THE UNIVERSITY OF
MELBOURNE

Review of Birth Deaths & Marriages Victoria (BDMV) mortality data for the Latrobe Valley and the time of the Hazelwood coal mine fire in Morwell

Louisa Flander PhD
Senior Research Fellow

Dallas English PhD
Professor

Centre for Epidemiology & Biostatistics,
Melbourne School of Population & Global Health
University of Melbourne, VIC 3010

l.flander@unimelb.edu.au

Executive Summary

Our review of the BDMV mortality data (2009-14) for the Latrobe Valley shows that an excess number of deaths occurred in the period January to June 2014, compared to the period January to June 2009-13.

This assessment reviews the data provided, and shows several ways of demonstrating the small increase in Latrobe Valley deaths in 2014, compared to 2009-13. We have shown these results using the following analyses, looking at deaths per month/per postcode, deaths per month/all postcodes, and annual deaths/all postcodes.

We do not find this increase to be conclusive evidence of any particular effect, given the very wide confidence intervals around the data, and the lack of useful denominators to compare health events in these postcodes. These uncertainties include, but may not be limited to, the small population size under review, and the fact that we have no information about the underlying age or sex distribution or population movements over time within the postcodes concerned.

Monthly mortality

The graphic representation of reported deaths by month and associated exact confidence intervals for these observations over the period 2009-14 shows that 2014 deaths are within the range observed for the previous five years, with postcode data combined for analysis (Figure 1).

Standard mortality ratios

The standard mortality ratios (SMR) and associated confidence intervals show that 2014 mortality exceeded the period 2009-13 by 15% extra deaths, that is an extra 1.87 deaths, per month per postcode (see Table 1). The comparison of the period February-March 2014 with February-March 2009-13 reveals 20% extra deaths, that is an extra 2.3 deaths, per month per postcode. However, these data cannot be interpreted without considering the associated wide confidence intervals, which reflect the uncertainty of these estimates. In addition, we lack denominator data for each postcode, so must assume a stable population across all postcodes.

Linear Regression

The monthly number of deaths was approximately normally distributed, so the data were analysed using linear regression. There was no evidence of serial autocorrelation of the residuals. 'Exposure' for this analysis was defined in three ways:
1. All of 2014 versus all other years;
2. February and March 2014 versus all other months;
3. Feb/March 2014, Jan/April/May/June 2014 versus all other months.

The data are consistent with increased numbers of deaths in 2014, with 7.4 additional monthly deaths for 2014 compared to 2009-13, and 9.2 additional monthly deaths for February-March 2014 compared to February-March 2009-13.

However, the evidence is weak and the confidence intervals very wide (see Table 2).

Poisson regression

The 2009-13 data were modelled in addition using Poisson regression (for categorical data) and the 2014 period deaths were predicted using this model (see Figure 2 and Table 3). This model shows that there are 37 excess deaths overall in the 2014 period (339 observed for 2014, compared to the 302 annual average predicted by the model). The excess deaths observed occurred in March and May of 2014.

Limitations

We cannot conclude that the excess 2014 mortality is due to any single cause, or whether it has occurred by chance alone. We did not take external factors such as local weather conditions into account in the analysis. Analysis of the cause of deaths for this period would be required to explore common risk factors. We have no information on the underlying age/sex distribution of these localities, or of the recent demographic changes in these communities, both trends that could underlie the excess mortality seen in 2014.

Figure 1. Monthly mortality and associated exact 95% confidence intervals for aggregated Latrobe Valley postcodes, 2009-14
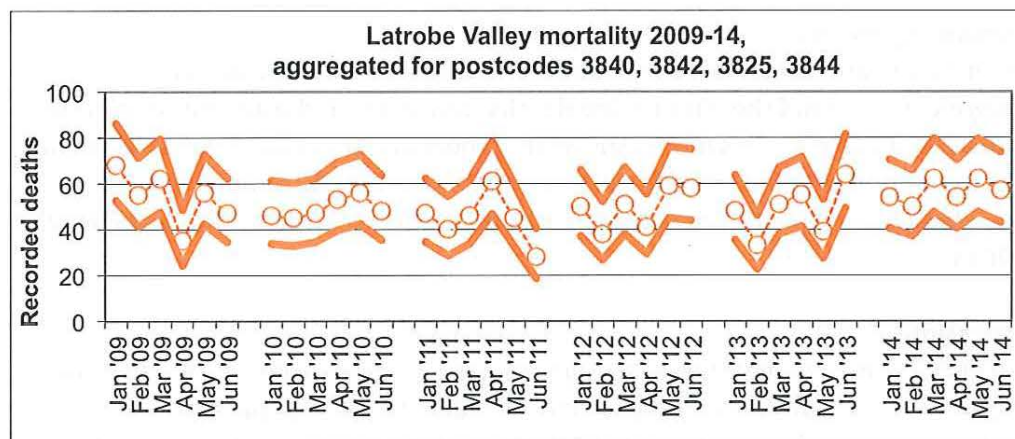

