

## Reference to high child mortality rate in Armidale

A recently published report titled '*Spatial analysis of child deaths in New South Wales*' identified Armidale (Statistical Area Level 3) SA3 as having the highest child mortality rate in NSW in the five year period between 2011-2015, while Manly SA3 (in Sydney) had the lowest (NSW CDRT, 2018). The question is whether this high child mortality is due to the use of wood fire heating in Armidale. The answer to this question depends on the information available in the report and the scientific evidence on the association between exposure to residential wood fire smoke and child mortality.

The report examines three, five year periods but it is only in one of these periods that Armidale appears on the list of highest child mortality rates in the State. In the absence of other supporting information, the fact that Armidale appears in only one of the three reporting periods does not support a relationship with exposure to a chronic issue such as wood fire smoke from residential heating. Additionally, with an average of just 5 child deaths per year during the period of high child mortality (2011-2015), estimates of child mortality at this small area level may be unstable due to the effects of random variation.

Despite this, an association between exposure to residential wood fire smoke and child mortality rates may be considered if there is conclusive evidence from the scientific literature supporting such as an association. In the absence of such evidence, there is a need to recognise the role of other determinants of child mortality, and examine associations with known risk factors prevalent in Armidale. These include (but are not limited to) higher than State proportion of smokers, mothers who smoke during pregnancy; Aboriginal and Torres State Islander peoples living in Armidale, and people who delayed seeking medical help or purchasing prescribed medication because they couldn't afford it.

Overall, there is insufficient information at present to support a causal association between wood fire smoke and child mortality in Armidale. Further investigation is required to investigate this association.

### Explanation

The following needs to be considered when claiming an association between wood fire heating and child mortality specific to Armidale.

1. Is the association causal?

While there is evidence of associations between air pollution and morbidity of older people, there is no consistent and definitive evidence from published literature supporting an association between pollution resulting specifically from wood fire smoke (as opposed to urban or industrial pollution) and child mortality.

There is in fact literature that report "associations between air pollutants and mortality in children under 5 years of age were not statistically significant. There was a significant trend of increasing risk of death according to age with effects most evident for subjects over 65 years old."(Gouveia and Fletcher, 2000)<sup>1</sup>. This was the finding from a time series study – a design that is often used in environmental epidemiology to explore possible associations prior to conducting further investigations.

2. Child mortality is multifactorial in origin.

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<sup>1</sup> Note that majority of the child deaths in NSW are in the 0- 5 year age group (NSW CDRT 2018; Queensland Family and Child Commission, 2017).

Factors such as socioeconomic status, maternal smoking status, and access to health care are all predictors of health outcomes including low birth weight and child mortality. In Australia, Aboriginal and Torres Strait Islander peoples experience higher rates of child mortality compared with the general population (Australian Health Ministers' Advisory Council, 2015).

To be noted are the following characteristics of the population in Armidale Dumaresq region (Hunter New England and Central Coast Primary Health Network 2015; 2016):

- a. The percentage of mothers smoking during pregnancy is higher compared with NSW. (16.9% Armidale compared with 12% NSW).
- b. The higher than State average percentage of Aboriginal and Torres Strait Islander peoples (7.8% Armidale compared with 2.9% NSW).

Armidale is unfavourable compared to NSW in the following indicators:

- c. SEIFA Index of Relative Socio Economic Disadvantage
- d. Life Expectancy at birth
- e. Smoking prevalence
- f. Obesity prevalence
- g. People who delayed consultation because they could not afford it (rate per 100)
- h. People who delayed purchasing medication because they couldn't afford it (rate per 100)
- i. People who had difficulty accessing services (rate per 100)
- j. People who often had difficulty or could not get to places needed with transport (rate per 100)
- k. Children developmentally vulnerable on one or more domains
- l. Premature mortality - not limited to child mortality
- m. Prevalence of high / very high psychological distress (18 years or older – rate per 100)<sup>2</sup>
- n. Prevalence of chronic disease including high cholesterol, Chronic Obstructive Pulmonary Disease, Circulatory System Disease, Hypertension, Respiratory System Disease, Asthma, Musculoskeletal disease, Arthritis, and incidence of Prostate Cancer and Colon Cancer<sup>2</sup>.

Many or all of these factors could contribute to the child mortality rates reported for Armidale. The role of these factors in contributing to the reported child mortality rates needs to be investigated prior to making claims of a causal association between wood smoke in Armidale and child mortality.

