Hazelinks - Cancer incidence analysis (First data extraction)

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Abbreviations

ASGS	Australian Statistical Geography Standard
AGSC	Australian Standard Geographical Classification
ERP	Estimated Residential population
LGA	Local government area
MUHREC	Monash University Human Research Ethics Committee
SA	Statistical area level
SIR	Standardised incidence ratios
VCR	Victorian Cancer Registry
95%CI	95% Confidence Interval

Executive Summary

The aim of this analysis was to identify patterns of cancer in the Latrobe Valley (which closely follows the boundary of Latrobe City) and surrounding areas prior to the Hazelwood mine fire to provide a baseline against which future data extractions and analyses will compare cancer patterns that occur after the mine fire. An anonymised data extract from the Victorian Cancer Registry for the period 1 Jan 2009 to 31 December 2013 was analysed. Rural and regional Victoria was used as the reference population to determine whether observed numbers in the Latrobe Valley and combined surrounding areas were in excess of expected numbers. Results showed similar overall cancer incidence in the Latrobe Valley and combined surrounding areas when compared with the rural and regional Victorian population. A statistically significant higher rate of mesothelioma and bladder cancer in males was observed in the Latrobe Valley. For females in the Latrobe Valley, significant excesses were observed for liver, lung and overall blood cancers. The combined surrounding areas did not show any statistically significant results. The identified cancer linkage of Hazelwood Adult Survey participants over time will further examine the cancer incidence in the Latrobe Valley and will be able to take into account the exposure from the Hazelwood mine fire and relevant confounders e.g. smoking and work histories.

1. Introduction

On February 9, 2014, the Hazelwood open cut brown coal mine in the Latrobe Valley, Victoria, caught fire resulting in the nearby town of Morwell being covered in plumes of smoke and ash over a six week period. Monash University has been contracted by the Victorian Department of Health and Human Services to undertake a comprehensive study of the long term health and wellbeing of Morwell residents following exposure to the smoke from the Hazelwood mine fire.

The Hazelwood Health Study is investigating whether exposure to smoke from the Hazelwood Mine Fire smoke event in February-March 2014 has affected the health of residents. The study determines the health status of the population at the time of the fire and ascertains individual risk and lifestyle factors for different conditions.

2. Background

As part of the overall Hazelwood Health Study, there is a particular focus on cancer incidence and whether residents who were exposed to emissions from the Hazelwood mine fire have a higher incidence of cancer over a prolonged period of follow-up when compared with similar people who

were not exposed. Specific cancers (malignancies) that are hypothesised to be associated with the type of exposures that were present at the Hazelwood fire included lung and bladder cancers.

Cancer incidence, which means the occurrence of new cancers over a specified period of time, will be investigated by undertaking an identified data linkage of Hazelwood Adult Survey participants with the Victorian Cancer Registry (VCR), and with the Australian Cancer Database (ACD) held by the Australian Institute of Health and Welfare (AIHW). This identified linkage will be undertaken once the group of Adult Survey participants is finalised. Regular anonymised data extracts from the VCR will also be used to investigate cancer incidence in the whole study population.

Data linkage and data extraction will be repeated approximately every 2-3 years for the duration of the study.

This report details the results of the first VCR data extraction that includes de-identified cancer records for the period 1 Jan 2009 to 31 December 2013 for Latrobe City and surrounding areas. As there is a known latent period between exposure and the onset of cancer (usually in excess of 7-10 years, especially for solid tumours) the analysis presented in this report is restricted to cancer incidence before the mine fire period to establish a background picture of cancer incidence in these areas.

3. Aims and objectives

The aim of this analysis was to provide information on the incidence of the main types of cancer in Latrobe City and surrounding areas prior to the Hazelwood Mine fire in 2014. Understanding the background incidence of cancers in these areas will help in the interpretation of findings of the planned individual cancer linkage of Hazelwood Adult Survey participants and later data extraction analyses of the whole population using cancer incidence data after the mine fire.

4. Human Research Ethics Committee approvals

Monash University Human Research Ethics Committee (MUHREC) approved the Hazelwood Adult Survey & Health Record Linkage Study on the 21st of May 2015. This included approval to access the Victorian Cancer Registry (VCR) for the Adult Survey identified linkage and data extraction. Approval number: CF15/872 – 2015000389.

