

Multimorbidity among Aboriginal people in New South Wales contributes significantly to their higher mortality

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The known Aboriginal and Torres Strait Islander Australians have a lower life expectancy and a higher burden of disease than non-Indigenous Australians, but it is not known whether the prevalence of multimorbidity is also different.

The new The prevalence of multimorbidity was higher among Aboriginal than non-Aboriginal patients in all age groups. This difference accounts for a large proportion of the difference in one-year mortality between the two groups of patients.

The implications Implementing evidence-based, integrated care should be a high priority for Aboriginal and Torres Strait Islander Australians, particularly focusing on reducing the prevalence of mental and combined mental and physical comorbidity.

Australia is currently ranked sixth among OECD nations for life expectancy at birth.¹ This excellent health status is not shared by all Australians: the life expectancy at birth of Aboriginal and Torres Strait Islander people is estimated to be 11.5 years lower for men and 9.7 years lower for women than for other Australians.² The burden of disease for Aboriginal and Torres Strait Islander Australians (as measured in disability adjusted life years [DALYs]) is more than twice that of other Australians, and non-communicable diseases are responsible for 70% of the difference.³

This greater burden of disease is attributable to the higher prevalence of conditions such as diabetes and kidney disease⁴ as well as to higher rates of comorbidity,⁵⁻⁷ which have been linked with higher mortality⁷ and less intensive treatment⁵ than for age-matched non-Aboriginal Australians. Further, deaths with multiple causes are more frequent among Indigenous than non-Indigenous Australians.⁴

Multimorbidity, or the presence of two or more chronic morbidities in an individual,⁸ is increasingly recognised as a challenge to the current focus of health systems on single diseases and clinical specialities.^{8,9} A representative national survey found that nearly half the patients attending general practices in Australia had multiple chronic diseases (47.4%, equating to 32.6% of the general population).⁹ The only assessment of multimorbidity in Indigenous Australians found a higher prevalence of multimorbidity among Aboriginal people attending a Fremantle street health clinic serving a marginalised population than among its non-Aboriginal patients (50.4% *v* 44.6%).¹⁰

The aims of our study were to compare the prevalence of multimorbidity and its impact on mortality among Aboriginal and non-Aboriginal Australians in New South Wales who had been hospitalised at least once during the previous 10 years. Given the small proportion of Torres Strait Islander people in the

Abstract

Objectives: To compare the prevalence of multimorbidity and its impact on mortality among Aboriginal and non-Aboriginal Australians who had been hospitalised in New South Wales in the previous 10 years.

Design, setting and participants: Cohort study analysis of linked NSW hospital (Admitted Patient Data Collection) and mortality data for 5 437 018 New South Wales residents with an admission to a NSW hospital between 1 March 2003 and 1 March 2013, and alive at 1 March 2013.

Main outcome measures: Admissions for 30 morbidities during the 10-year study period were identified. The primary outcome was the presence or absence of multimorbidity during the 10-year lookback period; the secondary outcome was mortality in the 12 months from 1 March 2013 to 1 March 2014.

Results: 31.5% of Aboriginal patients had at least one morbidity and 16.1% had two or more, compared with 25.0% and 12.1% of non-Aboriginal patients. After adjusting for age, sex, and socio-economic status, the prevalence of multimorbidity among Aboriginal people was 2.59 times that for non-Aboriginal people (95% CI, 2.55–2.62). The prevalence of multimorbidity was higher among Aboriginal people in all age groups, in younger age groups because of the higher prevalence of mental morbidities, and from age 60 because of physical morbidities. The age-, sex- and socio-economic status-adjusted hazard of one-year mortality (Aboriginal *v* non-Aboriginal Australians) was 2.43 (95% CI, 2.24–2.62), and 1.51 (95% CI, 1.39–1.63) after also adjusting for morbidity count.

Conclusions: The prevalence of multimorbidity was higher among Aboriginal than non-Aboriginal patients, and this difference accounted for much of the difference in mortality between the two groups. Evidence-based interventions for reducing multimorbidity among Aboriginal and Torres Strait Islander Australians must be a priority.