3. No study has been done in Armidale to examine the association between exposure to wood smoke and child mortality.

A letter to the Editor published in the Medical Journal in Australia in 2006 reports hourly smoke pollution comparing Armidale with Liverpool (Sydney) 10-11 June 1997 (9 years prior to publication date) (MJA, 2006). The concentration of fine particle pollution is reported to be measured by nephelometer scattering coefficient.

The nephelometer measures the light scattering coefficient of atmospheric particles. While there is some evidence to suggest that the nephelometer can obtain “both light scattering (for visibility) and fine particulate (PM<sub>2.5</sub>) mass concentrations ... reliably and importantly in a time effective manner for a rapid assessment of fine particle (PM<sub>2.5</sub>) air pollution” (Shendrikar and Steinmetz, 2003), this evidence is from

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<sup>2</sup> There is increasing evidence to support an association between chronic disease in the mother prior to and during pregnancy and birth outcomes/child health. Ref: Johnson k, Posner SF, Bierman J, et al. Recommendations to improve preconception on health and health care—United States. *Morbidity and Mortality Weekly Report* 2006; 55 (RR06):1-23.

a study that sampled air from a location following complaints from residents of irritant fogs and pungent odours. There is also no information in the paper to suggest that the location was of high altitude. The composition of this fog is unknown, and therefore it is not possible to know whether the fog was due to air pollution from smoke or other chemical pollutants, or due to weather conditions. There is no definitive evidence to demonstrate the validity of the nephelometer in measuring air pollution in the presence of winter fog caused by high altitude and low lying clouds. While the heavy water particles in low lying cloud can trap air pollution (such smoke particles), there is no evidence to date from Armidale that this is occurring.

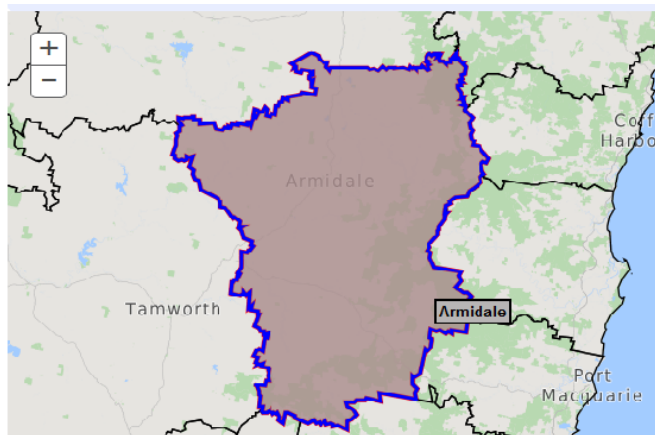
4. Child mortality rates are reported for three periods of five years - 2001 -2005; 2006-2010; and 2011-2015. It is only in the last period that Armidale appears in the listing of SA3 with the highest child rates (Table 2.5 of the report – page 20).

The fact that Armidale does not appear in the list for previous periods of reporting suggests that this high rate is not a usual occurrence. In contrast, Taree-Gloucester appears in all three reporting periods, and Upper Hunter and Bourke-Cobar-Coonamble on two of the three reporting periods.

A closer look at the numbers identify that there have been 26 deaths in Armidale in the five year period between 2011 and 2015 – an average of five child deaths per year. Rates calculated based on such small numbers are unstable, and must be interpreted with caution. With the small numbers and the absence of Armidale in the other two reporting periods mean that random variation cannot be excluded as an explanation.

5. The unit of reporting child mortality rate is the Statistical Area Level 3 (SA3), which extends beyond Armidale Local Government Area.

The population for Armidale SA3 in 2016 was 38,306 (ABS, 2018), which is slightly larger than the ABS Census reporting by LGA (2016 = 29,449 – ABS census). The boundaries of Armidale SA3 extend beyond the Local Government Area of Armidale (see Figure below).



Source: ABS 2018.

## Conclusion

There is insufficient information at present to support a causal association between the use of residential wood fires for heating in Armidale and reported child mortality.

## Recommended further investigation

1. Undertake a systematic review of the scientific literature to determine whether wood fire heating used in homes is associated with increased risk of adverse health outcomes including child mortality.
2. Further explore mortality data available in the public domain to examine trends and associations with known risk factors for child mortality.
3. Examine any available data on air quality for Armidale against concentrations identified from the literature (if any) as being harmful to health of children and adults.
4. Systematic monitoring of air quality in Armidale – in conjunction with EPA, to determine whether air pollution levels are within acceptable levels.

## References

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