Approval to access VCR data was also granted from the Director of the VCR on the 6th of May 2016 based on local institutional ethics approval (MUHREC). Approval number CF15/187.

5. Methods

5.1 VCR Dataset

The Victorian Cancer Registry (VCR) includes all invasive cancers, in-situ carcinomas, benign tumours and tumours of uncertain behaviour in Victoria since 1982. Data for the VCR is provided by hospitals, pathology laboratories and cancer screening registers. Cancer notification to the VCR is mandatory, but excludes non-melanoma skin cancers (basal or squamous cell carcinoma of the skin).

Data were analysed for the five year period from 1 January 2009 to 31 December 2013 (based on date of diagnosis), for all ages. A five year period was chosen for this initial analysis to ensure there were sufficient cancers for less common cancer types and also to minimise the findings being influenced by year-to-year variation. The geographical boundaries of the dataset were defined using Australian Statistical Geography Standard (ASGS) 2011 classification Statistical Area Level 3 (SA3)

spatial units. Analysis included the Latrobe Valley SA3 (main exposure area) which closely follows the boundary of Latrobe City (see figure 2), as well as the surrounding SA3 areas of Baw Baw, Gippsland-South West and Wellington. These three surrounding SA3 areas have been shown to contain some areas which had increased levels of $PM_{2.5}$ during the fire and were combined for the purpose of the analysis. The date range and geographical boundaries of the analysis were selected to capture cancer incidence in the Latrobe Valley and surrounding areas **before the fire period.**

The SA3 areas included in the analysis were Latrobe Valley (20504), and the combined surrounding areas of Baw Baw (20501), Gippsland-South West (20503) and Wellington (20505).

Figure 1 shows a map of the geographical areas included in the analysis.

Figure 1: Geographical boundaries of cancer records included in the analysis

Since the Australian Standard Geographical Classification (AGSC) has been replaced with the Australian Statistical Geography Standard (ASGS), Local Government area structures have been replaced with SA3s. As the local community refer to the Latrobe Valley area as Latrobe City (LGA) it is important to ensure that most of the area formerly defined as Latrobe City is captured in the Latrobe Valley SA3. Figure 2 shows the Latrobe Valley SA3 mapped to the Latrobe City LGA. The geographical boundaries essentially coincide, with only a small part of the SA2 of Leongatha (21990), Mount Baw Baw region (20177), and Trafalgar (20178) SA2s excluded from the Latrobe Valley SA3.

