

Mortality by Commonwealth Electoral Divisions in Australia

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A technical paper describing a collaborative study between researchers at Public Health Information Development Unit, Torrens University Australia and Centre for Health Policy, University of Melbourne.

ABSTRACT

The purpose of this study is to describe variations in mortality across Federal Electorates based on the 2013 boundaries. Like most countries, Australia displays significant geographic variation in mortality which is strongly correlated with levels of socio-economic disadvantage. Some urban/regional electorates have mortality ratios that are 30% greater than the national average and the mortality rates are even higher in some rural electorates. In Australia these variations in mortality are not strongly correlated with voting preference as there are higher rates of mortality both in more disadvantaged urban/regional electorates that vote Labor and many rural seats that predominately vote for the National party. The study provides evidence of the need to develop policies to tackle health inequalities in the Australian community.

Mortality data reported in this study can accessed via the web:
http://www.atlasesaustralia.com.au/CED_mortality_atlas/atlas.html

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INTRODUCTION

Variations in mortality rates across geographic regions are often used as common measures of health inequality. For example, a recent analysis by the Australian Institute of Health and Welfare (AIHW) indicated that mortality rates were 1.3 times higher in areas of lowest socio-economic status (SES) compared to the highest SES (AIHW, 2014). Earlier research by the AIHW found differences in life expectancy between the most and least disadvantaged regions in Australia which translated into gaps in life expectancy of around four years for males and two years for females (Draper et al., 2004).

Past analyses of variations in mortality rates involved local Government areas for some Australian states (Vos and Begg, 1999), or measures of geographic remoteness and area measures of socioeconomic disadvantage (Draper 2004). What have not been previously examined in Australia are the variations in mortality across politically based geographic areas such as Federal electorates. Evidence from England and Wales has shown a very strong correlation between electorates with high mortality and the proportion voting for the British Labour party, as constituents that tend to vote Labour often have higher levels of high deprivation (Davey Smith and Dorling, 1996). Such an analysis not only provides a way of representing inequalities in terms of politically meaningful regions, but also provides a way understanding how the variation in mortality is associated with voting patterns.

The purpose of this technical paper is to present estimates of mortality for Australian Commonwealth Electoral Divisions (CED) and to examine associations with voting patterns and area-based measures of socio-economic status. The analysis is descriptive and intended to inform public debate regarding the level of health inequalities in Australia.

METHODS

All data used in this study are publically available from a variety of sources including geographic information from the Electoral Commission and information from the most recent Census. Specifically:

Australian electoral data

Data on the CED were obtained from publicly available data on the Australian Electoral Commission website. This list of CEDs is based on the 2013 distribution of electoral boundaries. The two-party preferred (TPP) final results by CED from the 2013 election were used for this analysis. The TPP reports the proportion of votes where the highest preference is given to either the Australian Labour Party (ALP), or the Liberal/National Coalition (LNC).

Electoral demographics

The demographics data analysed for this study were obtained from the 2011 Australian Census conducted by the Australian Bureau of Statistics (ABS). Information such as population size and persons by remoteness areas for each of the CED were extracted using TableBuilder on the ABS website. The Census provides information on population numbers for each electorate listed by Remoteness Structure: Major Cities, Inner Regional, Outer Regional, Remote and Very Remote. CEDs were classified as *urban/regional* if greater than 90% of their populations were in the Major Cities and Inner Regional classes. Those below this threshold were classified as

rural. The population with no usual address or who lived in migratory/offshore categories (and could not therefore be allocated to a CED) were excluded from the analysis.

Socioeconomic status

Socioeconomic status of the electorates was measured using the Index of Relative Socioeconomic Disadvantage (IRSD). The IRSD is calculated and provided by the ABS based on the 2011 Census (Australian Bureau of Statistics, 2011). The IRSD is comprised of a range of factors indicating economic disadvantage (e.g. low income, high proportion of people with no educational qualifications and in low skilled occupations). A low score indicates areas of higher socio-economic disadvantage.

