

Estimating Indigenous Life Expectancy: pitfalls with consequences

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Abstract

Objective: The methods used by the Australian Bureau of Statistics (ABS) to estimate life expectancies on Aboriginal and Torres Strait Islander peoples in 2009 have been controversial and require critical analysis.

Approach: The direct method for estimating Indigenous life expectancies, based on estimated deaths and populations, has been generally welcomed. But the death estimates used were not soundly based. These were based on a first ever linkage between Indigenous deaths and census records following the 2006 census. Census based identification was used in place of identification in the death registrations, rather than as a supplementary data source. The various national, State and regional life expectancy estimates published are all biased upwards by this process. Because the impact of the methodology varies across Australia, differentials reported appear substantial but are not soundly based.

The unreliable results are highlighted and discussed. Analysis based on more comprehensive linkage of death records in New South Wales over 5 years confirms that the ABS methods have understated Indigenous deaths and so overstated life expectancy. The impact of an alternative ABS approach is also discussed.

Conclusion and Implications: ABS life expectancy estimates published in 2009 are suspect. Estimates should be based on accurate estimates of deaths and population. Consultation and a thorough review are essential before the next round of estimates following the 2011 census.

Closing the Gap commitments focus on eliminating the life expectancy gap between Aboriginal and Torres Strait Islander peoples and other Australians. Life expectancy estimates need to be based on methods and data that are well understood and broadly supported. The alternative is unproductive debate about statistics rather than the range of policies and resourcing issues needed to improve Indigenous health.

Keywords: Indigenous, life expectancy, data linkage

Background

Up to the 1980s, there had been little interest in Indigenous statistics in Australia for 50 years. There had been continuing interest in estimates of the Australian Indigenous population from 1900 to 1930, with a recognition by various experts that direct estimates significantly undercounted the population.¹

When the Australian Constitution was developed during the 1890s, section 127 provided that

In reckoning the numbers of the people of the Commonwealth, or of a State or other part of the Commonwealth, aboriginal natives shall not be counted (section 127)

Aboriginal people were still counted and reported in each population census from 1911. But full blood people were then excluded from population estimates. This provision hardly encouraged the official statisticians to make much effort to locate and count Indigenous people in the census. But there was ongoing interest in Indigenous population estimates up to 1930, with a declining population reported up to 1920.

Statistical interest ceased after 1930, and only direct estimates were published which substantially understated the true population. Recently a restated 'plausible' time series of population estimates has been produced.²

Section 127 was repealed in 1967. From then, censuses included a self identification question on Indigenous status and efforts to include Indigenous people progressively expanded.

In the 1980s, an Indigenous identifier was proposed to be included in each State and Territory's birth and death registrations. National coverage was not achieved until 1994.

In 1994, the ABS produced 'experimental' estimates of the Indigenous population at 30 June 1991 and 30 June 1986.³ In 1998, estimates for 30 June 1996 and 30 June 1991 were published, along with an Indigenous life table based on the period 1991-1996. 'This life table was produced using the Preston-Hill method by comparing the change in counts of the Indigenous population between the two censuses with the number of Indigenous deaths registered for each five-year cohort. This enables the rate of increase in identification and the level of under-enumeration of deaths to be calculated.'⁴

2004 saw experimental population estimates for 2001, 1996 and 1991 published following the 2001 census, and a life table based on the period 1996-2001.⁵ This life table was based on the Bhat method; this method allowed for unexplained population growth (reflecting the varying completeness of enumeration at each census) to be explicitly estimated. 'Using this method, ...the ABS calculates the consistency of Indigenous death registrations for the 1996-2001 intercensal period relative to the population estimates at the beginning and end of the five year period'. Consistency factors were assumed to be constant for each at each age group.

The life expectancy estimates at age 0 were as follows:^{6,7}

Table 1 Life Expectancy Estimates at age 0

| | Male | | Female | |
|-----------|------------|-----------|------------|-----------|
| | Indigenous | Australia | Indigenous | Australia |
| 1991-1996 | 56.9 | 75.2 | 61.7 | 81.1 |
| 1996-2001 | 59.4 | 76.6 | 64.8 | 82.0 |

Source: ABS & AIHW, 1999 and 2005

Given the different methodologies used for the two sets of estimates, no comparison can be made between the two sets of results, and in particular no improvement can be imputed.