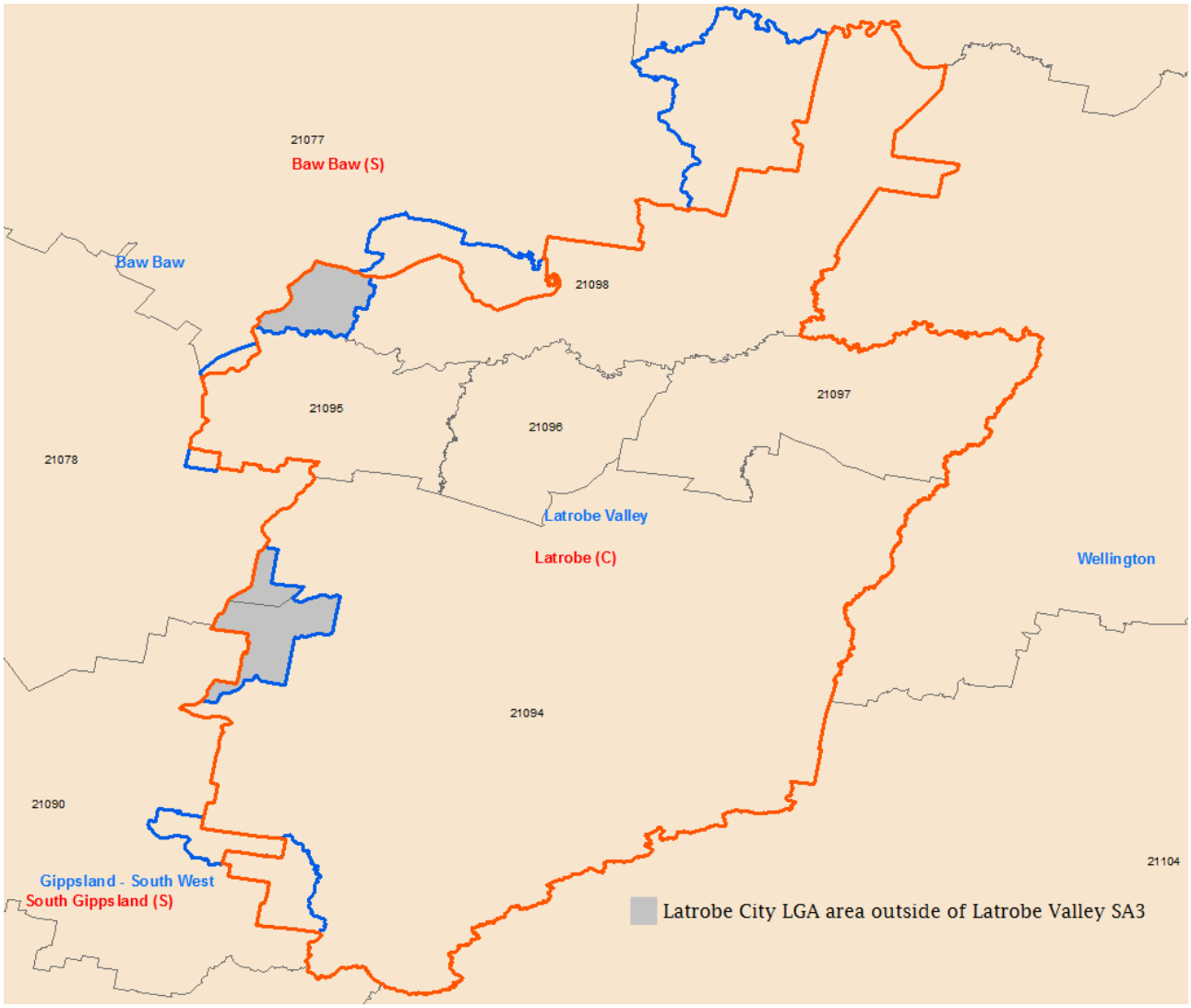

Figure 2: Latrobe Valley SA3 mapped to Latrobe City SA3 (with SA2s)

5.2 Statistical analysis

The analysis was conducted in Stata Version 14 (Stata Corporation, College Station, Texas 2015). Indirect standardization was conducted using the istdize procedure. The analysis reports the observed number of different types of cancer in the Latrobe Valley SA3 and surrounding areas (Baw Baw, Gippsland- South West and Wellington combined), the expected number of these cancers, as well as Standardised Incidence Ratios (SIRs) with 95% confidence intervals.

Observed rates included malignant cancers only (as defined by tumour behaviour codes 3 and 6 in the VCR data). Incidence reflects the number of primary tumours rather than the number of individuals with

cancer. The data obtained from the VCR may include multiple cancers in the same person, of which only some were included in the analysis using the following decision rules:

1. If a second primary cancer was at the same site as the first (that is, with the same 3-digit ICD10 code) **and** has the same morphology group then only the first cancer was included in the analysis, using the World Health Organisation morphology grouping.
2. Multiple records for the same person with different ICD10 3-digit code were each counted in the analysis, except for the a small group of cancers, which are considered to be a single 'site' for reporting purposes, such as blood cancers.

The 2011 ABS regional population data and the regional Victorian cancer data were used to calculate the reference population rates. The 2011 ABS data was used for all examined years (2009-2013) which assumes the same age distribution across the five years. Rural and regional data (SA3 areas outside of metropolitan Melbourne classified by ASGS 2011) was used as there are known to be differences in cancer incidence between urban and rural/regional areas for many types of cancer (Australian Institute of Health and Welfare and Australasian Association of Cancer Registries, 2007). The Victorian rural and regional population reference data included data from Latrobe Valley and surrounding areas however this is only a small proportion of the total Victorian rural and regional population and so is not considered to entail a major form of bias in the results. Any bias which occurs is likely to be towards the null, which means that any excess SIR may be slightly underestimated.

The expected number of each type of cancer was estimated based on the age-specific rates in the reference population (rural and regional Victoria). The reference age-specific rates by 5-year age group (0-4, 5-9,...80-84, 85+) and sex were calculated using the population cancer incidence data in rural and regional Victoria between years 2009-2013 and the 2011 ABS Victorian rural and regional population data. SIRs were calculated by dividing the total number of observed cancers by the total number of expected cancers for each cancer type. The exact 95% confidence interval was estimated by assuming a Poisson process (Breslow and Day, 1987).