Mortality

Information on mortality was sourced from the Social Health Atlas of Australia (<http://www.phidu.torrens.edu.au/social-health-atlases/data#social-health-atlas-of-australia-population-health-areas>) which provided data on all-cause premature mortality (deaths at ages 0-74 years) and all-cause total mortality (deaths at all ages) for persons over the periods 2009 to 2013. The data were compiled by the Public Health Information Development Unit (PHIDU) from deaths data based on the 2009 to 2013 Cause of Death Unit Record Files supplied by the Australian Coordinating Registry and the Victorian Department of Justice, on behalf of the Registries of Births, Deaths and Marriages and the National Coronial Information System. Age-standardised rates and ratios were produced by the indirect method to adjust for differences in age distribution within the population at the CED level.

Analysis

The correlation between mortality and factors such as TPP and IRSD, were assessed for all CEDs and separately for urban/regional and rural electorates. Statistical significance was set at the 5% level unless otherwise stated. Data were analysed using STATA, version 13.

RESULTS

In 2013 there were a total number of 150 CEDs in Australia and, of these, 122 (81%) were classified as urban/regional and 28 (19%) as rural. Table 1 shows the distribution of CEDs by remoteness for the two major parties on a TPP basis. Electorates in which the ALP had a higher proportion of the preferences were almost entirely in urban/regional areas, while the LNC was divided between urban/regional (i.e. Liberal party) and rural (i.e. National Party) electorates.

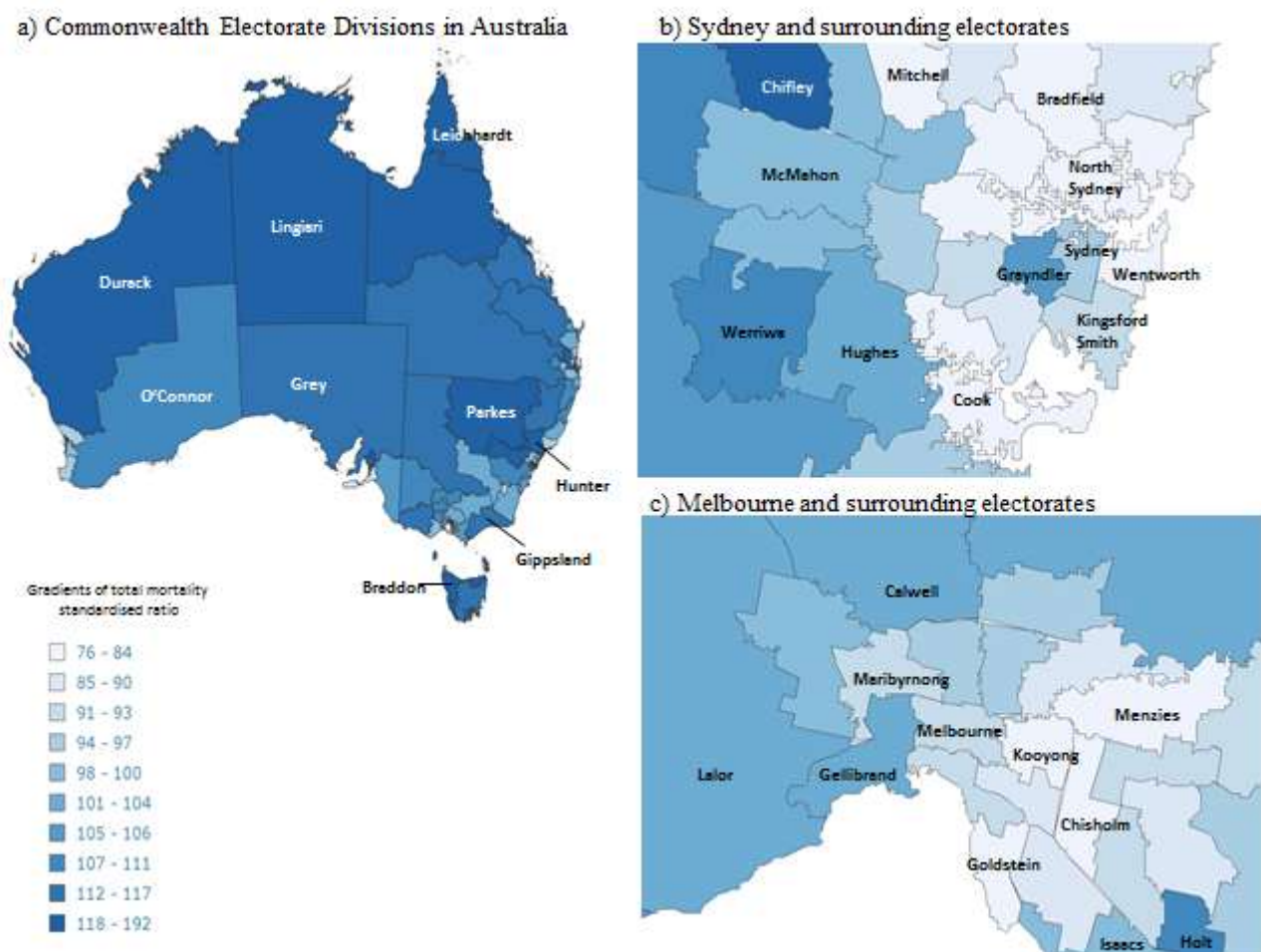
Table 1: Two-party preferred distribution of CED by remoteness