NSW hospital data (0.1%),¹¹ in this article we use the descriptor “Aboriginal” to refer to the original people of NSW and their descendants.

Methods

Study design

We undertook an observational cohort study analysis of routinely collected NSW hospital and mortality data.

Data sources

The NSW Admitted Patient Data Collection (hospital data) was linked to NSW Registry of Births, Deaths and Marriages mortality data (deaths data). The hospital data included all public and

private hospital admissions ending in a discharge, transfer, type change, or death. Diagnoses were coded according to the International Statistical Classification of Diseases and Related Problems, 10th revision, Australian modification (ICD-10-AM). The mortality dataset captured all deaths registered in NSW. Probabilistic linkage of data extracts was performed by the NSW Centre for Health Record Linkage (CHeReL, www.cherel.org.au), who supplied de-identified records to the investigators.

Study population

The study population comprised the cohort of NSW residents (all ages) alive at 1 March 2013 who had been admitted to a hospital in NSW between 1 March 2003 and 1 March 2013 ($n = 5\,464\,595$). Vital status was defined by the presence or absence of a linked death record to 1 March 2013. Datasets with missing age data (2151 people, 0.04%), missing or indeterminate sex information (2658 people, 0.05%), or missing socio-economic status of residential area (22 795 people, 0.42%) were excluded, so that the final cohort included 5 437 018 people.

Variables of interest

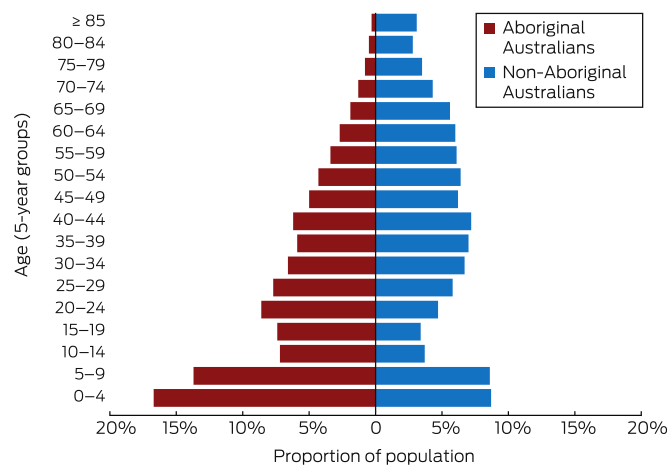
The main analysis variables were Aboriginal and Torres Strait Islander status and the cumulative count of morbidities for individuals across the 10-year lookback period. A person was deemed to be of Aboriginal and/or Torres Strait Islander origin according to the status recorded on their most recent hospital record. This definition was chosen to avoid differential misclassification bias.¹¹ Sensitivity analyses applied two alternative definitions of Aboriginal status: a weight-of-evidence algorithm (two or more separate hospital stay episodes for which the individual was recorded as being an Aboriginal and/or Torres Strait Islander, or one episode for people with fewer than three hospital stays),¹² and an ever-identified algorithm (at least one admission for which the person was recorded as being an Aboriginal and/or Torres Strait Islander).

Thirty target morbidities, classified as physical or mental, were selected from the Elixhauser and Charlson Comorbidity Indices.¹³ Some morbidity categories were grouped (eg, complicated and uncomplicated hypertension) or split (eg, multiple sclerosis and epilepsy/convulsions) were each separated from “other neurological disorders”), and one was added (chronic ischaemic heart disease) (online [Appendix](#), table 1), all according to recent recommendations.^{8,14} If a target morbidity was coded in any hospital admission diagnosis field at least once during the lookback period, it was recorded as being present on 1 March 2013. Multimorbidity was defined as having two or more morbidities. Patients with no target morbidities coded in a hospital admission record were classified as having no morbidities at 1 March 2013. Indicators were constructed from combinations of morbidities, such as mental and physical comorbidity and cumulative morbidity count.