6. Results

The analysis compared the number of observed cancers of the Latrobe Valley SA3 and surrounding SA3 areas with the number of cancers expected based on rural and regional rates by age group and sex.

The SIRs show if there is a higher incidence of any cancer types in the Latrobe Valley SA3 and surrounding three SA3s compared with the rural and regional Victorian population. When the SIR value is greater than 1 then there is an excess, however the excess is only statistically significant, i.e. beyond what could reasonably be expected by chance fluctuations alone, if the 95% confidence interval excludes the value 1. SIR results which are significantly in excess or reduced are in bold and underlined. It should be noted that this convention of defining as statistically significant any 95% CI that excludes an SIR of 1 brings with it a type 1 error rate of 5%, i.e. we would expect 1 in 20 such conclusions to be false, in other words 1 in 20 statistically significant results could have arisen by chance and is not indicative of any true underlying difference in cancer risk.

As shown in Table 1, compared with rural and regional Victoria, the population age structure differs to a small extent in the areas of interest, with a higher proportion of younger people (aged between 20 and 50) in the Latrobe Valley and a higher proportion of older people (aged over 50) in the surrounding areas. These age structure differences were adjusted with indirect standardization when calculating the SIRs.

Table 1: Population demographics in Latrobe Valley, surrounding areas and Rural and Regional Victoria

	Latrobe Valley (ERP[#]= 73,386)	Surrounding areas (ERP[#]= 143,099)	Rural & Regional Victoria (ERP[#]= 1,365,423)
	%	%	%
Gender			
Male	49.5%	50.0%	49.8%
Female	50.5%	50.0%	50.2%
Age Category			
0-9	12.8%	12.2%	12.4%
10-19	13.7%	13.0%	13.4%
20-29	13.7%	10.5%	11.5%
30-39	11.7%	10.9%	11.5%
40-49	13.4%	13.2%	13.6%
50-59	13.5%	14.5%	13.9%
60-69	10.6%	13.1%	11.7%
70-79	6.5%	7.7%	7.2%
80+	4.1%	4.8%	4.8%

[#] Estimated residential population in 2011

Between 2009 and 2013, there were 2,130 people with 2,244 cancers reported in the Latrobe Valley SA3 and 4,589 people with 4,851 cancers reported in the surrounding SA3 areas. Among the multiple primary tumours, 79 records were excluded according to the decisions rules listed in section 5.3.

Table 2 shows the SIRs and 95% confidence intervals for incident cancers in females in the Latrobe Valley SA3 and surrounding SA3 areas.

Table 2: Observed (O), Expected (E), Standardised Incidence Ratios (SIR) and 95% confidence intervals (95% CI) for incident cancers in females in the Latrobe Valley SA3 and surrounding SA3 areas between 2009 and 2013