Latrobe Valley mortality 2009-14, aggregated for postcodes 3840, 3842, 3825, 3844

Table 1. Standardised Mortality Ratios (SMR) and associated 90% confidence intervals for Latrobe Valley mortality 2009-13 compared to 2014[1]

	Average Deaths per month/postcode 2009-13	Average Deaths per month/postcode 2014	SMR	90% confidence interval
January-June	12.27	14.13	115.15	57.69 to 1877.59
February -March	11.7	14.0	119.65	78.16 to 267.59

[1] Confidence interval of SMR from H.J. Motulsky, Intuitive Biostatistics, 3rd ed., Oxford University Press, 2014; following the method of E.C. Fieller, Suppl to J R Stat Soc, 7:1-64, 1940.

4

Table 2. Predicted additional monthly deaths during 2014 from linear regression analysis, for aggregated postcodes

Time period	Predicted additional deaths per month, all postcodes		p-value	R^2
	Number	95% confidence interval		
Jan-June 2014 *vs* Jan-June 2009-13	7.4	-0.69, 15.55	0.07	0.09
Feb-Mar 2014 *vs* Feb-Mar 2009-13	9.2	-5.48, 23.88	0.19	0.16

Figure 2. Monthly mortality and 95% associated confidence intervals, Latrobe Valley postcodes 2009-13, with Poisson regression predicted values, 2014
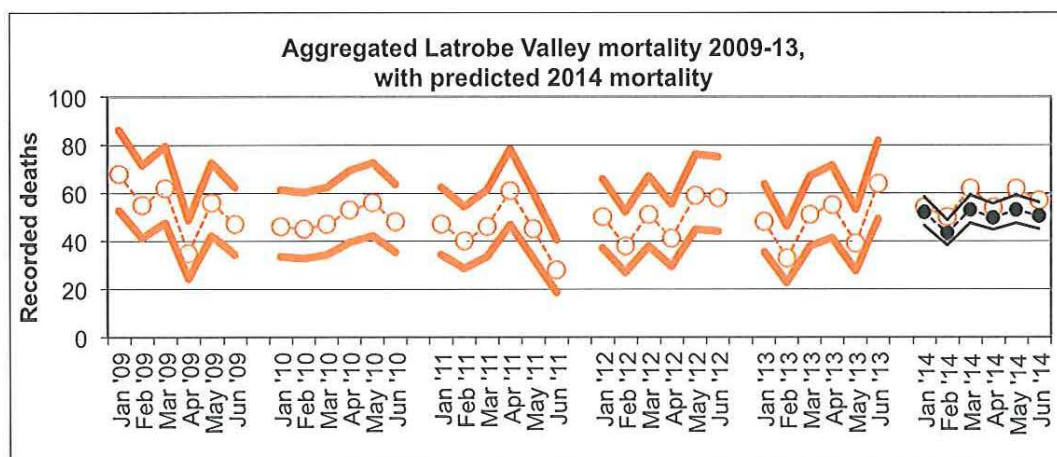
Table 3. Predicted additional monthly deaths during 2014 from Poisson regression analysis, for aggregated postcodes

	Observed	Predicted	Lower bound	Upper bound
Jan 2014	54	51.94	46.53	58.56
Feb 2014	50	43.38	38.47	48.91
Mar 2014	62	52.98	47.47	59.15
Apr 2014	54	49.90	44.70	55.70
May 2014	62	52.98	47.47	59.15
Jun 2014	57	50.40	45.15	56.26
TOTAL	**339**	**301.58**	269.78	337.72