



Hazelwood Health Study

Annual Report 4

16 November 2018

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# Abbreviations

<b>ACD</b>	Australian Cancer Database
<b>AIHW</b>	Australian Institute of Health and Welfare
<b>CAC</b>	Community Advisory Committee
<b>CRG</b>	Clinical Reference Group
<b>CRIES</b>	Children's Revised Impact of Event Scale
<b>CSIRO</b>	Commonwealth Scientific and Industrial Research Organisation
<b>DHHS</b>	Victorian Government Department of Health and Human Services
<b>DHS</b>	Commonwealth Government Department of Human Services
<b>ECG</b>	Electrocardiogram
<b>eGFR</b>	Estimated Glomerular Filtration Rate (marker of kidney function)
<b>ELF</b>	Latrobe Early Life Follow Up Stream
<b>FOT</b>	Forced Oscillation Technique
<b>HHS</b>	Hazelwood Health Study
<b>HbA<sub>1c</sub></b>	Glycosylated haemoglobin (marker of diabetic control)
<b>IES-R</b>	Impact of Event Scale – Revised (Adults)
<b>LCHS</b>	Latrobe Community Health Service
<b>MAC</b>	Ministerial Advisory Committee
<b>MBS</b>	Medicare Benefits Schedule
<b>NAPLAN</b>	National Assessment Program – Literacy and Numeracy
<b>NDI</b>	National Death Index
<b>PBS</b>	Pharmaceutical Benefits Scheme
<b>PM<sub>2.5</sub></b>	Particulate matter with an aerodynamic diameter of 2.5 thousandths of a millimetre or less
<b>PMG</b>	Project Management Group
<b>PSC</b>	Project Steering Committee
<b>SRG</b>	Scientific Reference Group
<b>SOP</b>	Standard Operating Procedure
<b>VACAR</b>	Victorian Ambulance Cardiac Arrest Registry
<b>VACIS</b>	Victorian Ambulance Clinical Information System
<b>VAED</b>	Victorian Admitted Episodes Dataset
<b>VCR</b>	Victorian Cancer Registry
<b>VEMD</b>	Victorian Emergency Minimum Dataset
<b>VPDC</b>	Victorian Perinatal Data Collection

# 1 Executive Summary

This is the fourth Annual Report to be submitted to the Department of Health and Human Services as part of the milestones for the Hazelwood Health Study. This report provides a summary of progress made since the third Annual Report was submitted in November 2017, and includes a forecast on developments that are expected over the coming months. Summaries of findings which have been released by the Hazelwood Health Study in the last year, are included as appendices to this report.

The first three years of the Hazelwood Health Study primarily comprised collection of a large volume of data by each of the research Streams. In this fourth year, the focus has shifted largely to analyses of those data and reporting of the findings.

The key advisory, research and management groups continue to meet regularly and provide oversight of all aspects of the Hazelwood Health Study. In the last year, the [Community Advisory Committee's](#) priorities have been to review research results and to provide advice on community engagement strategies. The [Clinical Reference Group](#) has assessed findings of clinical interest arising from several Streams. The Group has also provided advice and feedback about the abnormal findings letters generated by the Respiratory and Cardiovascular Streams, and potential engagement strategies within the healthcare sector in the Latrobe Valley. Individual [Scientific Reference Group](#) members have primarily been consulted out of session in relation to those Hazelwood Health Study components for which they have particular expertise.

The [Project Steering Committee's](#) key activities have included updating the internal review process and dissemination plan, for reports, papers and abstracts; assessment and oversight of progress; and review of staffing. The [Project Management Group's](#) focus remains around ensuring good research practice standards, monitoring the budget and successfully delivering the Study's contractual requirements. The researchers have met regularly with, and responded to questions from, the [Ministerial Advisory Committee](#) aimed at better understanding Hazelwood Health Study issues and opportunities.

Since the previous Annual Report, the [Latrobe Early Life Follow-Up \(ELF\) Study](#) has released two reports on findings: "*Volume 2: Investigation of possible associations between exposure to mine fire emissions and indicators of lung function measured three years after the fire*", and "*Volume 3: Investigation of possible associations between exposure to mine fire emissions and indicators of blood vessel function measured three years after the fire*". Analyses using anonymised data to investigate perinatal outcomes in all Latrobe Valley babies born in the period 2012 to 2015, has progressed with a scientific paper recently

submitted to DHHS for review. Analyses of linked identified Medicare, Pharmaceutical Benefits, Victorian Perinatal, Victorian Emergency and Admitted Episodes data are also underway.

The [Psychological Impacts](#) Stream has been progressing both the Schools and the Adult Studies. A qualitative analyses of 69 interviews collected from the first round of the Schools Study has been completed with a paper, entitled “Children’s perspectives on the impact of the Hazelwood mine fire and subsequent smoke event”, submitted to the journal *Qualitative Health Research*. A paper based upon interviews with staff of a specialist school that relocated during the mine fire event, has also been completed. That paper, entitled “*The impact of a disaster on students and staff from a specialist, trauma-informed school in Australia*” has been published by the *Journal of Child and Adolescent Trauma*. A mixed methods analysis has been conducted, incorporating survey data with interview data. A paper arising from that analysis is in the final stages of review. The second round of data collection for the Schools Study is complete, the data have been entered and cleaned. A database is being developed to bring together the survey and NAPLAN data from both rounds, in preparation for analysis and reporting. Thematic analysis of the second round of Schools Study interviews has been undertaken and a report will soon be completed.

Thematic analysis of 26 adult interviews has also been completed. Based upon those interviews, a paper entitled “*Experiences of a prolonged anthropogenic disaster*” has been published in *Disaster Prevention and Management*. A second paper combining interview and Adult Survey data has also been completed and is under consideration by the *Australian and New Zealand Journal of Psychiatry*. Lay language Research Summaries, describing all findings to date, have been placed on the Hazelwood Health Study website. Planning is underway for the roll out of the Adult Psychological Impacts survey in 2019 and the third round of Schools Study data collection.

The [Community Wellbeing Stream’s](#) focus is on how the community perceived the mine fire’s impact on their wellbeing, the effectiveness of communication during and after the event, and the effectiveness of community rebuilding activities. Analyses of the data from years 1-3 have been completed and reports are being prepared on community wellbeing, resilience and recovery, and communication (based on media analysis). A major photographic exhibition entitled ‘Our hopes for the future of Morwell’ was held at Parliament House in Melbourne in May 2018, generated considerable positive interest in the study and the community. It is now showing at the Mid-Valley Shopping Centre in Morwell. The Community Wellbeing Stream has merged with the Older People Stream, bringing together the findings from both programs of work and ensuring that there is a focus on the impacts of the event on older people across the broader Hazelwood Health Study research

program. An example is a Masters thesis which has used Adult Survey data to explore the determinants of distress associated with the mine fire event in older people. That work will be written up as a journal article.

The major task in the last year for the [Adult Survey](#) researchers, has been to audit and clean the participants' time-location diaries. These important data were the key to being able to allocate PM<sub>2.5</sub> exposure estimates for participants based on their locations on each day and night of the mine fire period. Whilst programmed algorithms were sufficient to code approximately 3,500 of the Adult Survey participant calendars, the remaining 500 or so had to be manually cleaned. In parallel, the researchers developed and reviewed the statistical analysis plan for these data, and the structure of the Adult Survey Volume 2 Report investigating the relationship between Hazelwood mine fire smoke exposure and self-reported health outcomes. The analyses and write up of the Adult Survey Volume 2 Report is in the final stages of technical review, and will soon be submitted to DHHS.

The [Hazelinks](#) Stream has now received the first round of all requested anonymised data extracts. A report describing analyses of anonymised Medicare Benefits Schedule data from July 2012 to June 2016, and Pharmaceutical Benefits Scheme data from January 2012 to December 2016, has been finalised and publicly released. The findings from the Medicare Benefits Schedule and Pharmaceutical Benefits Scheme analyses were presented at the International Society for Environmental Epidemiology 2018 conference in August. A paper based on the Medicare Benefits Schedule data has submitted to the *International Journal of Epidemiology*. Another paper based on the Pharmaceutical Benefits Scheme data has been submitted to *Environmental Pollution*. A further Hazelinks report has been completed, describing analysis of anonymised ambulance attendance data, for July 2010 to March 2015. That report and an associated lay language Research Summary have been submitted concurrently with this 4<sup>th</sup> Annual Report.