Cancer Categories	Latrobe Valley (ERP#=37,070)			Surrounding areas (ERP#=71,569)		
	O	E	SIR (95% CI)	O	E	SIR (95% CI)
Lip, oral cavity and pharynx (C00-C14)	24	19.0	1.27 (0.81, 1.88)	31	41.9	0.74 (0.50, 1.05)
Digestive organs (C15-C25)	203	201.9	1.01 (0.87, 1.15)	455	450.2	1.01 (0.92, 1.11)
Oesophagus (C15)	8	8.4	0.96 (0.41, 1.88)	22	18.9	1.16 (0.73, 1.76)
Stomach (C16)	12	12.9	0.93 (0.48, 1.62)	28	28.8	0.97 (0.65, 1.41)
Colorectal (C18-C21)	138	137.3	1.00 (0.84, 1.19)	306	305.4	1.00 (0.89, 1.12)
Colon (C18)	97	96.0	1.01 (0.82, 1.23)	223	214.0	1.04 (0.91, 1.19)
Rectum (C20)	24	29.1	0.82 (0.53, 1.23)	64	64.5	0.99 (0.76, 1.27)
Liver (C22)	13	5.7	**2.28 (1.21, 3.89)**	18	12.7	1.41 (0.84, 2.23)
Pancreas (C25)	24	25.6	0.94 (0.60, 1.40)	59	57.5	1.03 (0.78, 1.32)
Respiratory and intrathoracic organs (C30-C38)	104	83.2	**1.25 (1.02, 1.51**)	172	187.4	0.92 (0.79, 1.07)
Larynx (C32)	<5			<5		
Lung (C33-C34)	101	80.2	**1.26 (1.03, 1.53)**	161	180.9	0.89 (0.76, 1.04)
Melanoma (C43)	59	86.0	**0.69 (0.52, 0.88)**	186	183.8	1.01 (0.87, 1.17)
Mesothelioma (C45)	<5			<5		
Breast (C50)	268	257.2	1.04 (0.92, 1.17)	599	561.1	1.07 (0.98, 1.16)
Female reproductive organs (C51-C58)	103	95.0	1.08 (0.89, 1.32)	200	207.1	0.97 (0.84, 1.11)
Cervix (C53)	17	12.2	1.40 (0.81, 2.24)	17	23.8	0.71 (0.42, 1.14)
Uterus (C54-C55)	48	44.6	1.08 (0.79, 1.43)	89	99.6	0.89 (0.72, 1.10)
Ovary (C56)	27	27.2	0.99 (0.65, 1.44)	65	59.5	1.09 (0.84, 1.39)
Urinary tract (C64-C68)	32	36.7	0.87 (0.60, 1.23)	77	81.8	0.94 (0.74, 1.18)
Kidney (C64)	19	21.7	0.88 (0.53, 1.37)	48	48.0	1.00 (0.74, 1.33)
Bladder (C67)	11	11.0	1.00 (0.50, 1.79)	20	24.6	0.81 (0.50, 1.25)
Brain and other CNS (C70-C72)	17	14.7	1.16 (0.67, 1.85)	28	31.5	0.89 (0.59, 1.28)
Brain (C71)	16	14.0	1.15 (0.65, 1.86)	26	30.0	0.87 (0.57, 1.27)
Thyroid and other endocrine glands (C73-C75)	20	19.2	1.04 (0.64, 1.61)	44	39.4	1.12 (0.81, 1.50)
Thyroid (C73)	17	18.7	0.91 (0.53, 1.46)	44	38.5	1.14 (0.83, 1.54)
Unknown site (C76-C80,C26,C39)	35	28.7	1.22 (0.85, 1.69)	51	64.3	0.79 (0.59, 1.04)
Lymphoid, haematopoietic and related tissue (C81-C96, D45, D46, D47)	116	95.1	**1.22 (1.01, 1.46)**	208	207.6	1.00 (0.87, 1.15)
Hodgkins disease (C81)	6	4.2	1.42 (0.52, 3.09)	9	7.8	1.15 (0.53, 2.19)
Non-hodgkin lymphoma (C82-C85)	43	33.6	1.28 (0.92, 1.72)	82	74.1	1.11 (0.88, 1.37)
Multiple myeloma (C90)	18	14.6	1.23 (0.73, 1.94)	40	32.7	1.22 (0.87, 1.67)
Leukaemia (C91-C95)	30	22.3	1.35 (0.91, 1.92)	40	48.2	0.83 (0.59, 1.13)
Myelodysplastic* (D46)	10	8.9	1.12 (0.54, 2.06)	23	20.0	1.15 (0.73, 1.72)
All other cancers^ (C40-42, C44, C46-49, C69, C97)	11	15.8	0.69 (0.35, 1.24)	37	33.4	1.11 (0.78, 1.53)
All malignancy (C00-C97, D45-D47)	994	954.9	1.04 (0.98, 1.11)	2091	2094.7	1.00 (0.96, 1.04)

* Myeloproliferative & Myelodysplastic disease are now classified with Lympho-haematopoietic (LH) cancers

^ Includes bone and connective tissue, eye, rare LH conditions and cancer of multiple sites

Estimated residential population in 2011 applied to 5 years from 2009 to 2013

Compared to the rural and regional Victorian reference population, the incidence for all malignant cancers in females in the Latrobe Valley SA3 and surrounding SA3 areas were similar to those expected. In total, 944 cancers were observed and 955 cancers were expected in the Latrobe Valley SA3, and 2091 were observed and 2095 were expected in the surrounding SA3 areas for females. In the surrounding SA3 areas none of the cancer types for which there were more cancers observed than expected, such as liver and oesophagus cancer, were statistically significant.