Potential covariates examined included age at 1 March 2013 (in 5-year age groups and in three broad age groups), sex, and quintiles of socio-economic status according to the Australian Bureau of Statistics Socio-Economic Indices for Areas (SEIFA) Index of Relative Socio-economic Advantage and Disadvantage (IRSAD), based on geocoded Census Collection District of residence.¹⁵

The primary outcome was the presence or absence of multimorbidity during the 10-year lookback period. The secondary outcome was mortality in the 12 months from 1 March 2013 to 1 March 2014 (follow-up period), as ascertained in linked death records.

1 Age distribution of 5 437 018 New South Wales residents with an admission to a NSW hospital between 1 March 2003 and 1 March 2013, by Aboriginal status



Statistical analysis

Demographic characteristics and the prevalence of individual morbidities and of multimorbidity were compared by Aboriginal status and age group. Morbidity, multimorbidity, and mental and physical comorbidity rates for Aboriginal and non-Aboriginal Australians were compared as 5-year age group-adjusted rate ratios calculated by Poisson regression with a robust error term. The relative prevalence of multimorbidity among Aboriginals was also calculated by Poisson regression with a robust error term, adjusting for 5-year age group, sex, and socio-economic status. The adjusted hazard ratio for one-year mortality (Aboriginal *v* non-Aboriginal Australians) was estimated by Cox proportional hazards regression in sequential models, adjusting first for 5-year age group, sex, and socio-economic status (model 1) and then also for morbidity count (model 2). Analyses were undertaken in SAS 9.3 (SAS Institute) and Stata 12.1 (StataCorp).

Ethics approval

The study was approved by the NSW Population and Health Services Research (reference, 2009/03/141) and the Aboriginal Health and Medical Research Council (reference, 684/09) Ethics Committees.

Results

Of the 5 437 018 NSW residents alive at 1 March 2013 and who had been admitted to hospital during the previous 10 years, 117 999 (2.2%) were Aboriginal Australians; 54% were female (online [Appendix](#), table 2). The age profile of Aboriginal patients was skewed to younger age groups compared with that of non-Aboriginal Australians ([Box 1](#)), and a greater proportion lived in the most disadvantaged areas (lowest quintile, 55% *v* 18%; online [Appendix](#), table 2).

The prevalence rates of morbidity and of multimorbidity were higher for Aboriginal than non-Aboriginal patients in all broad age groups ([Box 2](#)). Physical morbidities were more prevalent than mental morbidities in all groups, except among 25–54-year-old Aboriginal Australians. The prevalence of combined physical and mental comorbidity was more than four times as high for Aboriginal as for non-Aboriginal Australians of the same age (adjusted rate ratio, 4.54; 95% confidence interval, 4.44–4.65).

2 Prevalence of morbidity, by Aboriginal status and broad age groups, and age-adjusted prevalence rate ratios

	Number of people	Total morbidity	Physical morbidity	Mental morbidity	Multimorbidity	Mental and physical comorbidity
0–24 years						
Aboriginal	63 160 (3.9%)	9445 (15.0%)	6742 (10.7%)	3237 (5.1%)	2086 (3.3%)	534 (0.8%)
Non-Aboriginal	1 548 093 (96.1%)	137 940 (8.9%)	113 081 (7.3%)	28 904 (1.9%)	19 017 (1.2%)	4045 (0.3%)
25–54 years						
Aboriginal	41 970 (2.0%)	18 839 (44.9%)	10 521 (25.1%)	13 231 (31.5%)	10 459 (24.9%)	4913 (11.7%)
Non-Aboriginal	2 098 287 (98.0%)	381 192 (18.2%)	258 215 (12.3%)	170 280 (8.1%)	136 372 (6.5%)	47 303 (2.3%)
55 or more years						
Aboriginal	12 869 (0.8%)	8909 (69.2%)	8396 (65.2%)	2491 (19.4%)	6397 (49.7%)	1978 (15.4%)
Non-Aboriginal	1 672 639 (99.2%)	809 969 (48.4%)	777 479 (46.5%)	123 493 (7.4%)	486 115 (29.1%)	91 003 (5.4%)
All age groups						
Aboriginal	117 999 (2.2%)	37 193 (31.5%)	25 659 (21.7%)	18 959 (16.1%)	18 942 (16.1%)	7425 (6.3%)
Non-Aboriginal	5 319 019 (97.8%)	1 329 101 (25.0%)	1 148 775 (21.6%)	322 677 (6.1%)	641 504 (12.1%)	142 351 (2.7%)
Adjusted rate ratio* (95% CI)		2.01 (1.99–2.02)	1.75 (1.73–1.77)	3.46 (3.41–3.50)	2.94 (2.90–2.98)	4.54 (4.44–4.65)