The existence of a 17 year difference in life expectancy (based on the 1996-2001 estimates) became well known, and was important in the development of Indigenous policy by all Australian Governments. A notable example was the 'Closing the Gap' target adopted by the Council of Australian Governments in 2008 to close the life expectancy gap within a generation.⁸

ABS 2009 Life Expectancy Estimates

There was widespread concern about the indirect methods that had been used to establish the Indigenous life expectancy estimates. In 2008, the ABS published a consultation paper in which it proposed a move to a direct method of calculation of Indigenous death rates.⁹ Deaths would be based on registered deaths, population on census estimates.

During the extensive consultation that followed, there was broad acceptance in principle of this proposal. But there was widespread rejection of the methods proposed to estimate Indigenous deaths. Despite the objections, the ABS persisted with its approach, although some alternative calculations were included as an appendix in the publication.¹⁰

In its discussion paper, the ABS argued that both numerator and denominator of death rates (ie. deaths and population) should be estimated consistently. While the critics accepted this in principle, it was argued that both numerator and denominator should be estimated as accurately as possible. Consistency and accuracy were distinct but equally valid criteria. If they led to different conclusions, a judgment was required about which should take precedence.

After the 2006 census, the ABS had for the first time linked registered deaths and census records during the short time period (9 August 2006-30 June 2007) before the census records were destroyed. Of particular interest in this linkage exercise was Indigenous deaths.

There were 106,945 deaths in the period. 92.5% linked to a census record. Of the deaths, 1800 were registered as Indigenous. Only 73.7% (1327) of these linked to a census record.⁹

For the linked deaths, reporting in the census and death registrations was compared. The NSW data were published as an illustration.

Table 2**Linked Deaths, NSW**

| Census Classification | Death registration | | | |
|------------------------------|---------------------------|----------------|------------|--------|
| | Indigenous | Non-Indigenous | Not stated | Total |
| Indigenous | 273 | 131 | 12 | 416 |
| Non-Indigenous | 87 | 34,460 | 196 | 34,743 |
| Not stated | 12 | 1,881 | 12 | 1,905 |
| Total | 372 | 36,472 | 220 | 37,064 |

Most observers recognise that there is incomplete reporting of Indigenous deaths in national data collections. Over the years, the ABS had made major efforts in deaths registrations and the census to improve reporting processes. On the other hand, reporting as Indigenous when not Indigenous (false positive) is not thought to be a major issue in Australia (apart from Tasmania where Indigenous population is small). Yet the ABS decided to **replace** the death registration identification with census reporting status, rather than applying the 'ever Indigenous' rule (ie, reporting as Indigenous in one collection is sufficient to count an individual as Indigenous in both collections). ABS therefore estimated Indigenous deaths at 416 rather than 372, whereas an 'ever Indigenous' approach would have given 515.

Table 3 shows the results for each jurisdiction, after a correction was applied to census results for post census enumeration changes (only 4 jurisdictions have sufficient Indigenous population for separate reporting).¹⁰

Table 3**Indigenous Deaths 9 August 2006 - 30 June 2007**

| | Linked Registered Indigenous Deaths | Estimated Indigenous Deaths | Increase % |
|-----------|--|--------------------------------|---------------|
| NSW | 372 | 427 | 14.8 |
| Qld | 351 | 372 | 6.0 |
| WA | 254 | 228 | -10.2 |
| NT | 204 | 188 | - 7.8 |
| Australia | 1,327 | 1,441 | 8.6 |

These results were surprising. For many years, the ABS had reported the 'implied coverage' of registered Indigenous deaths compared to deaths obtained from their current Indigenous population projections.¹¹

These coverage estimates are shown in Table 4 alongside the coverage derived from Table 3 (registered deaths divided by estimated deaths).

Table 4 Coverage of registered Indigenous deaths

| | Implied Coverage 2001-2005 ¹¹ | Coverage via census linkage 2006-2007 ¹⁰ |
|-----------|---|--|
| NSW | 45 | 87 |
| Qld | 52 | 94 |
| WA | 70 | 111 |
| NT | 92 | 109 |
| Australia | 56 | 92 |

NSW and Queensland factors are much higher than previous estimates, suggesting close to complete coverage. In WA and the NT, there is the implication that some deaths reported as Indigenous are reported in error.