In the Latrobe Valley SA3, a statistically significant excess of liver cancer was observed in females, with 13 observed cancers versus 6 expected cancers and an SIR of 2.28 (95% CI 1.21, 3.89). There was also an excess of liver cancer in the surrounding SA3 areas, 18 observed versus 13 expected but this excess was more consistent with chance fluctuations as it was not statistically significant. Overall, the number of respiratory cancers was significantly increased in the Latrobe Valley SA3, mainly due to a statistically significant excess of lung cancer with 101 observed cancers versus 80 expected cancers with an SIR of 1.26 (95% CI 1.03, 1.53). There was no excess of lung cancer in the surrounding SA3 areas.

The observed number of overall blood cancers in females was significantly higher than expected in the Latrobe Valley SA3 1.22 (95% CI 1.01, 1.46), while none of the excesses for the specific types of blood cancer categories, such as Hodgkin's disease and leukaemia, where the numbers were much smaller, reached statistical significance. No excess of overall blood cancers was seen in the surrounding SA3 areas for females.

The incidence of cancer in the Latrobe Valley SA3 for each of the other major types of cancer, such as breast, brain, female reproductive organs and urinary tract, was similar to expectation based on the rural and regional Victorian population. There was a significantly reduced incidence rate of melanoma observed in females in the Latrobe Valley SA3, with an SIR of 0.69 (95% CI 0.52, 0.88).

Table 3 shows the SIRs and 95% confidence intervals for incident cancers in males in the Latrobe Valley SA3 and surrounding SA3 areas.

Table 3: Observed (O), Expected (E), Standardised Incidence Ratios (SIR) and 95% confidence intervals (95% CI) for incident cancers in males in the Latrobe Valley SA3 and surrounding SA3 areas between 2009 and 2013

Cancer Categories	Latrobe Valley (ERP# = 36,316)			Surrounding areas (ERP# = 71,530)		
	O	E	SIR (95% CI)	O	E	SIR (95% CI)
Lip, oral cavity and pharynx (C00-C14)	51	45.6	1.12 (0.83, 1.47)	86	101.9	0.84 (0.68, 1.04)
Digestive organs (C15-C25)	254	263.7	0.96 (0.85, 1.09)	561	610.7	0.92 (0.84, 1.00)
Oesophagus (C15)	17	21.3	0.80 (0.47, 1.28)	43	49.1	0.88 (0.63, 1.18)
Stomach (C16)	36	25.5	1.41 (0.99, 1.95)	53	59.1	0.90 (0.67, 1.17)
Colorectal (C18-C21)	143	161.8	0.88 (0.74, 1.04)	336	374.5	0.90 (0.80, 1.00)
Colon (C18)	77	97.7	**0.79 (0.62, 0.98)**	217	227.6	0.95 (0.83, 1.09)
Rectum (C20)	50	50.1	1.00 (0.74, 1.31)	98	115.1	0.85 (0.69, 1.04)
Liver (C22)	20	18.1	1.10 (0.67, 1.70)	37	41.4	0.89 (0.63, 1.23)
Pancreas (C25)	25	27.6	0.91 (0.59, 1.34)	75	64.3	1.17 (0.92, 1.46)
Respiratory and intrathoracic organs (C30-C38)	154	132.5	1.16 (0.99, 1.36)	294	310.3	0.95 (0.84, 1.06)
Larynx (C32)	13	9.7	1.34 (0.71, 2.29)	17	22.4	0.76 (0.44, 1.21)
Lung (C33-C34)	138	119.4	1.16 (0.97, 1.36)	264	280.3	0.94 (0.83, 1.06)
Melanoma (C43)	112	107.6	1.04 (0.86, 1.25)	246	240.9	1.02 (0.90, 1.16)
Mesothelioma (C45)	25	9.4	**2.67 (1.73, 3.95)**	31	22.1	1.41 (0.95, 1.99)
Breast (C50)	<5			6	5.3	1.13 (0.41, 2.45)
Male reproductive organs (C60-C63)	337	357.7	0.94 (0.84, 1.05)	792	831.7	0.95 (0.89, 1.02)
Prostate (C61)	327	343.9	0.95 (0.85, 1.06)	761	805.1	0.95 (0.88, 1.01)
Testis (C62)	10	12.1	0.83 (0.40, 1.52)	24	22.5	1.07 (0.68, 1.59)
Urinary tract (C64-C68)	82	75.1	1.09 (0.87, 1.36)	190	173.8	1.09 (0.94, 1.26)
Kidney (C64)	32	35.8	0.89 (0.61, 1.26)	89	81.3	1.09 (0.88, 1.35)
Bladder (C67)	48	35.0	**1.37 (1.01, 1.82)**	92	82.6	1.11 (0.90, 1.37)
Brain and other CNS (C70-C72)	14	19.8	0.71 (0.39, 1.19)	47	43.6	1.08 (0.79, 1.43)
Brain (C71)	14	19.0	0.74 (0.40, 1.23)	45	42.0	1.07 (0.78, 1.44)
Thyroid and other endocrine glands (C73-C75)	5	10.0	0.50 (0.16, 1.17)	21	21.3	0.98 (0.61, 1.51)
Thyroid (C73)	5	9.0	0.55 (0.18, 1.29)	19	19.4	0.98 (0.59, 1.53)
Unknown site (C76-C80,C26,C39)	27	28.4	0.95 (0.63, 1.38)	67	66.4	1.01 (0.78, 1.28)
Lymphoid, haematopoietic and related tissue (C81-C96, D45, D46, D47)	152	141.1	1.08 (0.91, 1.26)	318	319.9	0.99 (0.89, 1.11)
Hodgkins disease (C81)	6	7.4	0.81 (0.30, 1.76)	11	14.8	0.75 (0.37, 1.33)
Non-hodgkin lymphoma (C82-C85)	61	50.1	1.22 (0.93, 1.56)	116	113.8	1.02 (0.84, 1.22)
Multiple myeloma (C90)	22	18.6	1.18 (0.74, 1.79)	42	43.0	0.98 (0.70, 1.32)
Leukaemia (C91-C95)	34	36.8	0.92 (0.64, 1.29)	87	82.9	1.05 (0.84, 1.29)
Myelodysplastic* (D46)	17	14.3	1.19 (0.69, 1.90)	35	33.7	1.04 (0.72, 1.44)
All other cancers^ (C40-42, C44, C46-49, C69, C97)	14	18.1	0.77 (0.42, 1.30)	45	39.9	1.13 (0.82, 1.51)
All malignancy (C00-C97, D45-D47)	1227	1211.2	1.01 (0.96, 1.07)	2704	2787.7	0.97 (0.93, 1.01)