Two-party preferred			
Remoteness	ALP	LNC	<u>Total</u>
<i>Urban/Regional</i>	55 (45.1%)	67 (54.9%)	122
<i>Rural</i>	2 (7.1%)	26 (92.9%)	28
<u>Total</u>	57 (38%)	93 (62%)	150

Figure 1 shows a colour gradient for total mortality for Australia (darker colours represent high regions of mortality) and for the electorates surrounding Sydney and Melbourne. Figure 1a highlights electorates with high total mortality rates in Australia such as Lingiari, Leichhardt, Parkes and Durack. In this paper mortality rates are expressed as ratios where 100 represents the average in Australia. Lingiari, notably has the highest mortality in Australia- the age-standardised rate of mortality is 1,245 per 100,000 persons or 192 when the rate expressed as a ratio. This means that mortality in Lingiari after adjusting for the demographic composition, has a mortality rate that is 1.92 times greater than the average across all of Australia. The comparable standardised ratios of total mortality for the three electorates with the next highest mortality are Leichhardt (127), Parkes (123) and Durack (120).

The figure also provides enlarged maps for electorates surrounding Sydney (Figure 1b) and Melbourne (Figure 1c). In cities such as Sydney and Melbourne generally have mortality rates below the Australian average. Electorates surrounding both cities have some of the lowest standardised ratios of mortality in the country, including Bradfield (79), Wentworth (80), North Sydney (80) in Sydney and Menzies (80), Chisholm (81), Kooyong (82) in Melbourne. The rates of mortality rise for outer metropolitan electorates, for example in Chifley the rate ratio is 117 and in Holt, 108.

Figure 1: Standardised total mortality rate by Commonwealth Electorate Divisions (based on 2013 boundaries) [#]



Electoral maps for all regions of Australia for total and premature mortality as well premature and avoidable mortality can be obtained from the following link:

http://www.atlasesaustralia.com.au/CED_mortality_atlas/atlas.html

A summary of characteristics between CEDs can be found in Table 2. The average population in each CED is 143,058 (SD 16,860) with urban/regional electorates tending to be larger than rural electorates ($P = 0.011$). In regard socio-economic status, the average IRSD score was 1,002 with urban/regional electorates having higher scores, or less socio-economic disadvantage ($P < 0.000$) than rural electorates. The mean annual rate of premature and total deaths in CEDs are 237.8 (SD 50.2) and 652.8 (SD 88.3) per 100,000 persons respectively, with the rural electorates having significantly higher mortality rates. Labour held electorates are observed to have mean mortality rates above the national average contrary to the rates of Coalition held electorates.