The ABS presented no argument to justify these substantial revisions to their coverage estimates, despite the widespread scepticism that was voiced during the consultation period.

The life expectancy estimates which resulted from using these estimated Indigenous deaths are shown in Table 5, along with current Australian life expectancy estimates. Table 6 shows the life expectancies for the various jurisdictions.

Table 5 Life Expectancy Estimates at Age 0 (2005-2007)

| | Male | | | Female | | |
|------------------|------------|-----------|------|------------|-----------|-----|
| | Indigenous | Australia | Gap | Indigenous | Australia | Gap |
| Australia | 67.2 | 78.5 | 11.3 | 72.9 | 82.4 | 9.5 |

Table 6 Life Expectancy Estimates at Age 0 (2005-2007)

| | Male | Female |
|------------|------|--------|
| NSW | 69.9 | 75.0 |
| Qld | 68.3 | 73.6 |
| WA | 65.0 | 70.4 |
| NT | 61.5 | 69.2 |

It can be seen that life expectancy is said to be highest in NSW, then Queensland, then WA and then the NT. This is in inverse order to the stated completeness of Indigenous death registrations according to both methods used in Table 4. The ABS presents no arguments to explain its decision to ignore the completeness differences in publishing the life expectancy estimates for the four jurisdictions.. On the face of it, the differentials reported are (to an unknown extent) an artefact of the estimation process.

The ABS has extended the methodology for State/NT estimates to calculate estimates for capital cities and the 'rest of State' regions.¹² State-wide correction factors were applied to deaths in each region, without regard to relative completeness of Indigenous death registration in capital cities compared to other areas. Table 7 shows the resulting estimated mortality differentials (ratios of life expectancy in each jurisdiction to the Australian figure):

| Table 7 | Male Mortality Differentials | | Female Mortality Differentials | |
|--------------------|-------------------------------------|---------------|---------------------------------------|---------------|
| | Capital city | Rest of state | Capital city | Rest of state |
| NSW | 109 | 102 | 105 | 102 |
| Queensland | 108 | 99 | 106 | 99 |
| Western Australia | 100 | 95 | 98 | 95 |
| Northern Territory | 97 | 91 | 98 | 95 |
| Australia | 100 | 100 | 100 | 100 |

Source: ABS 2009b Table 2.15

The ABS ignored the issue of differences in completeness of reporting in capital cities compared to the 'rest of State'. It has been widely assumed that Indigenous registration is more complete in rural areas than in urban areas. Funeral directors (who normally complete registration forms) are more likely to know people are Indigenous, and specialist Indigenous funeral services are in place in many communities. The ABS conclusion that life expectancy in capital cities is higher than in the 'rest of State' is a direct result of the assumption made, and the differentials should not be relied on.

Even more serious, estimates on the basis of Remoteness are based on registered Indigenous deaths in each region that were linked to census records. It was assumed that 'under-identification of Indigenous deaths across Remoteness Areas is consistent across Australia', without any discussion or evidence for this assumption. The results are shown in Table 8.

Table 8 Mortality Differentials, Remoteness Areas, 2005-2007¹²

| | Males(%) | Females(%) |
|--------------------------|----------|------------|
| Major Cities | 107 | 105 |
| Inner and Outer Regional | 103 | 102 |
| Remote and Very Remote | 90 | 93 |
| Australia | 100 | 100 |

Life expectancy in major cities is reported as longest, then inner and outer regional, with the lowest estimates in remote and very remote. These results too are a direct result of the assumption, and should not be relied on.

Alternative ABS Estimate (Ever Indigenous)

The ABS published several alternative estimates in an Appendix to the 2009 paper containing its life expectancy estimates.¹⁰ Of these, the alternative that had had general support in the consultation conducted by the ABS was the ‘ever Indigenous’ approach (Alternative 2): if a person is reported as Indigenous in either collection, then they are counted as Indigenous in both. This approach ignores the possibility of false positives. Table 9 shows the impact of the ‘ever Indigenous’ approach.