* Myeloproliferative & Myelodysplastic disease are now classified with Lympho-haematopoietic (LH) cancers

^ Includes bone and connective tissue, eye, rare LH conditions and cancer of multiple sites

Estimated residential population in 2011 applied to 5 years from 2009 to 2013

For males in the Latrobe Valley SA3 and surrounding SA3 areas, the total number of observed all malignant cancers was similar to the expected number based on the reference population. In total, 1227 cancers were observed and 1211 cancers were expected in the Latrobe Valley SA3, and 2704 were observed and 2788 were expected in the surrounding SA3 areas for males. In the surrounding SA3 areas none of the cancer types for which there were more observed than expected cases, such as cancer of the pancreas and kidney, were statistically significant.

A statistically significant excess of mesothelioma in males was observed in the Latrobe Valley SA3, with an SIR of 2.67 (95% CI 1.73, 3.95). There was also an excess of mesothelioma cases in the surrounding SA3 areas, but this was not statistically significant. The number of bladder cancers in males was higher than expected in the Latrobe Valley SA3, reaching statistical significance, with an SIR of 1.37 (95% CI 1.01, 1.82). There was also an excess of bladder cancers in the surrounding SA3 areas, but this excess was not statistically significant. In the Latrobe Valley SA3, observed numbers for lung, larynx, and stomach cancers were higher than the expected numbers for males; however none of these results reached statistical significance.

For the other major groups of cancer, such as respiratory, brain, and male reproductive organs there was no increased risk in the Latrobe Valley SA3 compared with the rural and regional Victorian population. There was a decreased risk of colon cancer in males in the Latrobe Valley SA3, with a statistically significant SIR of 0.79 (95% CI 0.62, 0.98).

7. Discussion

For overall cancers, there was little difference in the incidence in the Latrobe Valley or surrounding areas for females or males when compared with the rural and regional Victorian population and no excesses were seen for most types of specific cancers. However, there were some notable findings for some specific types of cancer in the Latrobe Valley, where excesses were seen that were not apparent in the surrounding SA3 areas.