Hazelinks has forwarded the identifying details for consenting Adult Survey participants to ambulance, emergency, hospital and cancer registry data custodians. Linked ambulance attendance and cardiac arrest registry data have been received. Linked Victorian Emergency Minimum Dataset, Victorian Admitted Episodes Dataset have also been received. An analyses plan for identified linkage to hospital and ambulance data is in progress. We are awaiting return of linked data from the Victorian Cancer Registry.

The [Respiratory Stream](#) was designed to make objective measures of lung function to assess impacts of smoke from the Hazelwood mine fire on lung health in adult residents of Morwell compared to Sale. Late 2017 saw the completion of data collection in the Morwell clinic with 339 participants tested. The target recruitment number of 170 Sale participants

was met in late March 2018. Throughout the data collection period, spirometry and gas transfer factor results for all participants were reviewed. Where abnormal findings were identified, letters were forwarded to those participants with the recommendation that these be taken to their general practitioner for review. All data have been entered and cleaned. A cross-sectional analysis, examining the differences in asthma control and severity in Morwell and Sale, has been completed and the first draft of the associated paper prepared.

Similarly, the [Cardiovascular Stream](#) aimed to assess the impact of the mine fire smoke on blood pressure, electrocardiographic measures, endothelial function as a marker of early vascular disease and inflammatory markers, such as C-Reactive Protein, in Morwell and Sale adults. Data collection in Sale commenced in October 2017 and was completed in January 2018. The clinic was then relocated to Morwell, where data collection was undertaken until April 2018. The numbers of participants tested were 162 in Sale and 336 in Morwell. Throughout the data collection period, where abnormal findings were identified, letters were forwarded to participant's nominated general practitioners for follow up. The researchers have completed entering and auditing the Cardiovascular Stream data. Data analysis and write up of results has commenced and two papers are near completion.

[Community engagement](#) continues to be a priority for the Hazelwood Health Study.

Considerable effort over the last year has gone into supporting recruitment into the Cardiovascular and Respiratory Streams, publicising the findings from the Hazelwood Health Study, and encouraging dialogue between community members and the study. The researchers continue to foster relationships with community groups and government bodies by meeting face to face when possible. The use of social media and uptake by the community has continued to increase, expanding the reach of the study. Traditional media outlets that have covered components of the Hazelwood Health Study include WIN News Gippsland, Monash LENS, Gippsland Times, TRFM Radio, Nine News Gippsland, the ABC Statewide Drive, Herald Sun and Latrobe Valley Express. This coverage has been supplemented by the development of an e-Newsletter which was sent to over 2,000 recipients in May, August and November 2018. The 'Our Hopes for the future of Morwell' exhibition has also positively contributed to our relationship building efforts. The annual Community Engagement Session was held at Morwell RSL Club on 22 August 2018 and was attended by over 70 people. Plans are now underway for community engagement activities in Sale.

## 2 Introduction

This is the fourth Annual Report to be submitted to the Department of Health and Human Services (DHHS) as part of the milestones for the Hazelwood Health Study (HHS). This report includes a summary of progress made in the twelve months since the third Annual Report was submitted in November 2017. This report also includes a summary of activities expected to occur over the coming few months. Copies of the first, second and third Annual Reports can be found at <http://hazelwoodhealthstudy.org.au/study-findings/study-reports/>.

The HHS comprises a number of separate research Streams with their own research aims, participants and methods. Combined, the research Streams bring together participant-reported health and wellbeing information, administrative health data records, clinical measurement data and media-derived information. Participants include infants, school aged children, adults, the elderly, community groups, the media and both Government- and non-Government authorities. These provide a comprehensive overview of the long-term impact of the 2014 Hazelwood mine fire upon the Latrobe Valley community. The first three years of this project have primarily comprised collection of a large volume of data by each of the research Streams. In this fourth year, the focus has shifted mostly to analyses of those data and reporting of the findings.

## 3 Previously completed contract milestones

Since commencement of the HHS in November 2014, and prior to the submission of this 4<sup>th</sup> Annual Report (16 November 2018), 21 contractual milestones have been completed. Those milestones, with their delivery dates, are presented in Table 1.

**Table 1 Contractual Milestones completed prior to this 4<sup>th</sup> Annual Report**

	<b>Contractual milestone</b>	<b>Delivered</b>
1	Project plan	17 December 2014
2	Community and stakeholder engagement strategy	17 December 2014
3	Organisational agreements with sub-contractors	9 February 2015
4	Research ethics submission	9 February 2015
5	Advisory groups established	10 March 2015
6	Outline of Ageing Policy Review	8 May 2015
7	1 <sup>st</sup> Interim Report	15 June 2015
8	1 <sup>st</sup> Annual Community Briefing	11 August 2015
9	1 <sup>st</sup> Annual Report	13 November 2015
10	1 <sup>st</sup> Recruitment Report	15 March 2016
11	2 <sup>nd</sup> Interim report	15 June 2016

	<b>Contractual milestone</b>	<b>Delivered</b>
12	Ageing Population Policy review	30 November 2016
13	2 <sup>nd</sup> Annual Community Briefings	29 November 2016
14	2 <sup>nd</sup> Annual Report	15 November 2016
15	2 <sup>nd</sup> Recruitment Report	19 March 2017
16	3 <sup>rd</sup> Interim report	15 June 2017
17	Contract review & revised project plan	17 July 2017
18	3 <sup>rd</sup> Annual Community Briefings	9 Oct 2017 Morwell & 10 Oct 2017 Sale
19	3 <sup>rd</sup> Annual Report	16 November 2017
20	4 <sup>th</sup> Interim Report	22 June 2018
21	4 <sup>th</sup> Annual Community Briefing	22 August 2018

## 4 Project Governance

The HHS governance structure is documented and reviewed on a regular basis. It can be viewed on the HHS website at <http://hazelwoodhealthstudy.org.au/about/governance/>.

### 4.1 Community Advisory Committee

The Community Advisory Committee (CAC) refreshes its membership on a regular basis and welcomed four new members in the last year. Chelsea Caple replaced Ian Gibson as the Latrobe Regional Hospital representative. Sharon Houlihan replaced Glenys Butler as the Wellington Shire Council representative. Vicki Hamilton and Geoff Duffell filled new positions as community representatives. Our two community representatives from Sale, Marg Harty and Bill Redmond, have resigned and expressions of interest have been sought for their replacement. The CAC has increased the frequency of its meetings which had previously been held quarterly. There have been six meetings held in the past year, brief details of which are as follows.

#### *1 November 2017*

Professor Sim presented the HHS recent findings from the Hazelinks Stream in regard to pre-mine fire cancer rates in the Latrobe Valley. Professors Walker and Abramson reported on their meeting with the Chair of the Ministerial Advisory Committee (MAC) in regard to an upcoming presentation to that Committee.

Dr Carroll reported on the progress of, and challenges faced, by the Respiratory and Cardiovascular Streams in regard to recruitment. In this regard, the CAC reviewed and



provided feedback on the fact sheets and FAQs that had been drafted by the researchers to address some known obstacles to participation. Dr Carroll also reported on progress in the Psychological Impacts and Community Wellbeing Streams, Ms Dalton presented a brief overview of the Latrobe Early Life Followup (ELF) Stream.

Mr Mallia sought CAC feedback on the recent Community Engagement Sessions in Morwell and Sale and advice about community groups which should be included in regular correspondence about HHS progress.

Postscript.

### *14 February 2018*

This meeting included nominations for new Chair and Deputy Chair positions with Ms Carolyn Boothman and Mr Shane Wilson appointed respectively. Prior to the meeting, nine members of the Committee had participated in a performance review of the operations of the Committee. Findings were presented and discussed. The 2018 community engagement plan was a priority area of discussion with Mr Mallia seeking feedback on a suite of ideas.

Recent, or soon to be, released findings were presented and discussed. Dr Amanda Wheeler presented an overview of the Latrobe residential House Dust Study undertaken by the University of Tasmania (with external funding). Dr Carroll described some recent findings on the perception of school staff at a specialist school which relocated during the mine fire. Prof Abramson briefly outlined findings in relation to Medicare Benefits Schedule (MBS) and Pharmaceutical Benefits Scheme (PBS) data which were soon to be publically released.

CAC members provided advice as to community and outpatient datasets that the Hazelinks Stream might be able to access.

### *11 April 2018*

CAC members had received the report titled “Hazelinks Medicare Benefits Schedule and Pharmaceutical Benefits Scheme data: Time Series Analyses” and its accompanying Research Summary (see [Appendix 2](#)). Hazelinks Stream Lead, Associate Professor Guo presented the findings and took questions.