Table 9 Indigenous Deaths and Life Expectancy, ‘ever Indigenous’ approach

| | Total Registered Indigenous Deaths | Indigenous deaths (‘ever Indigenous’) | Increase % | Implied Coverage | Life expectancies | |
|-----------|---------------------------------------|--|---------------|---------------------|-------------------|--------|
| | | | | | Male | Female |
| NSW | 453 | 594 | 31.1 | 76 | 68.3 | 73.6 |
| Qld | 429 | 493 | 14.9 | 87 | 67.2 | 72.7 |
| WA | 387 | 422 | 9.0 | 92 | 62.3 | 67.9 |
| NT | 341 | 345 | 1.2 | 99 | 59.9 | 67.9 |
| Australia | 1,800 | 2,123 | 17.9 | 85 | 66.0 | 71.9 |

The gap between these life expectancy estimates and the Australian estimates are 12.5 years for males (compared to 11.3 under the ABS preferred method) and 10.5 years for females (compared to 9.5). No age distribution for the additional deaths is available, so it is not possible to comment further on what appears at first sight to be a relatively small impact on life expectancy.

Comparison of Consistent and Ever Indigenous estimates

Table 10 Comparison of Consistent and Ever Indigenous estimates

| | Registered Indigenous Deaths | Indigenous deaths (‘ever Indigenous’) and % increase | Life expectancies | | | | | |
|------|------------------------------------|--|-------------------|--------|-----------------|--------|----------|--------|
| | | | Consistent | | Ever Indigenous | | Decrease | |
| | | | Male | Female | Male | Female | Male | Female |
| NSW | 453 | 594(31.1%) | 69.9 | 75.0 | 68.3 | 73.6 | 1.6 | 1.4 |
| Qld | 429 | 493(14.9%) | 68.3 | 73.6 | 67.2 | 72.7 | 1.1 | 0.9 |
| WA | 387 | 422(9.0%) | 65.0 | 70.4 | 62.3 | 67.9 | 2.7 | 2.5 |
| NT | 341 | 345(1.2%) | 61.5 | 69.2 | 59.9 | 67.9 | 1.6 | 1.3 |
| Aust | 1,800 | 2,123(17.9%) | 67.2 | 72.9 | 66.0 | 71.9 | 1.2 | 1.0 |

Table 10 casts considerable doubt on the validity of the ‘ever Indigenous estimates’. The decreases in life expectancy vary substantially across the four jurisdictions, and are larger than would be expected given the Australian decrease. The NT decrease is particularly puzzling, as deaths have only marginally increased but the decrease in life expectancy is almost identical to NSW, where deaths had increased significantly with the change in methodology. The NT age distribution of deaths would be unlikely to be greatly affected by 4 extra deaths.

Given these anomalous results, the 'ever Indigenous' estimates need to be used with care pending further clarification.

The ABS concludes the presentation of these results with the warning: 'This approach produces life expectancy estimates which are biased as the identification of Indigenous status in the numerator and denominator are inconsistent.'

Alternative 'Ever Indigenous' estimate

The Australian Institute of Health and Welfare (AIHW) has recently published estimates of life expectancy for 2001-06¹³ based on linkage of registered deaths with residential aged care data, admitted hospital patient data and neonatal death data from the National Perinatal Data Collection. None of these three data sets are held in identified form by AIHW, and linkage was based on other characteristics.

Life expectancies reported were 66.8 years for males, 72.9 years for females. AIHW compares these to the ABS consistent estimates, not the ever Indigenous estimates

Trends in Life Expectancy

In September 2009, the ABS published population estimates for the period 1986 to 2006.¹² These estimates were based on an annual improvement in life expectancy at age 0 over the period of 0.2 years per annum. The evidence base for this assumption merits some investigation.

The ABS identified three sources to support its view on Indigenous mortality improvements:¹²

- A study of Northern Territory mortality from the late 1960s¹⁴
- Declines in Indigenous mortality for males and females in WA, and for females in the NT from 1991¹¹

As can be seen, the data refers to only WA and NT, which together represented 26% of the Indigenous population in 2001.¹¹ There is no discussion, and no data, relating to the other jurisdictions, notably NSW and Queensland.

The ABS assumption for Australia as whole must be regarded as speculative.