Table 2: Summary of CED characteristics by geographic remoteness and ruling party¹

Mean	Remoteness		P-value ³	TPP Preference		P-value ⁴	Total
	Urban/Regional (n=122)	Rural (n=28)		ALP (n=57)	LNC (n=93)		
<i>CED population</i>	144,720	135,816	0.0112	148,860	139,501	0.0008	143,058
<i>SD</i>	15,352	21,109		21,250	12,324		16,860
<i>IRSD score</i>	1011	963	0.0000	988	1010	0.0088	1002
<i>SD</i>	48	37		48.67	48.75		49.70
<i>Total premature mortality</i>	224.2	296.8	0.0000	245.9	232.8	0.1205	237.8
<i>standardised rate²</i>							
<i>SD</i>	37.7	55.6		50.5	49.7		50.2
<i>Total mortality</i>	629.4	754.4	0.0000	668.6	643.1	0.0863	652.8
<i>standardised rate²</i>							
<i>SD</i>	64.7	105.6		97.0	81.6		88.3

Notes:

¹ A total of 48,993 people (0.23% of total population) who had no usual address, or who were classified as migratory/offshore were excluded from the analysis.

² Standardised rate expressed as deaths per 100,000 persons

³ p-value from t-test used to test for mean differences between urban/regional and rural

⁴ p-value from t-test used to test for mean differences between ALP and LNC

Figure 2 displays the standardised rate ratios for total mortality by proportion of Labor's TPP vote. Among Coalition held electorates where Labour TPP vote is below 50% (Figure 2a) Tangney in Western Australia has the lowest standardised mortality ratio of 76%, indicating that the rate of mortality is 24% below the national average. In contrast, Solomon in the Northern Territory has the highest rate ratio of Coalition held electorates. Among

Labour held electorates where Labour TPP vote is above 50% (Figure 2b), Lingiari has by far the highest mortality rate (almost double the national average). Amongst electorates held by minor parties and independents, Kennedy (Katter's Australian Party) has a mortality rate above the national average, while Melbourne (The Greens) is below average. Figure 2c is a combination of both 2a and 2b and shows Coalition electorates have a greater degree of variation in mortality than Labor electorates.

Figure 3 shows both total premature mortality (upper panel) and total mortality (lower panel) as scatter plots showing the association of standardised ratio of mortality against the TPP vote. These analyses are stratified by urban/regional and rural electorates. As Lingiari has a mortality rate that is substantially higher than all other electorates, correlations were calculated excluding Lingiari to assess the impact it has on the results. It is clear that the correlation between voting preference and rates of mortality holds in urban/regional, but not in rural electorates. In urban/regional electorates, the correlation is positive (0.40 for total mortality and 0.44 for premature mortality), indicating that urban/regional electorates with higher mortality tend to favour the Labour party. The correlation is much weaker in rural electorates, particularly when Lingiari is excluded from the analysis. When rural and urban/regional areas are combined the correlation is relatively weak (around 0.10) and not statistically significant.

Figure 4 shows both total premature mortality (upper panel) and total mortality (lower panel) as scatter plots showing the association with Index of Relative Socioeconomic Disadvantage (IRSD). Among electorates classified as urban/regional there is a strong correlation between the standardised mortality ratio and the level of socio-economic disadvantage, with lower socio-economic areas having higher rates of mortality. In rural areas the correlation is weaker (particularly when Lingiari is not included in the statistical analysis). The overall correlation is relatively strong and statistically significant (around -0.7).

CONCLUSIONS

Like most countries, Australia displays significant geographic variation in mortality which is strongly correlated with levels of socio-economic disadvantage. Some urban/regional electorates have mortality ratios that are 30% greater than the national average and the mortality rates are even higher in many rural electorates. What we have shown in this technical paper is these health inequalities are not strongly correlated with voting preference as there are higher rates of mortality both in more disadvantaged urban/regional electorates that vote Labor and many rural seats that predominately vote for the National party.