Dr Carroll outlined the HHS dissemination timetable for the remainder of 2018 and the recent response by the HHS Project Management Group to a series of questions received from the MAC. Dr Carroll and Dr Blackman reported on the progress of all research Streams. A discussion was held around the structure of the Expression of Interest form for



CAC membership in 2019 with ideas contributed about how maximum diversity could be achieved.

Mr Mallia sought advice about moving the date forward for the Annual Community briefings, and the idea of holding the Sale briefing at a regular meeting of a large community group as opposed to a separate HHS-only event. He also sought feedback on a draft newsletter intended for circulation to all HHS participants and stakeholders for whom we have email addresses.

Discussion was around the use of the study results to advocate for change to the health resources available in the Latrobe Valley, and how the HHS intersects with the Latrobe Health Assembly, the Latrobe Health Innovation Zone and the soon-to-be-appointed Latrobe Health Advocate.

### *11 July 2018*

The committee was asked for input into the upcoming Community Engagement Session, including the format, duration and location of the event. The committee was pleased to see the involvement of other stakeholders but stressed the need for the session to largely remain focused on the study and findings to date.

Dr Carroll sought the Committee's feedback on the process for dissemination of results, and the tensions between releasing results in a speedy fashion and the need for rigorous internal and external peer review. The committee stressed the need to give priority to releasing core results to the community as efficiently as possible.

CAC members considered a proposal for the inclusion of an independent member in the CAC membership selection panel and proposed changes to the expression of interest advertisement for new members to encourage diversity and transparency in the recruitment process.

Melissa Peppin sought feedback on the inaugural HHS e-newsletter to the community. The committee agreed that the digital newsletter performed well and future editions could be delivered to coincide with the release of findings or to advertise an upcoming study event.

### *8 August 2018*

This meeting primarily focused on the upcoming Community Engagement Session on the 22 August. The committee was presented with a draft format of the event and was invited to provide feedback. The committee also provided suggestions on advertising avenues to garner more interest in the event and suggested using an online system for participants to register interest prior to the session.

In follow up to the item raised in the 11 July meeting, Dr Carroll reported to the committee that following careful consideration and consultation, the DHHS advised that all findings must be released to the public as early as possible.

The location of future meetings, including the possibility of utilising the facilities of organisational representatives was raised.

#### *10 October 2018*

Due to unforeseen resignations, the CAC no longer had a community member representing Sale. The committee provided a list of potential community groups to advertise the vacancy within, and notice was provided seeking the appointment of community members from Sale, as per the terms of reference of the committee.

Melissa Peppin reported to the committee on the Community Engagement Session, held on the 22 August. The committee noted the success of the event and provided tips to further improve the event in the future. Melissa also provided an update on all media coverage in the last three months. In total, five stories were published in local media.

Dr Carroll provided a study status report, especially noting that the *Our hopes for the future of Morwell* exhibition, which was previously on display at Victorian Parliament, is currently on display at Mid Valley Shopping Centre.

## **4.2 Clinical Reference Group**

The Clinical Reference Group (CRG) continues to meet as required in response to the study's need for local clinical advice. A brief overview of meetings held in the last year is as follows:

#### *15 November 2017*

CRG members held an *in camera* session with Dr Fay Johnston to discuss findings of clinical significance arising from the ELF Report on possible associations between mine fire emissions and perinatal outcomes. The discussion focused on clinical issues that may arise for Latrobe Valley medical general practitioners (GPs) and paediatricians. Members provided advice on dissemination of findings to health professionals through the Gippsland Primary Health Network (GPHN), Latrobe Regional Hospital (LRH) and the Latrobe Community Health Service (LCHS) communication channels.

Members were also advised of possible findings of clinical significance arising from the then yet to be released MBS and PBS anonymous data extraction report. The progress of the Respiratory and Cardiovascular Streams was presented. Discussion focussed on the abnormal finding letters to be forwarded to participants in the Respiratory Stream and to the GPs of participants in the Cardiovascular Stream.

### *18 April 2018*

The focus of this meeting was around the findings from the Hazelinks Medicare Benefits Schedule and Pharmaceutical Benefits Scheme report which had been recently released.

Other areas of focus were the ongoing Cardiovascular and Respiratory Streams, the types and volume of abnormal finding letters arising from those, and the potential that these and other HHS findings would be influenced by more recent events such as the closure of the mine and power station. The CRG discussed its ability to advocate for more respiratory specialists in the Latrobe Valley. The Group also reviewed the feedback collected in the recent Performance Review of the operations of the CRG.

### *17 October 2018*

The main focus of this meeting was discussion around new findings which were soon to be released. These included discussions led by:

- Dr Juliana Betts: Factors associated with hypertension and its management amongst older rural Australians living in the Latrobe Valley;
- Dr Fay Johnston: ELF Reports Volume 2 & 3 – Indicators of lung and blood vessel function three years after the fire; and
- Dr Jill Blackman: Adult Survey Volume 2: The relationship between Hazelwood mine fire smoke exposure and health outcomes

Members discussed strategies to refresh membership of the CRG in light of an increase in reports of findings and subsequent publications in Year 5.

## **4.3 Scientific Reference Group**

Two meetings of the Scientific Reference Group (SRG) have been held since the 3<sup>rd</sup> Annual Report.

Associate Professor Jane Ford (Principal Research Fellow, Kolling Institute, Northern Clinical School, University of Sydney) joined the SRG in December 2018, replacing Associate Professor Christine Roberts. Associate Professor Ford is a perinatal epidemiologist. Her main research interests include maternal morbidity and mortality, and the use of linked routinely collected administrative data for investigation of maternal and neonatal outcomes.

The SRG determined that the HHS needed more expertise in qualitative and mixed research methods. Dr Beth Edmondson (Head of School, Arts, Humanities and Social Sciences, Federation University, accepted an invitation to join the SRG in September 2018. Dr Edmondson has an extensive record in researching and publishing on the politics of international climate change, and the importance of international governance mechanisms. In 2017, Dr Edmondson led an interdisciplinary team of researchers in collaborative co-design in developing the Latrobe Health Innovation Zone Charter, creating a co-designed charter for Australia's first Health Innovation Zone.

Professor Anna Hansell joined the SRG in December 2017. She is Professor of Environmental Epidemiology and Director of the Centre for Environmental Health and Sustainability, University of Leicester. Professor Hansell has a long-standing interest in environmental impacts on human health and the health of the environment with special research expertise in health impacts of environmental noise and air pollution, respiratory disease epidemiology, and low-level environmental exposures.

### *11 December 2017*

At the 11 December 2017 meeting, the SRG reviewed a number of reports including the 2<sup>nd</sup> recruitment report, the 3<sup>rd</sup> annual report, the Hazelinks MBS and PBS time series analyses report, an emergency presentations and hospital admissions report and the first ELF Volume 1 report describing the cohort and associations between mine fire emissions and perinatal outcomes.

Individual SRG members had previously (out of session) been consulted in regard to the preparation of these reports, particularly for those components of the HHS research for which they have particular expertise. More recently, Professor of Biostatistics, Rory Wolfe has provided oversight of the statistical analysis plans for Adult Survey and Hazelinks data. Professor of Physiology, Graeme Zosky, and Professor of Psychiatry, Alexander McFarlane, have provided expert comments on ELF Study, and Psychological Impacts Stream, analyses respectively.

At the 23 July 2018 meeting, the SRG discussed the Hazelwood Health Study Adult Survey Report Volume 2 describing the relationship between Hazelwood mine fire smoke exposure and health outcomes. The SRG also reviewed the second round of recruitment for the Schools Study. A further topic of discussion was the dissemination of HHS findings prior to external peer review.

## 4.4 Project Steering Committee

The Project Steering Committee (PSC) membership comprises each of the Stream leads and the Project Management Group members. This Committee meets regularly and provides overall strategic guidance for the Hazelwood Health Study. Eight formal meetings have been held in the last year plus numerous out-of-session consultations.