The ABS also has published Indigenous population projections up to 2021. Two series are published, one with life expectancy constant, the second assuming an increase in life expectancy of 0.3 years per annum. In a section entitled 'Which series to use', the ABS concludes

'Given evidence of improvements in mortality for some states and territories and given the assumption of increasing life expectancy used in producing the 1991 to 2005 estimates, it is expected that the projection series incorporating increasing life expectancy at birth (Series B) will be chosen by most users.'¹²

Alternative estimates for Indigenous deaths in NSW

In NSW, a State wide data linkage system is now in place (Centre for Health Record Linkage, or CHeReL). This system was used to link registered deaths in NSW for the years 2002 to 2006 with the hospital inpatient separations for the years 2001 to 2006.¹⁵ (Note that ABS death figures are based on State of residence, not State of registration of the death)

From 2002 to 2006, 2,461 Indigenous deaths were registered in NSW. Using an ever Indigenous algorithm in the data linkage (ie, a person reports as Indigenous at least once in either collection), the number of Indigenous deaths rises to 3,164, an increase of 28.6%. It may be noted that this percentage increase is close to the 31.1% shown for NSW in Table 9, where the ever Indigenous approach was used by the ABS.

It was recognised that false positive reporting could occur in the hospital collection. A person might have 20 inpatient separations over the 6 years with only one reported as Indigenous. In that case, it can be argued that this person should not be counted as Indigenous.

It was noted that Indigenous reporting was more stable for multiple admissions within a particular hospital than across different hospitals. After some testing of alternatives and discussion, it was decided to adopt the following algorithm¹⁴, referred to as Algorithm 6:

‘If an individual was either: reported as Aboriginal or Torres Strait Islander on the mortality record; or in two or more separation records in two or more hospitals, then the person was designated as Aboriginal or Torres Strait Islander. If only one or two records/facilities were available, one record/facility was considered sufficient.’

So if a person has two separations, and is reported as Indigenous in one, that person will be counted as Indigenous. If they have three at one hospital, and only one is reported as Indigenous, the person will not be counted as Indigenous. If a person uses more than two hospitals, and at least two report the person as Indigenous, the person is counted as Indigenous.

Using Algorithm 6, the number of Indigenous deaths is 2995, an increase of 21.7%.

It should be remembered that no allowance has been made, or can be made, for deaths that are not recorded as Indigenous in either the death registrations or where the person has never identified as Indigenous as a hospital in-patient. So the percentage increase quoted needs to be considered an under-estimate.

Alternative life expectancy estimates for NSW

Using these deaths estimates, and with appropriate ethical approvals, alternative life expectancy estimated have been calculated for NSW.

There were some data differences which make direct comparison with the published ABS estimates (shown in table 10) inappropriate. First, the time period covers 2004 to 2006, whereas the ABS uses 2005 to 2007. It should be noted that the ABS figures for Indigenous deaths are substantially higher in 2007 than in 2004, 2005 or 2006¹⁰, so that life expectancy estimates based on 2005-07 will be lower than those based on 2004-06. Second, as noted above, ABS death figures are based on State of residence, whereas the alternative estimates are based on State of registration of the death.

after the 2011 census; the announcement suggests that the current intention is to use the same 'consistent' methodology as was used in 2009.

Sub-national Estimates

The reported differentials between jurisdictions, between capital cities and 'rest of State', and between major cities, inner and outer regions and remote areas are a result of the assumptions made in their calculation, and should not be relied on.

These estimates are of great concern, as policy conclusions can be based on them. There is no reliable evidence on variations in life expectancy across Australia. Indigenous health is a serious concern in all areas, and efforts to counter Indigenous disadvantage should not be varied without reliable evidence.

The ABS in 2008 clearly expressed its position about the need for caution in the use of Indigenous mortality data.¹¹ Why these reservations were ignored in its 2009 publications and estimates was not explained, and is of great concern.

Future Life Expectancy estimates

The reliance of ABS on correction factors based on its limited census linkage study is surprising. The census linkage study was an excellent innovation and threw up results that merit reflection and further testing. But they were not suitable for immediate use in life expectancy estimates.

At this stage, it appears that the linkage 'window' available to the ABS after the 2011 census will be no longer than that after the 2006 census. But it is to be hoped that the ABS will seek to use a wider array of data sets for its linkage, and not restrict its work to data sets that it collects itself (the census and registered deaths).

The potential offered by the use of non-ABS data sets in linkage exercises (as the authors have done with hospital separations data) needs to be much further explored. Linkage of large numbers of deaths with other events offers wide scope for improved understanding of Indigenous health outcomes. It is important that Indigenous people have input to these linkage studies, both to improve understanding of reporting practices and to ensure the results are accepted by Indigenous people.

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