



# Ageing badly: indicators of old-age structure in Australia and New Zealand

Yoram Barak MD, MHA;<sup>1,2</sup> Shona Neehoff PhD;<sup>1</sup> Paul Glue MB ChB(Otago), MD(Bristol), MRCPsych<sup>1</sup>

<sup>1</sup> Department of Psychological Medicine, Dunedin School of Medicine, Otago University Dunedin, New Zealand

<sup>2</sup> Corresponding author. Email: yoram.barak@otago.ac.nz

J PRIM HEALTH CARE

2020;12(3):272–276.

doi:10.1071/HC19095

Received 5 November 2019

Accepted 26 June 2020

Published 3 August 2020

## ABSTRACT

**INTRODUCTION:** Until 2050, Australia and New Zealand will experience continuing increase in the population aged >65 years. Studying differences in indicators of old-age structure between these countries can inform policymakers.

**AIM:** To calculate and analyse indicators of old-age structure for Australia and New Zealand.

**METHODS:** Five indicators of old-age structure were calculated: centenarian ratio (number of centenarians per 100,000 people), longevity index (proportion of people aged  $\geq 90$  and  $\geq 65$  years in the population), longevity level (proportion of 80+/60+ years population), ageing tendency (proportion of people aged  $\geq 60$  years in the population) and centenarity index (ratio between the centenarians and the total population  $\geq 90$  years).

**RESULTS:** All indicators of old-age structure demonstrated an advantageous ageing structure in Australia compared with New Zealand. In addition, the New Zealand Māori and Australian Aboriginal indicators of old-age structure demonstrated a significant disadvantage to these ethnic groups compared with the general population.

**DISCUSSION:** Public health policy needs to target ageing in New Zealand as a major goal in advancing the 'Ageing Well' policy advocated by the government.

**KEYWORDS:** Indicators of old-age structure; Māori; Aboriginal; centenarians

## Introduction

Two decades ago, a description of the characteristics of New Zealand's centenarians was published, with the authors concluding that extreme ageing can be used as a basis for comparison with other countries.<sup>1</sup> No single indicator is good enough to assess longevity. To obtain a more reliable estimate of longevity and population ageing, epidemiological indicators, in addition to those reflecting extreme ageing, are needed.<sup>2</sup> The ratio between ultra-nonagenarians (people aged 90 – 99 years, inclusive) and the total population aged >65 years (longevity index: LI %) and the ratio of centenarians to the total population aged >90 years (centenarity index: CeI %) are two proposed indices. Increases in life expectancy have not been uniform across ethnic

and socioeconomic groups. The older a person becomes, the more extreme is the longevity phenotype. At 90 years of age, one is close to the 90th percentile of the life expectancy and at age 100 years, people are beyond the 99th percentile for contemporary birth cohorts. Thus, the use of multiple indicators such as LI or CeI better represents healthy longevity.<sup>3</sup>

The presence of people older than 65, 90 and 100 years in the total population of various countries may be used in calculating various indices that reflect the quality of ageing on a national level better than simply using mean life-expectancy or percentage of older adults in a country. Population ageing measured through a fixed old-age threshold (usually  $\geq 60$  years or  $\geq 65$  years of age) ignores

other key dimensions of ageing such as years lived with disability.<sup>4</sup> Understanding population ageing across countries with distinct demographic and health achievements calls for a combination of ageing indices.<sup>5</sup> Many important characteristics of people diverge with age, but age-specific characteristics also vary over time and differ from place to place. Augmenting the measurement of chronological age with indices that take into account the changing characteristics of populations allows more broad and precise analysis of ageing.<sup>6</sup>

Between 2013 and 2050, Australia and New Zealand are expected to experience an increase in the proportion of people aged  $\geq 60$  years. Increases in the population aged  $\geq 80$  years will be the greatest, estimated at 200% increase over the 2013–50 time frame. The speed of ageing in both countries is higher than the average rate of increase in developed countries.<sup>7,8</sup>

However, there are major differences in crude measures of ageing in these two countries, especially in life expectancy. Studying differences in indicators of old-age structure can inform policymakers on both sides of the Tasman Sea. The aim of this study was to calculate and compare five indices reflecting the differences in old-age structure between New Zealand and Australia, and to suggest plausible explanations for these differences.

## Methods

Data from the World Bank, Australian Bureau of Statistics and New Zealand's Ministry of Health, Ministry of Social Development and Statistics New Zealand were sourced for information about the disability, health and trends in older general and Indigenous populations.<sup>9–13</sup> The authors compiled results using the most recent data from each source.