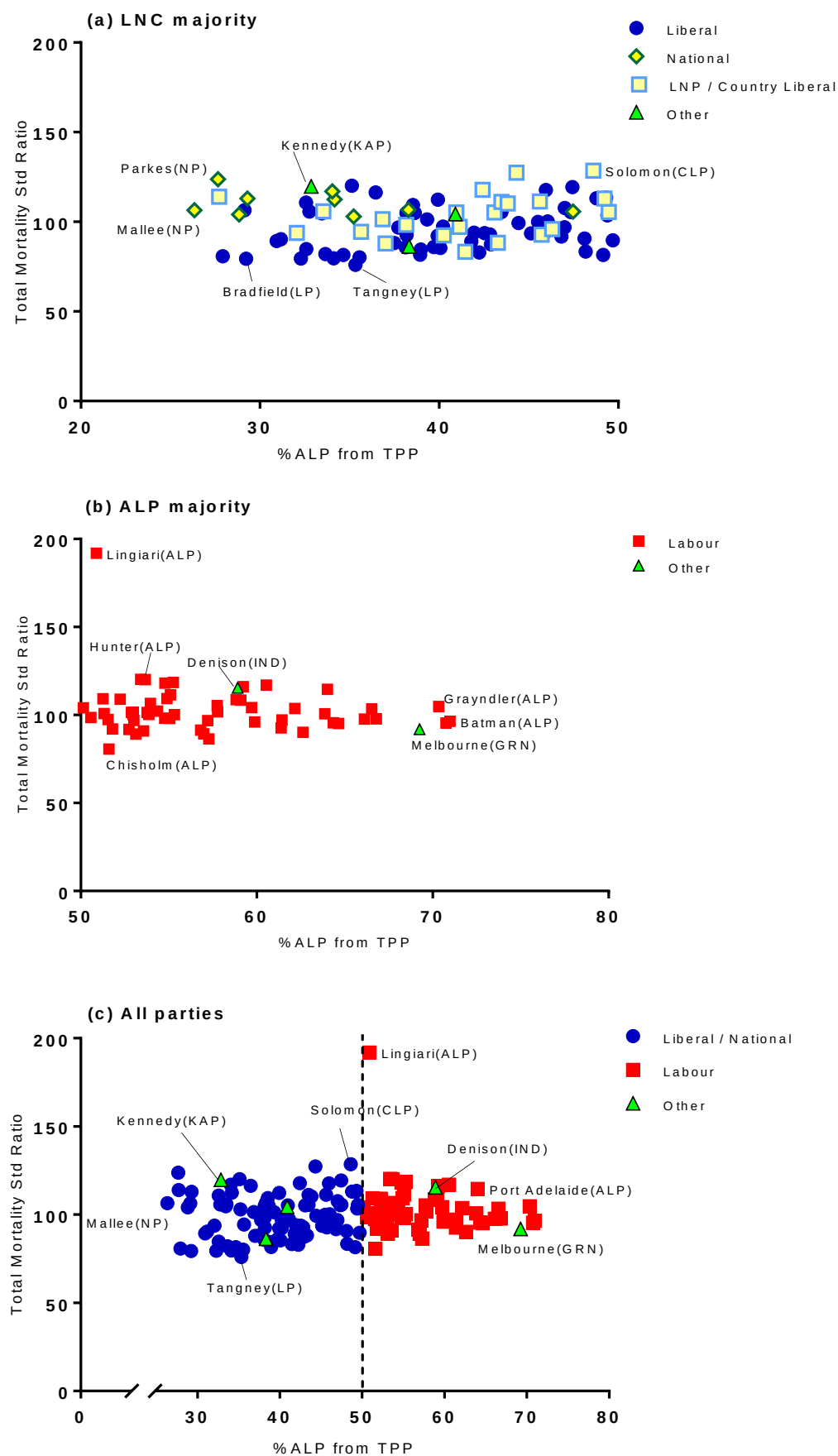
The degree of health inequality across electorates appears to be similar to that of a comparable analysis conducted in for England and Wales in the 1990s (Davey Smith and Dorling 1996). In England and Wales the standardised mortality rate ratios also range from around 80 to 130, but the political distribution is very different. In England the standardised mortality ratios are highly correlated with the proportion voting for both the British Conservative party (-0.74) and for the British Labour party (0.73). The reason for the difference is that many rural electorates in England have low levels of mortality, while in Australia all rural electorates have mortality rates above the national average. Interestingly, three urban/regional electorates in Western Sydney appear to have low IRSD scores indicating higher levels of deprivation, but with relatively low mortality ratios. It would be useful to undertake further research to understand these variations.