Key agenda items have included:

- the response to questions received from the Ministerial Advisory Committee;
- appropriate avenues of engagement with the Latrobe Health Assembly, Latrobe Health Innovation Zone and Latrobe Health Advocate;
- Study Stream progress;
- contingency planning around staff leave;
- the application to take the Community and Wellbeing Stream's "Our hopes for the future of Morwell" photographic exhibition to Queen's Hall in Victoria's Parliament House;
- participant recruitment for the Respiratory and Cardiovascular Streams and for the second round of Schools Study data collection;
- further review of Cardiovascular Stream recruitment and power calculations in light of the end-date and costs beyond the original project plan;
- review of all proposals for analysis and write up of HHS findings;
- each Stream's plan for the reporting of results and the appropriate balance of technical reports, research summaries, scientific papers and conference abstracts;
- consideration as to how the reporting of findings can meet both the needs of the stakeholders (DHHS and the community) and academic requirements;
- review of the structure of the Finance subcommittee;
- review of the new HHS publication guidelines in regard to the internal and external approval process for analyses and reports, from conception to final draft to public

release, and also DHHS requirement that findings in journal articles not be withheld whilst undergoing external peer review;

- project-wide staff changes such as the Recruitment Coordinator and the Senior Communications and Engagement Advisor positions;
- oversight of planning to decommission the Respiratory and Cardiovascular Stream clinics and securely store all equipment for future use.

## 4.5 Project Management Group

The Project Management Group (PMG) has continued to meet regularly, providing oversight to the operationalisation of the Project Plan, reviewing study progress, managing staff appointments, monitoring the budget and ensuring adherence to good research practice standards and the successful delivery of contractual milestones. Specifically PMG activities have included:

- attending meetings of the Ministerial Advisory Committee and preparing a written response to several questions posed by that Committee;
- attending DHHS Contract Committee meetings;
- reviewing and revising the HHS Project Governance Structure;
- reviewing and replacing the HHS Publications Policy with new guidelines entitled “From proposal to publication: The process for Hazelwood Health Study researchers to propose, write up and disseminate findings”;
- preparing the 4<sup>th</sup> Interim and 4<sup>th</sup> Annual Reports;
- reviewing preliminary and final drafts of all reports, papers, abstracts, research summaries and newsletters arising from HHS research;
- facilitating the submission of all HHS findings to DHHS for approval;
- overseeing the public release of HHS findings via the HHS website, media and other internet sites;
- tracking all HHS publications and dissemination products;
- monitoring monthly budget reports, adjusting planned expenditure accordingly;
- monitoring adherence to all contractual obligations;
- facilitating, attending and reporting to regular meetings of key committees/advisory groups including the CAC, CRG, SRG and PSC;

- administration of new staff appointments, extensions, renewals and/or terminations;
- administration of all purchasing.

## 4.6 Ministerial Advisory Committee

A Ministerial Advisory Committee (MAC) was established in 2017 to provide independent oversight of the study and facilitate engagement with the community. The MAC was particularly interested in looking at how the study can best meet the needs of the community now and in to the future. It was keen to gain learnings and insights from the first three years of the study. In addition to meeting directly with the MAC in November 2017, February 2018 and April 2018, the researchers have also responded out-of-session to a series of detailed questions aimed at better understanding issues and opportunities going forward.

## 5 Project Staff appointments

Updates in regard to the appointments of staff whose roles cross over a number of HHS research Streams are described here. Stream-specific staff changes are included with the Study Stream updates in section 7.

### 5.1 Hazelwood Health Study Biostatistician

At the time of the 3<sup>rd</sup> Annual Report, Dr Joanna Dipnall was the interim HHS statistician while Dr Caroline Gao was on maternity leave. Dr Gao has since returned and Dr Dipnall has moved onto another project.

### 5.2 Senior Communications and Engagement Advisor

Senior Communications and Engagement Adviser, Mr Shaun Mallia, completed his 12-month contract with the HHS in May 2018. Mr Mallia has since accepted a new position as Social Marketing Coordinator for the Latrobe Health Innovation Zone. The HHS has not replaced Mr Mallia with a new Senior Communications and Engagement Adviser for two reasons: Firstly, the position had never been included in the original Project Plan or budget. Secondly, the HHS has moved out of a busy recruitment stage, where frequent community engagement was required, and into a period of more intense data analysis.

## 5.3 Recruitment Coordinator

Mrs Susan Denny, who was the Hazelwood Health Study Recruitment and Engagement Coordinator for the period September 2015 to March 2017, then Recruitment Coordinator for the period April 2017 to March 2018, has completed her contract.

## 5.4 Clinical Stream Coordinator

At the time of the 3<sup>rd</sup> Annual Report, Ms Brigitte Borg was the coordinator for the Respiratory Stream and Dr Jill Blackman was interim coordinator for the Cardiovascular Stream. Subsequently, Ms Borg took on the coordination role for the Cardiovascular Stream in addition to the Respiratory Stream. Her coordination role ended in July 2018 after the Cardiovascular and Respiratory Stream clinics closed in May 2018; however, Ms Borg remains involved in the analysis and write up of findings. Ms Borg holds a qualification in Applied Science (medical biophysics and instrumentation) and is a Certified Respiratory Function Scientist. She is currently also a Senior Respiratory Scientist, Respiratory Medicine at The Alfred Hospital in Melbourne. It is hoped that Ms Borg will again be involved in the coordination of the clinical Streams when follow-up data collection is planned.

## 5.5 Administrative Officer

In February 2018, Ms Melissa Peppin was appointed as the Administrative Officer for Gippsland. The role primarily comprised secretarial support to the Gippsland-based HHS researchers and Committees, and also administration of the HHS website and social media activities. Ms Peppin's diverse professional background has included employment with Chisolm Institute, the Noor Foundation, National Commission for the Fight against Genocide (CNLG) and UN Sustainable Development Solutions Network. Ms Peppin has also recently completed a Masters in International Development Practice with Monash University.

# 6 Stream coordination retreat

The Study's fourth Stream coordination retreat was held at Monash University's School of Public Health and Preventive Medicine, Alfred campus, on 28 February 2018. The retreat involved members of all HHS research Streams, overarching project staff, as well as CRG Chair Dr Fred Edwards, SRG member Alexander McFarlane and paediatric respiratory physiologist Professor Graham Hall (see Figure 1). The CAC chair was also invited, but unable to attend. The retreat objectives were to:

1. take stock of HHS progress to date in a changed environment in the Latrobe Valley;



2. increase collective understanding of the study's research Streams and areas for alignment;
3. plan and map systematically the dissemination of expected results and research outputs in 2018-2019; and
4. identify potential research collaborations for progressing HHS research funding opportunities.

The retreat included an introduction of Ministerial Advisory Committee members (Ian Gibson, Dr Lyn Denison and Helen Murphy).

Stream leads presented overviews of their recent and upcoming activities. The Project Management Group provided oversight in regard to contract deliverables and project-wide quality assurance such as data security. The Senior Communications and Engagement adviser reported on the public dissemination of Hazelwood Health Study findings.



**Figure 1 Hazelwood Health Study researchers at the Stream coordination retreat in February 2018**

## 7 Study Stream updates

### 7.1 The Latrobe Early Life Follow Up (ELF) Study

#### 7.1.1 Aims and objectives of the ELF Study Stream:

The overall aim is to investigate the potential impacts of exposure to smoke from the Hazelwood mine fire during pregnancy or infancy on subsequent health and development of children in the Latrobe Valley.

Specific objectives include:

- comparing perinatal outcomes, particularly foetal growth and maturity, for infants who were exposed, not exposed or minimally exposed to smoke from the Hazelwood mine fire;
- comparing the frequency of parental reports of minor illnesses in infants, over a three year period, for those exposed, not exposed or minimally exposed to smoke from the Hazelwood mine fire;
- comparing respiratory and vascular function in children, from 3 to 12 years of age, for those exposed, not exposed or minimally exposed to smoke from the Hazelwood mine fire; and
- assessing long-term indicators of health and development using an anonymised data linkage study comparing those areas exposed and those not exposed, or minimally exposed, to smoke from the Hazelwood mine fire.

#### 7.1.2 Updates on the ELF Study Stream:

##### Developments since the 3<sup>rd</sup> Annual Report

###### *The Latrobe ELF Identified Cohort Study*

- A report titled “*The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 1: Description of the cohort and preliminary assessment of possible associations between mine fire emissions and parent-reported perinatal outcomes*” was accepted by DHHS in November 2017. The report was placed on the HHS website on 1 February 2018 and can be found at <http://hazelwoodhealthstudy.org.au/study-findings/study-reports/>. The Executive Summary to that Report is reproduced in Appendix 1.
- Results from the ELF Volume 1 report were shared with the CRG, CAC, SRG and with the Gippsland community via several media outlets.