### Old-age structure indices

Based on the publication by Deng *et al.*<sup>14</sup> who analysed indicators that may best assess longevity, we calculated and compared five indicators of old-age structure in New Zealand and Australian older adults. The five longevity indicators are: centenarian ratio (number of centenarians per 100,000 people); LI; longevity level

### WHAT GAP THIS FILLS

**What is already known:** Both Australia and New Zealand are moving towards becoming 'Ageing Societies'. Indicators of old-age structure that take into account the changing characteristics of the population allow us to analyse ageing more broadly and more precisely.

**What this study adds:** Using five indicators of old-age structure, we demonstrated advantageous ageing in Australia compared with New Zealand. Research as to the root cause of this difference is needed, but differences in minorities' health inequity, cancer and cardiovascular diseases survival may be driving these differences.

(proportion of the total population who are aged  $\geq 80$ +/ $60+$  years population); ageing tendency (proportion of the total population who are aged  $\geq 60$  years); and CeI. Table 1 shows all indices calculated.

## Results

Based on the World Bank dataset, the population, life expectancy and number of centenarians in Australia and New Zealand is 24.6 million population, 82.5 years life expectancy and 4279 centenarians in Australia and 4.8 million population, 81.6 years life expectancy and 450–500 centenarians in New Zealand.

All indices demonstrated an advantageous ageing structure in Australia compared with New Zealand. The disadvantages, that is, smaller indices, for older New Zealanders ranged from 5% to 14%, except for centenarians, who were even more disadvantaged. In addition, the Māori and Aboriginal ageing structure indices demonstrated a significant disadvantage to these ethnic groups compared with the 'non-Māori' and 'non-Aboriginal' data (Table 2). The disadvantages for ethnic minorities ranged from 10% to 60%.

The degree of differences between countries was calculated by ratios of the proportions. New Zealand's ratio of centenarians to the total population was 60.0% (95% confidence interval [CI]: 54.7–65.8%) of the same measure in Australia ( $P < 0.001$ ), and the centenarians ratio as well as the CeI are the most disadvantaged indices compared with Australia.

Table 1. Indicators of old-age structure

Indices*	How it is calculated	Rationale
Centenarian ratio	The number of centenarians per 100,000 population	To reflect extreme regional longevity rate
Longevity index	The ratio of $\geq 90$ year olds to the population aged $\geq 65$ years	To reflect extreme longevity among the elderly population
Longevity level	The ratio of $\geq 80$ year olds to the population aged $\geq 60$ years	To reflect the secondary longevity rate of the elderly population
Ageing tendency	The ratio of $\geq 60$ year olds to the total population	To reflect the total local elderly population proportion and ageing tendency
Centenarian index	The ratio of centenarians to the population aged $\geq 90$ years	To identify variables on which longevity depends

\*Based, in part, on Deng *et al.* 2018.<sup>14</sup>

Table 2. Indices of old-age population structure in New Zealand (NZ) and Australia

Indicator	NZ	Māori	Australia	Aboriginal
Centenarian ratio	10.43		14.1	
Longevity index	0.0414		0.053	
Longevity level	0.173		0.190	
Ageing tendency	0.20	0.054	0.21	0.19
Centenarian index	0.0161		0.022	

## Discussion

This analysis of five indicators demonstrates a disadvantage of old-age structure in New Zealand. The demographic and health aspects of ageing populations in Australia and New Zealand were recently described by researchers who predicted that both countries will experience a  $>80\%$  increase in the elderly population (people aged  $\geq 60$  years) by 2050.<sup>7</sup> The average life expectancy at birth and age 60 years is higher in Australia than New Zealand, with the differences predicted to increase by 2050. However, these authors emphasised similarities rather than differences between the two countries – and these may inform strategies to change the trajectory of ageing in New Zealand. Internationally, data from Italy and Japan also report an old-age structure with higher longevity level and centenarians ratio or index. China reports a comparable level of longevity with New Zealand.<sup>2,15</sup>