While health inequalities can be measured here in terms of geographic location, they are also associated with individual level measures such as individual income and education. Clarke and Leigh (2011) have estimated that life expectancy gap between the poorest and richest 20% of the population in Australia is around 6 years (at the age of 20). These individual level associations tend to be even stronger than regional measures of socio-economic status. There is much work that could be done to better understand the level and trends in inequalities in Australia, particularly using large administrative data sets. For example, a recent major study in the United States has linked de-identified taxation records and mortality records to examine trends in gap in life expectancy across levels of income to understand differences in different regions. They conclude that differences in life expectancy across income groups increased over the last decade (Chetty, 2016).

In England and Wales the high concentration of health inequalities on side of politics, may explain why there has been much greater focus on tackling inequalities among politicians in United Kingdom. For example the Blair Labour government in commission Acheson Report (Department of Health, 1998) which documented the level of socio-economic related inequalities and proposed a policy agenda aimed at reducing these inequalities partly through utero and early life interventions (Oliver and Nutbeam, 2003). Strategies for reducing inequalities need to be evidence based (Macintyre, 2003).

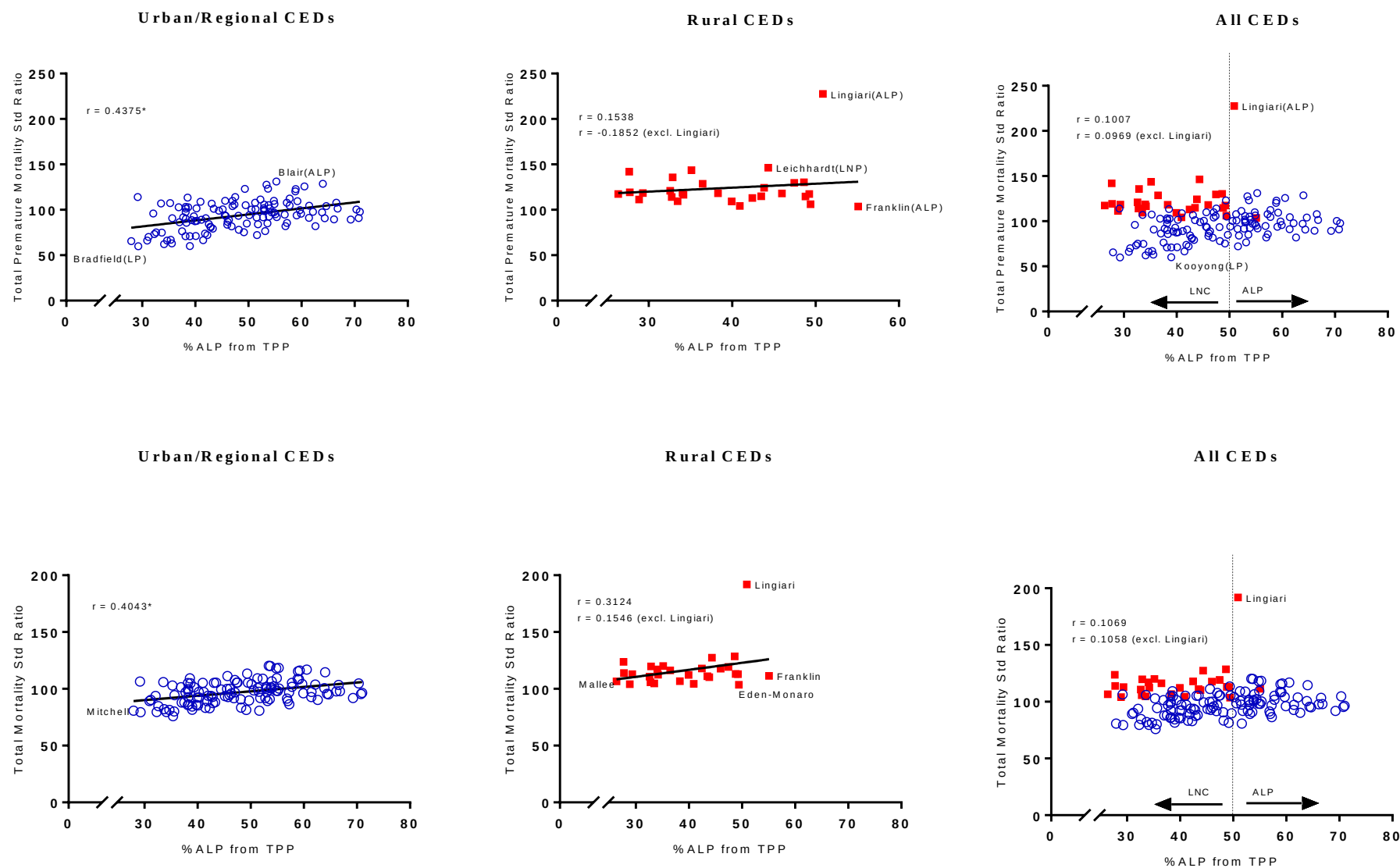
In Australia most of the political focus has been on reducing the gap between indigenous and non-indigenous life expectancy. Our data clearly supports this strategy, as the two Northern Territory electorates (Solomon and Lingiari), which have a high indigenous population also have the highest mortality rates in Australia. However, we also illustrate that there are substantial health inequalities in many other regions of Australia that are strongly associated with socio-economic disadvantage. This provides a case for future Australian Governments to develop a broader *closing the gap* strategy for reducing health inequalities in entire Australian Community.