- A lay language Research Summary of the Volume 1 report was prepared. The Research Summary is shown at Appendix 2 and can be found on the HHS website at <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/>.
- The first extraction of children's MBS and PBS data for the period 1/3/2012 – 31/7/2017 was received in February 2018. An abstract based on the initial analysis of these data was approved by DHHS for submission to the American Thoracic Society for consideration for presentation at the annual scientific meeting in 2019. The abstract is shown at Appendix 3.
- The first identified extract of Victorian Perinatal Data Collection (VPDC), Victorian Emergency Minimum Dataset (VEMD) and Victorian Admitted Episodes Dataset (VAED) data for the period 2012-2017 was received in May 2018. Analyses of VPDC, VEMD and VAED datasets are in progress.
- An abstract entitled "An Assessment of Early Life Exposure to Coal Mine Fire Smoke and Children's Lung Health" was presented to the Thoracic Society of Australia & New Zealand Conference in March 2018. The abstract is shown in Appendix 3.
- Analysis and description of indoor and outdoor environmental exposures in the ELF Cohort is in progress.
- An abstract entitled "Smoking during pregnancy significantly increases the risk of early atherosclerosis: a study from coalmine smoke exposure" was presented to the European Society of Cardiology conference in August 2018. The abstract is shown in Appendix 3.
- Analysis of the 2017 clinical testing data has now been completed.
- A report entitled "*The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 2: Investigation of possible associations between exposure to mine fire emissions and indicators of lung function measured three years after the fire*" was accepted by DHHS in September 2018.



A lay language Research Summary of the Volume 2 report was prepared. The Executive Summary to that Report is reproduced in Appendix 1, the Research Summary is shown in Appendix 2 and can also be found on the HHS website at <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/>.

Summary statistics resulting from analysis of Forced Oscillation Technique (FOT) and ultrasound results were sent to participating families in October 2018.

Results from the ELF Volume 2 report were shared with the CRG, CAC, SRG and with the Gippsland community via several media outlets.

- A report entitled “*The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 3: Investigation of possible associations between exposure to mine fire emissions and indicators of blood vessel function measured three years after the fire*” was accepted by DHHS in September 2018. The Executive Summary to that Report is reproduced in Appendix 1, the lay language Research Summary is shown in Appendix 2 and can be found on the HHS website at <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/>. Results from the ELF Volume 3 report were shared with the CRG, CAC, SRG and with the Gippsland community via several media outlets.
- Symptom diaries have continued to be received from participating families each month. This data collection will end at the end of 2018. Preliminary analysis of these reports has commenced

#### *The Latrobe ELF anonymised state-wide data linkage study*

- The first extract of anonymised VAED, VEMD, MBS and PBS data is now scheduled for February 2019. This will include data from 2012 to 2017.
- Analysis of part of the statewide VPDC data is underway. The first analysis has evaluated outcomes from all babies born in the Latrobe Valley from 2012 to 2015. A draft manuscript intended for submission to a scientific journal has been submitted to DHHS for review; “*Maternal exposure to fine particulate matter from a coal mine fire and birth outcomes in Victoria, Australia*”.

### **7.1.3 Publications**

Since the last Annual Report, this Study Stream has publicly released the following Reports, Research Summaries, journal papers and conference abstracts:

#### Reports

- *The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 1: Description of the cohort and preliminary assessment of possible associations between mine fire emissions and parent-reported perinatal outcomes.*
- *The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 2: Investigation of possible associations between exposure to mine fire emissions and indicators of lung function measured three years after the fire.*
- *The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 3: Investigation of possible associations between exposure to mine fire emissions and indicators of blood vessel function measured three years after the fire.*

#### Research Summaries

- The Latrobe Early Life Follow-up Cohort Study Vol 1 Research Summary.

- The Latrobe ELF Study: Indicators of lung and blood vessel function three years after the fire.

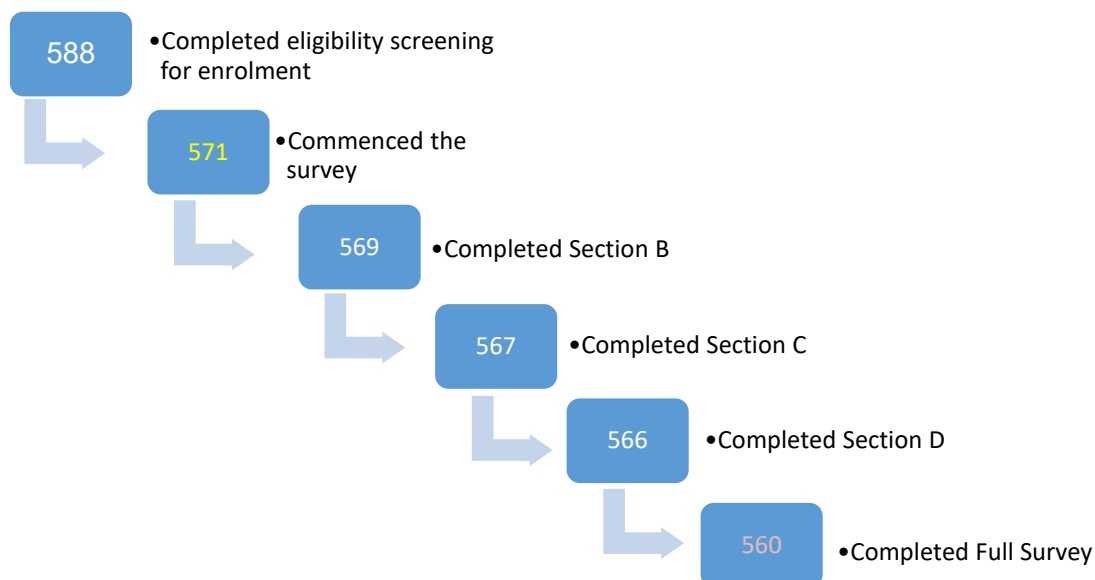
#### Conference abstracts/posters/presentations

- **J. Shao**, G. R. Zosky, G. L. Hall, A. J. Wheeler, M. Dalton, S. Dharmage, R. Foong, G. Williamson, T. O'Sullivan, F. H. Johnston;  
*An Assessment of Early Life Exposure to Coal Mine Fire Smoke and Children's Lung Health*. Oral presentation to the Australian & New Zealand Thoracic Society Conference, March 2018.
- J. Shao, G. R. Zosky, G. L. Hall, A. J. Wheeler, M. Dalton, S. Dharmage, R. Foong, G. Williamson, T. O'Sullivan, F. H. Johnston. *Exposure to smoke from a coal mine fire during infancy and lung function 3 years after the event*. Poster presentation to the International Society for Environmental Epidemiology, Ottawa, September 2018
- Bing Zhao, Fay H. Johnston, Marita Dalton, Grant Williamson, Tierney O'Sullivan, Kazuaki Negishi. *Smoking during pregnancy significantly increases the risk of early atherosclerosis: a study from coalmine smoke exposure*. Poster presentation to European Society of Cardiology conference, August 2018.

### 7.1.4 Overview of recruitment

The ELF Study aimed to recruit 500 participants through completion of a baseline survey. In total, 571 surveys were either fully completed (n=560) or partially completed (n=11) which exceeded expectations. All cohort members were invited to completed monthly symptom diaries for a three year period subsequent to completion of the baseline survey. In total, 384 out of a possible 571 participants commenced monthly symptom reporting. The response rates have varied from 44% to 84% each month, with about half of the group reporting consistently. There is good representation of ages and exposure to mine fire smoke in this group with more than 1,000 symptom reports available for analysis. Monthly data collection will end after December 2018.

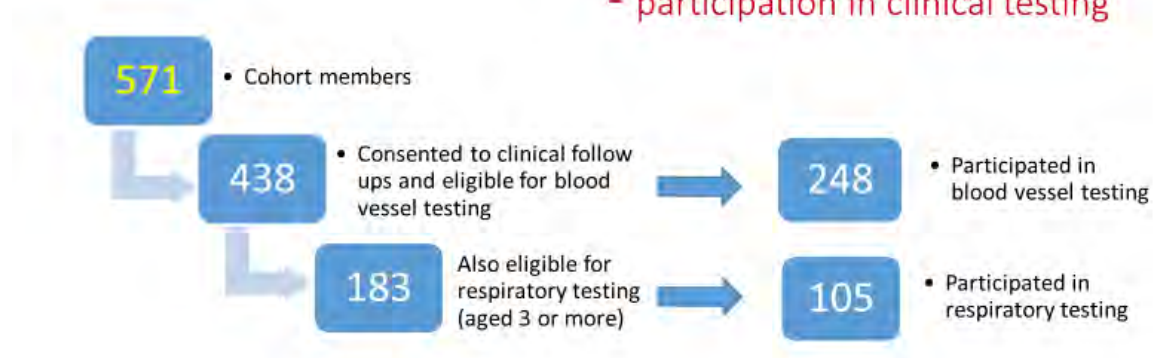




Most families (n=438) provided consent for their children to participate in clinical testing at three, six and nine years after the mine fire. The first clinics were held in Morwell between March and July 2017. However, not all children were old enough to participate in 2017. Children needed to be at least 2 years old (n=352) to participate in blood vessel testing and at least three years old (n=185) to participate in lung function testing. Seventy one percent (n=248) of those potentially eligible, successfully participated in blood vessel testing and 62% (n=105) of those eligible, successfully participated in the lung function testing. With at least 100 participants in each group, we were happy with the number able to participate and feel confident that there will be greater participation at the next clinics planned for 2020 with the additional inclusion of the youngest cohort members.