Several processes may account for the disadvantaged old-age structure in New Zealand. First, the health status of the Indigenous populations of both countries manifests as life expectancies substantially lower than the total populations. Premature adult mortality

before the age of 60 years has improved for all populations, but mortality ratios show little change since 2000, with Aboriginal at nearly four-fold that of all Australians, and Māori nearly three-fold that of non-Māori.<sup>16</sup> These findings may be attributed to nutritional inadequacy among older Māori<sup>17</sup> and smoking rates that are more than twice the smoking rate in the general population;<sup>18</sup> rates of dementia rapidly becoming a health priority in Australian Aboriginal communities;<sup>19</sup> and high rates of diabetes and renal failure accounting for 28% of all Australian Aboriginal deaths.<sup>20</sup> Frailty is prevalent and emerging at a younger age than expected in remote-living Aboriginal Australians, with rates substantially higher than in other populations.<sup>21</sup> Even after controlling for their differences in age structure, Māori and Pacific males had a higher relative risk of dying than European New Zealanders. Furthermore, ethnic mortality gradients persist into old age and the mortality level of most ethnic groups is influenced by erratic distribution of socioeconomic factors.<sup>22</sup>

An additional difference between ageing in New Zealand and Australia is the significant differences in cardiovascular and cancer mortality. Cardiovascular disease rates are higher in New Zealand than

Australia, and cardiovascular disease mortality is higher in New Zealand across all socioeconomic groups. In both countries, there were socioeconomic gradients in open-label usage of cholesterol-lowering medication, percutaneous coronary intervention and coronary artery bypass surgery. However, Australians in all socioeconomic groups were more likely than New Zealanders to receive these treatments.<sup>23,24</sup> From 2000 to 2007, there were each year 15% more deaths from cancer in New Zealand women than expected from Australian rates, and nearly 5% more deaths in men. Higher cancer death rates in New Zealand are not due simply to higher incidence.<sup>25</sup> The greater differences in deaths than in incidence suggest that patient survival is lower in New Zealand.<sup>26</sup> In addition, Australia showed significant improvements in overall 5-year cancer survival, whereas New Zealand had an only minimal increase in cancer survival.<sup>27</sup>

We tentatively conclude that public health policy needs to target ageing in New Zealand as a major goal in advancing the 'Ageing Well' policy advocated by the government.<sup>28</sup> This will be in line with the Australian and New Zealand Society for Geriatric Medicine position statement including, among others, the call for '... further research into Māori Health'.<sup>29</sup>

## Conflicts of interest

The authors declare no conflicts of interest.

## Funding

This research did not receive any specific funding.