CI = confidence interval. * Poisson regression model, adjusted for 5-year age group: Aboriginal v non-Aboriginal patients. ♦

(Box 2). During the 10-year lookback period, at least one morbidity was recorded for 31.5% of Aboriginal Australian patients, and two or more for 16.1%, compared respectively with 25.0% and 12.1% of non-Aboriginal people.

The five most frequent morbidities by broad age group were similar for Aboriginal and non-Aboriginal Australians. The major contributors to mental morbidity among 25–54-year-old Aboriginal people were alcohol misuse (19.0%), drug misuse (16.8%), and depression (11.3%), the prevalence rates of which were higher than for non-Aboriginal 25–54-year-olds (depression, 4.1%; alcohol misuse, 3.5%; drug misuse, 2.8%). Aboriginal Australians had higher age-adjusted rates of all individual morbidities than non-Aboriginal Australians, except of cancer and multiple sclerosis (online Appendix, table 3).

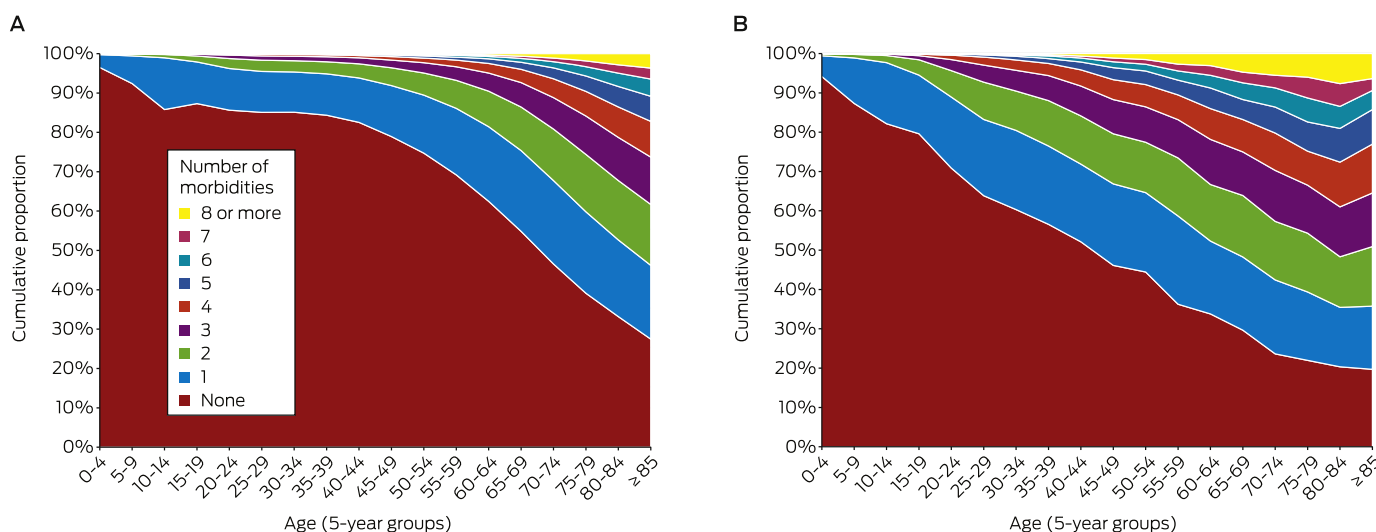
The numbers of morbidities per person increased with age, but was higher in all age groups for Aboriginal Australian patients,

particularly from the age of 25 years; the difference declined from around 75 years of age as the prevalence of multiple morbidities among non-Aboriginal people increased (Box 3).