## The identified ELF Cohort

- participation in clinical testing



In addition to the data provided by our survey and clinic participants, the identified and anonymised statewide data extractions provide substantial additional information. For

example, the recent extraction of births data from the VPDC included 3,591 singleton livebirths.

### **7.1.5 Future plans for the ELF Study Stream**

In the upcoming months, the ELF Stream anticipates:

- preparing a descriptive report on exposures in children living in the Latrobe Valley;
- an updated version of the Volume 1 report, using exposure estimates based on time-location reporting;
- completing the analyses of the monthly symptom diaries, and of the linked hospital, Medicare, PBS and VPDC data ;
- Reporting on the obstetric and perinatal outcomes of 4,000 children in the Latrobe Valley (using anonymised state-wide data); and
- further extraction of anonymised datasets.

## 7.2 Psychological Impacts

### 7.2.1 Aims and objectives of the Psychological Impacts Stream:

The aim of the Psychological Impacts Stream is to determine whether exposure to smoke from the fire was associated with psychological trauma and distress. Given that the study commenced more than a year after the smoke event, it was also important to examine recovery and resilience. The Psychological Impacts Stream is targeting both adults and school-aged children.

#### **The specific objectives include:**

1. Investigate the extent of trauma and distress symptoms in adults and school-aged children exposed to the mine fire event.
2. Examine the role of individual, family and social factors on recovery and wellbeing outcomes.
3. Explore the qualitative perceptions of adults and school-aged children regarding the fire and the ensuing circumstances.

### 7.2.2 Updates on the Psychological Impacts Stream:

#### **Staff Appointments**

Ms Sarah Lee was the Psychological Impacts Stream Research Assistant and Administrator up until January 2018, when she resigned in order to commence doctoral studies with the Monash Centre for Scholarship in Health Education.

Mr Tim Campbell has been appointed as the Stream Research Assistant on a casual basis for the remainder of the year, with the possibility of continuing to work with the stream in 2019. Tim previously completed an undergraduate degree at Monash University and Honours in psychological science at Federation University Gippsland, and has recently commenced a PhD with Monash Rural Health. Tim's research focuses on the mental health of parents who have a child attending mental health services.

Dr Sonia Allen has been appointed on a casual basis to conduct the qualitative analysis of Schools Study interviews collected in 2017. Sonia is a long-standing colleague, having worked at both Monash Gippsland and Federation University and having held an adjunct role at Monash Rural Health since her retirement from full-time work. Sonia is a highly experienced qualitative researcher who has published in multiple areas including research methods, nurse education, aged care, and rural health.



At the end of 2017, Research Fellow Dr Rebecca Jones completed the collection and analysis of interviews from adult residents of Morwell. Dr Jones has since returned to the Australian National University to continue her research in environmental history. Rebecca continues to work with the Psychological Impacts Stream on the production of journal articles arising from her work.

## **Developments since the 3<sup>rd</sup> Annual Report**

Psychological Impacts Stream activities in the last year include the following:

- The production of a number of publications arising from both the Schools Study and Adult Psychological Impacts Study (see Dissemination of Findings below);
- Working with the HHS Biostatisticians, Drs Caroline Gao and Joanna Dipnall, we have:
  - Refined the analysis of the Children's Revised Impact of Event Scale (CRIES) data from the Schools Study, to deal with clustering and better account for missing data, so that it could be included in a mixed methods analysis combining survey and interview data;
  - Refined the analysis of the Impact of Event (IES-R) data from the Adult Survey, so that it could be included in a mixed methods analysis combining survey and interview data;
- We currently have three Educational and Development Psychology research students working on projects within the Psychological Impacts stream:
  - Jessica Tsoutsoulis has just completed a Masters project focusing on Posttraumatic Stress Disorder symptomology in older adults following the mine fire, involving analysis of existing Adult Survey data to look at the influence of age, health status, history of mental health diagnoses and previous traumatic exposures;
  - Katelyn O'Donohue is undertaking a PhD project focusing on the wellbeing of younger adults since the Hazelwood mine fire, which involves analysis of existing Adult Survey data as well as collection of follow up survey and interview data;
  - Kathleen Cunningham has recently begun a Masters project focusing on markers of Posttraumatic Stress Disorder symptomatology in the School Study interviews;
- Presentations of our research have been made to local academic audiences:
  - Gippsland Collaborative Centre for Innovation, Research and Practice Learning and Knowledge Exchange Dialogue series – on 4 April 2018, Dr Matthew Carroll and Dr Emily Berger presented on findings from the add-on

study examining the experiences of staff from a local specialist school that relocated during the mine fire;

- Federation University Psychology Colloquium series – on 22 May 2018, Dr Matthew Carroll provided an overview of the Psychological Impacts Streams activities and findings to date to students and staff at the Federation University School of Psychology, which included streaming from the Churchill campus to students and staff at the Ballarat and Berwick campuses;
- A meeting between members of the Psychological Impacts and Community Wellbeing streams took place in October to discuss the potential for cross-stream analyses including combining qualitative datasets to better reflect the community and using existing qualitative data to enhance our understanding of survey results.

Further detail specific to the Schools Study and Adult Psychological Impacts components is provided below.

## Schools Study

- Considerable effort has been put into the analysis and dissemination of findings from the first round of the Schools Study, with three journal articles written in 2018:

- **Paper 1: The impact of a disaster on students and staff from a specialist, trauma-informed school in Australia**

**Overview:** This paper was based on the findings from sub-study examining the experiences of staff from a specialist school which was relocated during the mine fire.

**Status:** This paper has been accepted for publication by the Journal of Child & Adolescent Trauma and will be published in due course. A publicly accessible pre-print version of the paper has been uploaded to <http://hazelwoodhealthstudy.org.au/publications/> along with a Research Summary. The Research Summary is also shown in Appendix 2.

- **Paper 2: Children's perspectives on the impact of the Hazelwood mine fire and subsequent smoke event.**

**Overview:** This was a qualitative analyses of the 69 interviews collected from the first round of the Schools Study.

**Status:** This paper has been approved for public release by the DHHS and is currently under consideration by the Qualitative Health Research journal. A publicly accessible pre-print version of the paper has been uploaded to

<http://hazelwoodhealthstudy.org.au/publications/> along with a Research Summary. The Research Summary is also shown in Appendix 2.

- **Paper 3: The psychological stress and experiences of children following the Hazelwood mine fire and subsequent smoke event**

**Overview:** This mixed methods paper combined analyses of the CRIES survey data and the findings from the qualitative interviews.

**Status:** This paper is in the final stages of internal review and will soon be submitted to DHHS.

- Data collection for the second round of the Schools Study is now complete. Data were collected from 20 schools, including two new high schools to which students had transitioned. Where students transitioned to schools outside our catchment, or where we were unable to identify to which school they had moved, attempts were made to contact the students via their parent/guardian's home address, nominated phone number or email address. This work included resurveying and interviewing continuing students and recruiting and surveying a new cohort of Grade 3 students. details on the participation rates etc are provided under section 7.2.4.
- Working with the HHS Data Manager, Mr David Brown, we have developed a Research Electronic Data Capture software (RedCap) database for the Schools Study. With assistance from the clinical Stream bookings team, Gippsland Administrative Officer Ms Melissa Peppin, and stream Research Assistant Mr Tim Campbell, all survey data have been double entered to enhance accuracy;
- National Assessment Program – Literacy and Numeracy (NAPLAN) data for 2013, 2015, and 2017 have now been received;
- Data from the Schools Study survey and NAPLAN rounds have now been linked using a unique identifier;
- Considerable data checking and cleaning has been undertaken and we are in the process of merging all the files into the database so that the final sets can be extracted for analysis;

## **Adult Psychological Impacts**

- We completed 26 interviews with adults who had been resident in Morwell during the mine fire event and participated in the Adult Survey. The aim of these interviews was to explore the experience of the Hazelwood mine fire event among adult residents of Morwell, particularly the psychological impact at the time of the event, ongoing impacts and resilience factors, which may have ameliorated the

psychological impacts. Dr Rebecca Jones coordinated this component of the study with support from research assistant Sarah Lee and Monash Social Work students.