## References

1. Wilkinson TJ, Sainsbury R. A census-based comparison of centenarians in New Zealand with those in the United States. *J Am Geriatr Soc.* 1998;46:488–91. doi:10.1111/j.1532-5415.1998.tb02472.x
2. Magnolfi SU, Petrucci E, Pinzani P, et al. Longevity index (LI%) and centenarity index (CI%): new indicators to evaluate the characteristics of aging process in the Italian population. *Arch Gerontol Geriatr.* 2007;44:271–6. doi:10.1016/j.archger.2006.05.006
3. Newman AB, Murabito JM. The epidemiology of longevity and exceptional survival. *Epidemiol Rev.* 2013;35:181–97. doi:10.1093/epirev/mxs013
4. Global Burden of Disease Study Collaborators 2013. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 2015;386:743–800. doi:10.1016/S0140-6736(15)00692-4
5. Balachandran A, James KS. A multi-dimensional measure of population ageing accounting for quantum and quality in life years: an application of selected countries in Europe and Asia. *SSM Popul Health.* 2019;7:100330. doi:10.1016/j.ssmph.2018.100330
6. Scherbov S, Sanderson WC. New approaches to the conceptualization and measurement of age and aging. *J Aging Health.* 2016;28:1159–77. doi:10.1177/0898264316656517
7. Kowal P, Towers A, Byles J. Ageing across the Tasman Sea: the demographics and health of older adults in Australia and New Zealand. *Aust N Z J Public Health.* 2014;38:377–83. doi:10.1111/1753-6405.12194
8. Gerland P, Raftery AE, Ševčíková H, et al. World population stabilization unlikely this century. *Science.* 2014;346:234–7. doi:10.1126/science.1257469
9. Snowdon W. Indigenous Health [Internet]. 16 September 2013 edn. Canberra, ACT: Australian Institute of Health and Welfare; 2013. [cited 2020 January 21]. Available from: [https://www1.health.gov.au/internet/main/publishing.nsf/content/B92E980680486C3BCA257BF0001BAF01/\\$File/health-plan.pdf](https://www1.health.gov.au/internet/main/publishing.nsf/content/B92E980680486C3BCA257BF0001BAF01/$File/health-plan.pdf)
10. Cho B. Experimental Life Tables for Aboriginal and Torres Strait Islander Australians. Canberra, ACT: Australian Bureau of Statistics; 2009.
11. Ministry of Health. The Health of New Zealand Adults 2011/12: Key Findings of the New Zealand Health Survey. Wellington: Government of New Zealand; 2012.
12. Collins P, Kalisch D. The Health and welfare of Australia's Aboriginal and Torres Strait Islander peoples. Canberra, ACT: Australian Bureau of Statistics; 2010.
13. Bascand G. New Zealand Life Tables. 2005–07. Wellington: Government of New Zealand; 2009.
14. Deng Q, Wei Y, Zhao Y, et al. Understanding the natural and socioeconomic factors behind regional longevity in Guangxi, China: is the centenarian ratio a good enough indicator for assessing the longevity phenomenon? *Int J Environ Res Public Health.* 2018;15(5):938. doi:10.3390/ijerph15050938
15. Chen R, Xu P, Song P, et al. China has faster pace than Japan in population aging in next 25 years. *Biosci Trends.* 2019;13(4):287–91. doi:10.5582/bst.2019.01213
16. Phillips B, Daniels J, Woodward A, et al. Mortality trends in Australian Aboriginal peoples and New Zealand Māori. *Popul Health Metr.* 2017;15:25. doi:10.1186/s12963-017-0140-6
17. Pillay D, Wham C, Moyes S, et al. Intakes, adequacy, and biomarker status of iron, folate, and vitamin B12 in Māori and non-Māori octogenarians: life and living in advanced age: a cohort study in New Zealand (LiLACS NZ). *Nutrients.* 2018;10(8):1090. doi:10.3390/nu10081090
18. Teh R, Kerse N, Kepa M, et al. Self-rated health, health-related behaviours and medical conditions of Māori and non-Māori in advanced age: LiLACS NZ. *N Z Med J.* 2014;127:13–29.
19. Radford K, Mack HA, Robertson H, et al. The Koori Growing Old Well Study: investigating aging and dementia in urban Aboriginal Australians. *Int J Psychogeriatr.* 2014;26:1033–43. doi:10.1017/S1041610213002561
20. Hyde Z, Smith K, Flicker L, et al. Mortality in a cohort of remote-living Aboriginal Australians and associated factors. *PLoS One.* 2018;13:e0195030. doi:10.1371/journal.pone.0195030
21. Hyde Z, Flicker L, Smith K, et al. Prevalence and incidence of frailty in Aboriginal Australians, and associations with mortality and disability. *Maturitas.* 2016;87:89–94. doi:10.1016/j.maturitas.2016.02.013

22. Jatrana S, Blakely T. Ethnic inequalities in mortality among the elderly in New Zealand. *Aust N Z J Public Health*. 2008;32:437–43. doi:10.1111/j.1753-6405.2008.00276.x
23. Stewart RA, North FM, Sharples KJ, et al. Differences in cardiovascular mortality between Australia and New Zealand according to socioeconomic status: findings from the Long-Term Intervention with Pravastatin in Ischaemic Disease (LIPID) study. *N Z Med J*. 2008;121:11–23.
24. Beaglehole R, Bonita R, Jackson R, Stewart A. Cardiovascular mortality in New Zealand and Australia 1968–1983: how can the diverging trends be explained? *N Z Med J*. 1986;99:1–3.
25. Sarfati D, Dyer R, Vivili P, et al. Cancer control in small island nations: from local challenges to global action. *Lancet Oncol*. 2019;20:e535–48. doi:10.1016/S1470-2045(19)30511-X
26. Alafeishat L, Elwood M, Ioannides S. Cancer mortality and incidence trends comparing New Zealand and Australia for the period 2000–2007. *N Z Med J*. 2014;127:9–19.
27. Elwood JM, Aye PS, Tin Tin S. Increasing disadvantages in cancer survival in New Zealand compared to Australia, between 2000–05 and 2006–10. *PLoS One*. 2016;11:e0150734. doi:10.1371/journal.pone.0150734
28. Lay-Yee R, Pearson J, Davis P, et al. Changing the balance of social care for older people: simulating scenarios under demographic ageing in New Zealand. *Health Soc Care Community*. 2017;25:962–74. doi:10.1111/hsc.12394
29. Menzies O, Kerse N, Kēpa M. Australian and New Zealand Society for Geriatric Medicine Position Statement [Abstract]: Ageing and indigenous health in Aotearoa New Zealand. *Australas J Ageing*. 2017;36(2):134. doi:10.1111/ajag.12217