The excess of mesothelioma in males in the Latrobe Valley is most likely due to past asbestos exposure, as this is the only known cause of mesothelioma found in Australia. This may relate to past asbestos exposure at the State Electricity Commission or other worksites in the region and/or domestic exposure due to asbestos-containing building materials, which has been found to be an emerging risk factor for mesothelioma by the Australian Mesothelioma Registry (Australian Mesothelioma Registry, 2015).

The second notable finding is excesses of cancers (such as lung and bladder) known to be caused by exposure to polycyclic aromatic hydrocarbons and other carcinogens found in cigarette smoke and bushfire smoke, although the results did not show consistent excesses. Females in the Latrobe Valley had an elevated incidence of lung cancer, while bladder cancer was not in excess. For males, bladder cancer was elevated, and while there were more lung cancer cases than expected, this excess was small and did not reach statistical significance. There were no consistent excesses of these cancers in either males or females in the surrounding SA3 areas. Without further information on smoking rates, past bushfire smoke exposure and exposure to other possible carcinogens in the region, it is not possible to investigate further the relationship of such exposures to the excess incidence of these types of cancer.

The third notable finding was the excess of blood cancers in females in the Latrobe Valley, which was not seen in males in the Latrobe Valley nor in either gender in the surrounding SA3 areas. Blood cancers are known to be caused by benzene exposure (Rinsky et al., 1987), but no major benzene source in the Latrobe Valley is apparent. Given the many analyses done for this report, it is to be expected that

statistical significance will occur in a small number of specific results, even in the absence of truly altered underlying cancer risk in different populations. Hence this may be a chance finding although this may be ruled out if the finding remains in later identified cancer linkages and data extractions.

In the Latrobe Valley, melanoma in females and colon cancer in males were found to be significantly reduced when compared with the rural and regional Victorian population; however these results may also be chance findings.

The ability to investigate the effect of the mine fire on cancers known to be caused by exposure to polycyclic aromatic hydrocarbons and other carcinogens found in cigarette smoke and bushfire smoke during further follow up will be complicated by the existence of these underlying cancer excesses. However the identified linkage will be able to take into account smoking history provided in the Adult Survey and adjust for this confounder. The identified linkage will also allocate exposure on an individual level which will allow investigation of any exposure-response relationships. The relationship between mesothelioma and past asbestos exposure (at worksites and/or domestic exposure due to asbestos-containing building materials) will be further explored in the identified linkage using additional data from the Adult Survey that was collected on work history and possible exposures.

As cancer reporting in Victoria became mandatory in 1982, the VCR data used in the analysis are very complete for the relevant years, which is a strength of this analysis. One limitation is that risk factor information was not available to further investigate possible causes of the excess cancers observed. A further limitation is that only Victorian cancer data were included in the analysis, so that cancers occurring in Latrobe Valley residents who later moved interstate and had their cancer diagnosed there would not be identified.

This analysis of the first VCR extract for the Hazelwood Mine Fire Study has provided incidence rates of the main types of cancer in the Latrobe Valley SA3 and surrounding SA3 areas prior to the Hazelwood Mine fire in 2014. The background incidence of cancers in these areas will assist in the interpretation of the findings of the identified cancer linkage of Adult Survey participants, as well as further data extraction analyses for the period after the mine fire.

8. References

AUSTRALIAN INSTITUTE OF HEALTH AND WELFARE & AUSTRALASIAN ASSOCIATION OF CANCER REGISTRIES 2007. Cancer in Australia: an overview, 2006. Canberra: AIHW.

AUSTRALIAN MESOTHELIOMA REGISTRY 2015. Australian Mesothelioma Registry 5th annual report: Mesothelioma in Australia 2015.

BRESLOW, N. E. & DAY, N. E. 1987. Statistical methods in cancer research. Volume II--The design and analysis of cohort studies. *IARC Sci Publ***,** 1-406.

RINSKY, R. A., SMITH, A. B., HORNUNG, R., FILLOON, T. G., YOUNG, R. J., OKUN, A. H. & LANDRIGAN, P. J. 1987. Benzene and leukemia. An epidemiologic risk assessment. *N Engl J Med,* 316**,** 1044-50.