- The analysis of this interview data has now been incorporated into the following two papers:

- **Paper 1: Experiences of a prolonged coal-mine fire**

**Overview:** This was a purely qualitative paper examining the perspectives (from interviews) of Morwell residents regarding the impact of the fire.

**Status:** Paper has been published in Disaster Prevention and Management and a link to both the journal article as well as a public copy of the author-approved version has been uploaded to

<http://hazelwoodhealthstudy.org.au/publications/>. A Research Summary has been prepared, placed on the HHS website at

<http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/> and also shown in Appendix 2.

- **Paper 2: Psychological outcomes following the Hazelwood mine fire: A mixed methods study**

**Overview:** This mixed methods paper combined analysis of IES-R data from the Adult Survey with qualitative interview findings.

**Status:** Paper has been through full internal review process and approved for release by the DHHS and is currently under consideration by the Australian and New Zealand Journal of Psychiatry.

- A working group was convened at The Alfred on 13 June 2018, to develop the protocol for the next round of the Adult Psychological Impacts survey and interviews scheduled for 2019. At this meeting the content of the survey and sampling frame were discussed.
- Further discussions have taken place with Dr Caroline Gao, HHS biostatistician, regarding the analysis of existing data and the plans for 2019.
- A proposal for a paper has been developed looking at mental health outcomes following the Hazelwood event through ambulance, emergency and admissions data. A technical report and journal article are planned.

### 7.2.3 Publications

Since the last Annual Report, the Psychological Impacts Stream has publicly released the following scientific papers and Research Summaries.

## **Schools Study**

Paper 1: The impact of a disaster on students and staff from a specialist, trauma-informed school in Australia

- Pre-print - Berger, E., Carroll, M., Maybery, D., & Harrison, D. (2018, August 13). The impact of a disaster on students and staff from a specialist, trauma-informed school in Australia. <https://doi.org/10.31234/osf.io/agdb5>
- Research Summary shown in Appendix 2 and <http://hazelwoodhealthstudy.org.au/wp-content/uploads/2018/09/20180910-Psychological-Impacts-Stream-Specialist-School-Interviews-Research-Summary.pdf>

Paper 2: Children's perspectives on the impact of the Hazelwood mine fire and subsequent smoke event.

- Pre-print - Berger, E., Carroll, M., & Maybery, D. (2018, October 2). Children's perspectives on the impact of the Hazelwood mine fire and subsequent smoke event. <https://doi.org/10.31234/osf.io/8mhxf>
- Research Summary shown in Appendix 2 and <http://hazelwoodhealthstudy.org.au/wp-content/uploads/2018/10/20180906-Psychological-Impacts-Stream-Childrens-perspectives.pdf>

## **Adult Psychological Impacts**

Paper 1: Experiences of a prolonged coal-mine fire

- Published paper - Jones, R., Lee, S., Maybery, D., and McFarlane, (2018). Experiences of a prolonged coal-mine fire. Disaster Prevention and Management: An International Journal, 27(5), 534-545, <https://doi.org/10.1108/DPM-05-2018-0145>)
- Pre-print - Jones, R., Lee, S., Maybery, D., and McFarlane, (2018). Experiences of a prolonged coal-mine fire. [https://researchmgt.monash.edu/ws/portalfiles/portal/252507394/252145312\\_oa.pdf](https://researchmgt.monash.edu/ws/portalfiles/portal/252507394/252145312_oa.pdf)
- Research Summary shown in Appendix 2 and <http://hazelwoodhealthstudy.org.au/wp-content/uploads/2018/10/20180605-adults-Psych-stream-research-summary-4.pdf>

Paper 2: Psychological outcomes following the Hazelwood mine fire: A mixed methods study

- Research Summary shown in Appendix 2 and available at <http://hazelwoodhealthstudy.org.au/wp-content/uploads/2018/11/Psych-stream-mixed-methods-research-summary-V2.pdf>

## 7.2.4 Overview of recruitment

A separate discussion document on recruitment within the Schools Study is being prepared for consideration by the DHHS, so the information provided here will be kept brief.

As noted in the previous HHS Recruitment Reports and Annual Reports, the participation rate for the first round of the Schools Study was in line with published studies on recruiting students in post-disaster communities, but was less than we had hoped for given the study was initiated as a result of community concerns. As reported previously, we still have sufficient statistical power to detect a difference in the primary outcome measure, the CRIES. Where we are challenged is our capacity to conduct multivariate analyses on the multiple scales included in the Schools Study as we do not have a sufficient sample to drill down into each of these effects.

As a result, we have focused on the primary outcomes, in this case the CRIES results and the NAPLAN scores. This will be sufficient to answer the core research questions for this component of the study. This work is being supplemented by other analyses including qualitative interviews with children and school personnel.

In the second round of the Schools Study, continuing students now in Grades 5, 7 and 9 were asked to complete a follow-up survey. Where students transitioned to schools outside our catchment, or where we were unable to identify to which school they had moved, attempts were made to contact the students via their parent/guardian's home address, nominated phone number or email address. The re-surveying of students was quite successful when the student was still in a participating school, with 91% (224/245) responding. It was more challenging when students had to be approached via their last known home address/phone, with only 7% (3/43) completing the survey.

We also sought to do repeat face-to-face interviews with students who participated in a qualitative interview in the first round. Once again, we were quite successful, with 79% of students agreeing to be re-interviewed, resulting in 46 new interviews. The use of follow-up interviews in a post-event study is almost unique and provides us with an enormously rich dataset.

In addition to resurveying and interviewing continuing students, we recruited a new cohort of students, currently enrolled in Grade 3, who would have been about five years of age at the time of the event. We also invited the parents and teachers of these students to complete surveys. Surveying parents provided important background information about students and their families. Teachers were asked to complete a single measure for each student, the Strengths and Difficulties Questionnaire, which provided insight to students functioning and wellbeing at school.

We recognised from the outset that recruitment of a new cohort of students enrolled in Grade 3 would be challenging, because of the time that has now elapsed since the mine fire event. Accordingly, we developed a targeted Frequently Asked Question document outlining the value of having the participation of Grade 3 students (and their parents) in the study. In addition, we followed the lead of the Adult Survey in providing a \$20 reimbursement per survey and interview completion. We also made extensive efforts to communicate directly with schools and promote the study through the local media, including hosting a media event at a key local primary school.

Overall, parental consent was obtained for 50 out of a possible 412 Grade 3 students. This represented a participation rate of 12%, which was approximately half that achieved in the first round of recruitment. Feedback from parents and school staff suggested that this reduced recruitment rate was because the mine fire event has become less salient to them since the first round of data collection was conducted two years ago. Amongst the parents and teachers of the 50 Grade 3 students who were recruited, the survey completion rate was 62% and 78% respectively. Given the challenges of recruiting new students into the study, it is now likely that we will not follow through with plans to recruit a further new batch of Grade 3s in the third Schools Study round in 2019.

### **7.2.5 Future plans for the Psychological Impacts Stream**

In the coming months, the Psychological Impacts Stream will be:

- completing a report on the second round of Schools Study interviews;
- finalising a report on recruitment into the Schools Study and the viability of ongoing rounds of data collection, for consideration by the DHHS;
- analysing collated NAPLAN data from 2013, 2015 and 2017 to investigate changes in student academic performance following the mine fire;
- preparing for analysis, and reporting, of the second round of survey data collection for the Schools Study;

- working with the Hazelinks team to analyse and report on mental health data including ambulance utilisation, emergency and hospital presentations, and MBS and PBS activity related to mental health.
- preparing for the roll-out of the Adult Psychological Impacts survey and interviews in 2019; and
- preparing for the roll-out of the third round of the Schools Study in 2019.

## 7.3 Impact on Community Wellbeing

### 7.3.1 Aims and objectives of the Community Wellbeing Stream

The first part of this Stream's focus was on providing narrative evidence of the perceived impact of the Hazelwood mine fire smoke event in Morwell and surrounding communities on community wellbeing. Specific objectives were to identify community perceptions of:

- the impact of the smoke event on community wellbeing;
- the effectiveness of community rebuilding activities; and
- effective communication during and after the smoke event.

