid these sections of the community.

South Africa is on the cusp of being able to use vital registration for calculating childhood mortality rates routinely. However, further investigation is needed to assess the performance of linkage of the birth and death register information. To date we have only investigated these data separately. Linkage could be done through the National Population Register, but an obvious amendment to the system would be to include the registration of individuals whose birth had not been registered before death.

4. Conclusion

The commendable improvement in the registration of births can be attributed to government commitment to improving the civil and vital registration systems, relevant changes to the legislation and policies directed at the welfare of children such as remittances.

It is important that all interested parties agree on key definitions of completeness and assessment criteria. The assessment of completeness by age appears to be a useful method of evaluation, however such an analysis requires unit record data tabulated by year of occurrence and year of registration over several years in order to take late registrations into account. It also requires an independent estimate of the number of births in that year.

The analysis raises important questions around the measurement and monitoring of births at a provincial level. The need to utilize an independent empirical estimate of births to measure completeness of vital statistics revealed a dearth of this essential information being available on a continuous basis both for the country, and even more so for the provinces. The birth surveillance provided by the DHIS has proved an important source of birth information ideal for monitoring births during the inter-censal period and therefore worthy of investing the resources necessary for improving the quality of the routine statistics.

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