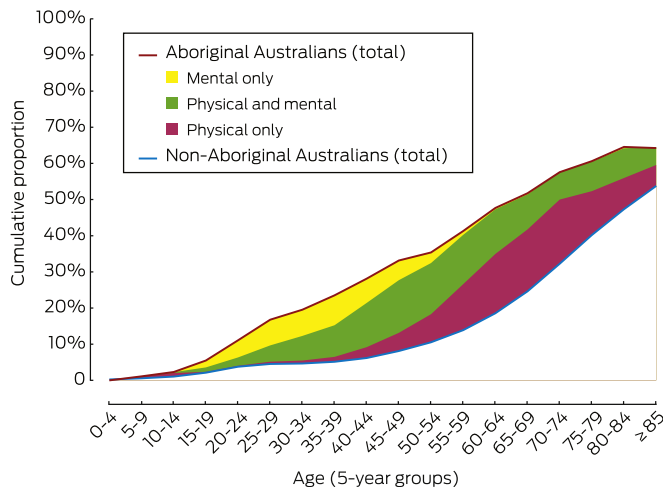
From the age of 25 years, the prevalence of multimorbidity was at least 10 percentage points higher among Aboriginal than among non-Aboriginal patients, and 20 percentage points higher between the ages of 40 and 79 years. Among 15–29-year-olds, the combined prevalence of mental multimorbidity and of mental and physical comorbidity explained about 95% of the difference in multimorbidity between Aboriginal and non-Aboriginal Australians. Their contribution decreased with age to 54% in the 55–59-year-old age group, and from 60 years of age physical multimorbidity alone accounted for more than half of the difference (Box 4).

The rate ratio for multimorbidity (Aboriginal v non-Aboriginal Australians), adjusted for age group, sex, and socio-economic status, was 2.59 (95% CI, 2.55–2.62). After adjusting for the same

3 Numbers of morbidities for non-Aboriginal (A) and Aboriginal (B) patients, as proportions of patients in each 5-year age group



4 Overall prevalence of multimorbidity among Aboriginal and non-Aboriginal patients, and contributions of mental and physical multimorbidity to the difference in overall prevalence, by 5-year age group*



* The shaded areas between the two curves correspond to the difference between Aboriginal and non-Aboriginal Australians in the age-specific prevalence of, for example, mental multimorbidity. ♦

covariates, the hazard ratio for mortality within a year was 2.43 (95% CI, 2.24–2.62); after also adjusting for morbidity count, the hazard ratio was 1.51 (95% CI, 1.39–1.63). We also examined the effect of geographic location (rurality), but found that socio-economic status was more strongly associated with multimorbidity and mortality, and that including both socio-economic status and rurality as covariates led to instability in the coefficients for rurality (a reduction or reversal in direction of effect) caused by multicollinearity. The relative hazard of one-year mortality (*v* people with no morbidities) increased with the number of morbidities, from 3.83 (95% CI, 3.69–3.98) for one morbidity to 22.8 (95% CI, 21.8–23.8) for eight or more morbidities (online [Appendix](#), table 4).

Sensitivity analyses

The age-adjusted rate ratio of multimorbidity (Aboriginal *v* non-Aboriginal people) was similar with all definitions of Aboriginal status: 2.90 (95% CI, 2.87–2.93) with the ever-identified definition, 3.07 (95% CI, 3.03–3.10) with the weight-of-evidence definition, and 2.94 (95% CI, 2.90–2.98) with the most-recent definition (as applied in the main analyses).

Discussion

We examined multimorbidity among Aboriginal and non-Aboriginal people in NSW by analysing linked hospital and mortality data. During the 10-year lookback period, almost one-third of Aboriginal patients (31.5%) had at least one morbidity, and 16.1% had two or more, compared with 25.0% and 12.1% of non-Aboriginal patients. The difference in multimorbidity rates between Aboriginal and non-Aboriginal Australians was more than 10 percentage points from the age of 25, and more than 20 percentage points for 40–79-year-olds, primarily because of the higher prevalence of mental morbidities among 25–54-year-old Aboriginal people and the higher rate of physical morbidities among Aboriginal patients over 60 years of age.