Figure 2: Standardised mortality ratio by two-party preferred vote *



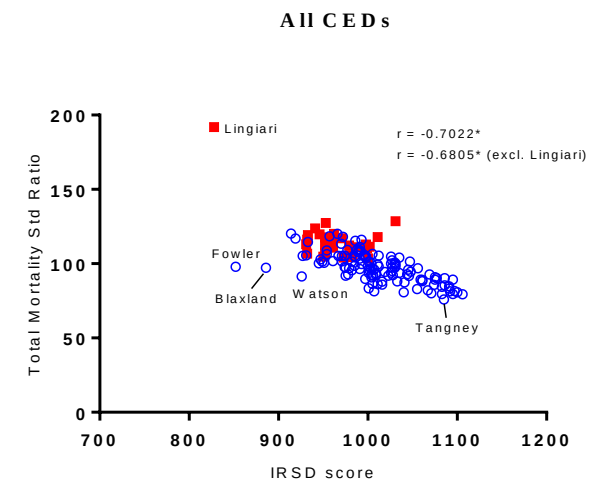
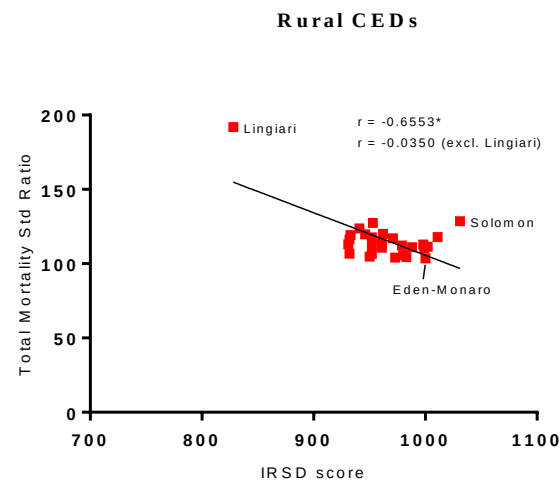
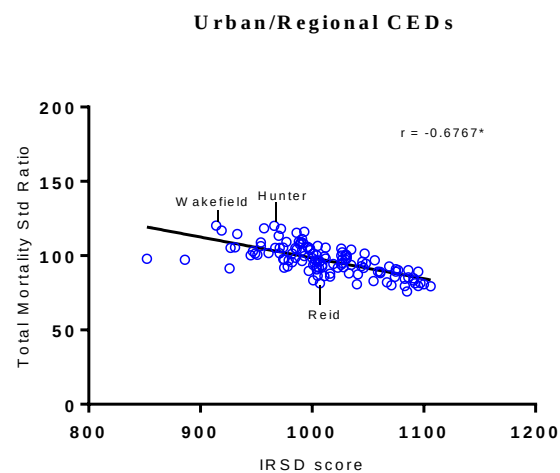
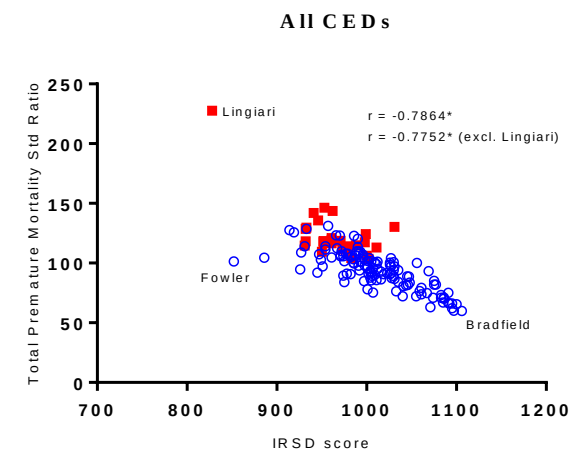
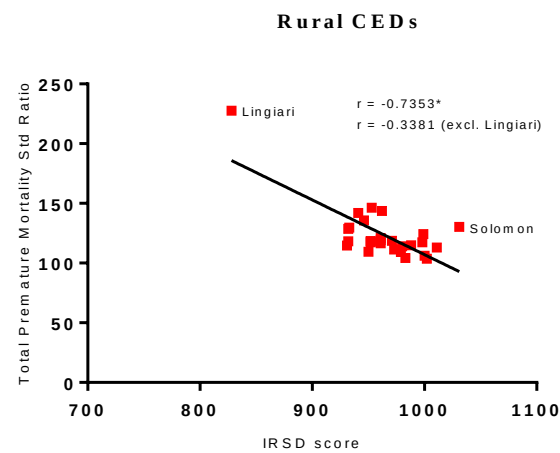
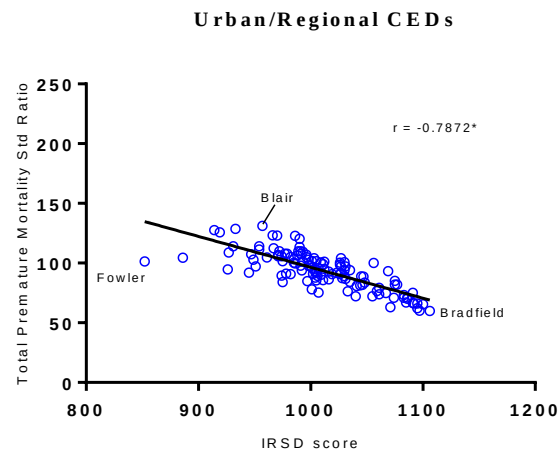
*Note: A total mortality standardised ratio of 100 is the average; electorates with higher (lower) ratios have greater (lesser) than average mortality.

Figure 3: Scatter plots showing the association between mortality (total premature and total) and voting preferences [#]



[#]**Note:** Correlation coefficients 'r' are shown alongside the plots for both urban/regional and rural electorates. Those denoted with an * are statistically significant. Blue dots represent urban/regional while red squares are rural.

Figure 4: Scatter plots showing the association between total premature and total mortality and IRSD score [#]



[#]**Note:** Correlation coefficients ‘r’ are shown alongside the plots for both urban/regional and rural electorates. Those denoted with an * are statistically significant. Blue dots represent urban/regional while red squares are rural.

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