After adjusting for age, sex and socio-economic status, the prevalence of multimorbidity among Aboriginal people in NSW was 2.6 times that among non-Aboriginal people; the hazard of mortality within one year was also 2.4 times as high, or 1.5 times after adjusting for morbidity count. A large proportion of the difference in mortality risk between Aboriginal and non-Aboriginal people of the same age, sex and socio-economic status was thus associated with Aboriginal people having a higher number of morbidities.

Our findings indicate the importance of mental morbidity and combined mental and physical comorbidity for the difference in the prevalence of multimorbidity among hospitalised Aboriginal and non-Aboriginal people in NSW. Differences in the prevalence of mental health problems have previously been documented: Aboriginal and Torres Strait Islander Australians are twice as likely to report high or very high levels of psychological distress as non-Indigenous people, and their rate of community mental health service contacts is 2–3 times as high.¹⁶ Aboriginal and Torres Strait Islander Australians are twice as likely to report harmful drinking,¹⁷ 1.6 times as likely to report illicit substance use,¹⁸ and have three times as many general practice encounters for alcohol problems and substance misuse.¹⁶ While much of the observed difference in the prevalence of mental morbidities is probably related to the higher background prevalence of substance use by Aboriginal people, it is also possible that health professionals are more likely to ask about and record substance use by Aboriginal patients.

Our estimates of multimorbidity were lower than recent estimates based on a sample of patients attending Australian general practices (47.4% of the study sample and 32.6% of the general population).⁹ This is not unexpected, given that many chronic diseases are treated outside the hospital system. A validation study comparing self-report and recording of morbidities in NSW hospital data found good agreement for rates of diabetes, and fair agreement for heart disease, stroke, and hypertension.¹⁹ Our prevalence estimates should be viewed in this context. There is currently no alternative population-based resource for comparing the prevalence of multimorbidity across age groups by Indigenous status, and our study provides a valuable insight into the complex morbidity profiles of Aboriginal Australians. The 10-year lookback period was chosen to maximise ascertainment of morbidities; however, some conditions may have resolved by the time of follow-up.

We found that one-year all-cause mortality increased with the number of morbidities. A systematic review of the impact of multimorbidity on mortality among older adults found that it increased the risk of death, no matter how multimorbidity was defined.²⁰ Detailed analysis of cause-specific mortality was beyond the scope of our study; difficulties in attributing deaths to specific morbidities mean that it has also not been investigated elsewhere.

Challenges for patients with multimorbidity include communication with health care professionals, their involvement in decision making, coordination of care, assistance with self-care, and focusing on holistic and continuing care.²¹ These challenges are exacerbated for Aboriginal and Torres Strait Islander people by discrimination and prejudice in mainstream care and difficulties in accessing culturally safe and appropriate care.²² A qualitative study found that sustained engagement of Indigenous people with health care providers was most likely when they felt that the health care service was part of the community and the staff were Indigenous Australians or had a willingness to understand the cultural, community and kinship contexts of the community.²³ Providing high quality care and evidence-based interventions, particularly interventions targeting alcohol and other substance use disorders, is crucial to reducing multimorbidity among Aboriginal and Torres

Strait Islander Australians. Unfortunately, there have been few quality evaluations of interventions for substance use disorders in these populations.²⁴ Further, the weathering and premature ageing of Indigenous Australians are as related to poverty and stress as to poor access to health care, so it is vital that the societal position of Aboriginal and Torres Strait Islander Australians be improved, that poverty and disadvantage be eliminated, and that the social determinants of health — including early development, education, employment, and income — be improved to remove the disparities in multimorbidity and mortality between Indigenous and non-Indigenous Australians.²⁵

Conclusions

The high prevalence of multimorbidity and its impact on mortality challenges the single disease focus of current medical practice, particularly when people have concurrent mental

and physical morbidities. Given that the prevalence of multimorbidity is higher among Aboriginal than non-Aboriginal Australians hospitalised in New South Wales, and that this difference contributes to one-year mortality being higher among Aboriginal than non-Aboriginal people, implementing evidence-based interventions for reducing multimorbidity among Aboriginal and Torres Strait Islander Australians must be a priority.

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