The second part of the Stream's focus was to engage with community groups in participatory action research, focusing on strengthening identified aspects of community wellbeing.

The Community Wellbeing Stream has since merged with the Older People Stream, bringing together the findings from both programs of work with the objective of ensuring that there is a focus on the impacts of the event on older people across the broader Hazelwood Health Study research program.

### 7.3.2 Updates on the Community Wellbeing Stream:

#### Developments since the 3<sup>rd</sup> Annual Report

##### *Reports*

Community Wellbeing researchers are currently analysing the full range of qualitative data gathered in years 1-3 on community recovery and communication during and after the mine fire. The findings are being drafted in to several reports including:

*Volume 1: Community perceptions of the impact of the smoke event on community wellbeing*, covering:



- What the community experienced.
- Relationship to the mines.
- Having a voice.
- Trust and mistrust.

*Volume 2: Community perceptions of the elements that are important for effective communication during and after the smoke event*, covering:

- Relation between official communication, news media and social media
- Trust and empowerment in social media.
- How communication could be improved in a similar future event.

A third report is planned which will analyse recovery processes after the smoke event.

On 15 October the combined Older People and Community Wellbeing stream held a half-day planning workshop to discuss future publications and reports, including cross-stream reports. Further intra- and inter-stream publications to explore included:

- Optimal communication principles, drawing on the Community Wellbeing and Older People's focus group data
- Further analysis of Adult Survey data to explore the impacts on Older People
- Bringing together the qualitative data from the Psychological Impacts, Community Wellbeing and Older People streams

A video summarising the outcomes of the social media analysis was uploaded to the HHS website in December 2017 and has generated discussion with the community. The video can be seen at <http://hazelwoodhealthstudy.org.au/research-areas/community-wellbeing/>.

Dr Yell was interviewed about the social media research by the *Latrobe Valley Express*. The article entitled "Community finds social media voice" was published 14 December 2017, is shown in Appendix and is available online at:

[www.latrobevalleyexpress.com.au/story/5122049/community-finds-social-media-voice/](http://www.latrobevalleyexpress.com.au/story/5122049/community-finds-social-media-voice/)

### *Exhibition*

The participatory action research phase of the Stream's year 3 activities culminated in a photographic exhibition "Our Hopes for the Future of Morwell", which was on display at the Switchback Gallery at Federation University, Churchill, from 14-24 November. Displaying 28 images of objects that symbolised their hopes for the future of Morwell (some reproduced below), the exhibition gave visible expression to the community's recovery from the mine fire, and their renewed sense of optimism and pride of place. It is hoped that the reflections, debate and conversations provoked by the 28 images will draw many more voices in to the community-wide conversation about their future.



*"Connecting the Morwell community through friendships and fitness"*  
Rose Garden Walking Group



*"That all families in the region have access to safe and stable housing"*  
Christina Melrose: Gippsland Centre Against Sexual Assault



*"For Morwell to thrive and grow"*  
Janet, St. Luke's Opportunity Shop

For the period 21-25 May 2018, the exhibition was moved to Queen's Hall, State Parliament. A launch event on 21 May attracted considerable interest, with a large contingent of local residents attending along with key stakeholders from the study, collaborating universities and other agencies (see Figure 2).



**Figure 2 Launch of the *Our Hopes for the Future of Morwell* exhibition at Queen's Hall, State Parliament of Victoria, 21 May 2018**

It was hoped to tour the exhibition to the Dungog Arts Festival in the Hunter Valley in October 2018, however our efforts to arrange this with the organisers proved unsuccessful. The photographic exhibition is currently on show at Mid-Valley Shopping Centre, in Morwell, where it will remain until early December (see Figure 3)

Media interviews, regarding the launch of the *Our Hopes for the Future of Morwell* exhibition, took place with Channel 9, WIN news and the Latrobe Valley Express. The print articles are reproduced in Appendix 4Appendix . The Channel 9 story is available online at <https://www.youtube.com/watch?v=rUH3gyCCwDQ>

Discussions are currently under way with the Latrobe Health Assembly to explore ways of continuing the conversation about the future stimulated by this photographic exhibition. Assembly members are being encouraged to come and view the exhibition.

A journal article is under way that examines the role of applied arts and community recovery, and is based on the exhibition 'Our hopes for the future of Morwell'. The focus will be on themes of the role of visual arts in community recovery, applied arts and participatory action research, photography as expression of pride of place and resilience.



**Figure 3 ‘Our hopes for the future of Morwell’ exhibition being set up at Mid-Valley Shopping Centre, Morwell**

### Older people

Following the merging of the Community Wellbeing and Older People research streams, efforts have continued to maintain an ongoing focus on the impacts of the Hazelwood event on older people. Stream researchers continue to work with colleagues from the Monash Faculty of Arts to explore the intersections between individual risk and social capital and the role that communities and older people in particular can play in preparing for, and responding to, regional emergency events. A Masters student working with the Psychological Impacts stream has just completed a thesis looking at the impacts of the event on older people, making use of Adult Survey data. That thesis explores differences in PTSD symptomatology in older adults and the influence of factors such as age, health status, prior mental health diagnoses and previous traumatic exposures.

A journal article by Walker and Carroll *Impacts on older people of a catastrophic mine fire in regional Australia: implications for future health policy and planning*, has been submitted to and approved by DHHS. It is currently under review by the *Australasian Journal on Ageing*.

### 7.3.3 Publications

Since the last Annual Report, the Community Wellbeing Stream has released the following journal papers, abstracts and videos.

#### Journal papers

Yell, S., Duffy, M (2018), Community empowerment and trust: social media use during the Hazelwood Mine Fire, *Australian Journal of Emergency Management* 33(2): 66-70.

Available at <http://hazelwoodhealthstudy.org.au/publications/> and <https://doi.org/10.31234/osf.io/aqdb5>

Duffy, M., Whyte, S. (2017) the *Latrobe Valley: the politics of loss and hope in a region of transition* *Australasian Journal of Regional Studies*, 23 (3): 421-446.

#### Abstracts

Walker, J., Carroll. M. (2018). *Beyond Vulnerability: Intersections between vulnerability, ageing and connectedness in a rural community*, paper presented to the 6th Rural and Remote Health Scientific Symposium in Canberra on 11-12 April 2018. Shown in Appendix 3.

*The impact of the Hazelwood mine fire in Australia on older people: review of policy-driven decisions made at the time*, abstract presented at the Aging and Society Research Network Conference, University of California, Berkeley, USA on 3-5/11/2017. Shown in Appendix 3.

#### Video

Hazelwood Health Study Social Media Analysis. Video available at <http://hazelwoodhealthstudy.org.au/research-areas/community-wellbeing/>.

### 7.3.4 Future plans for the Community Wellbeing Stream

We anticipate submitting the Volume 1 and 2 reports to DHHS in December 2018.

A third volume will be drafted in the first half of 2019:

- *Volume 3: Community perceptions of the effectiveness of community rebuilding activities*, covering:
  - Is there a plan now?
  - What is recovery?
  - Morwell's hopes for the future

Potential intra- and inter-stream publications to explore include:

- Optimal communication principles, drawing on the Community Wellbeing and Older People's focus group data



- Further analysis of Adult Survey data to explore the impacts on Older People
- Bringing together the qualitative data from the Psychological Impacts, Community Wellbeing and Older People streams

Discussions will continue regarding submitting a proposal for research funding for a project on *Beyond Vulnerability*, exploring the intersections between individual risk and social capital and the role that the community can play in preparing for, and responding to, regional emergency events.

The Stream plans to submit a paper to the journal *Environment and Planning C* with the focus of 'Caring-with', combining findings from the Community Wellbeing and Older People studies. The paper will examine the impacts of the Hazelwood Mine Fire on vulnerable people and how a 'Caring-with' approach may assist in addressing policy gaps to support vulnerable people and the wider community in future disaster events.

A journal article is planned that examines the role of applied arts and community recovery, and is based on the exhibition, 'Our hopes for the future of Morwell'. The focus will be on themes of the role of visual arts in community recovery, applied arts and participatory action research, photography as expression of pride of place and resilience.

We plan to continue synthesising and writing up our data, and integrating our findings with those of the Older People Stream through joint publications. In addition, efforts will continue to ensure that Adult Survey, Hazelinks and Psychological Impacts Stream analyses include a consideration of the impacts on older people.

Some analysis of the impacts of the Hazelwood smoke event on older people that has completed for a Masters thesis will be extended and written up as a journal article.

## 7.4 Adult Survey

### 7.4.1 Aims and Objectives of the Adult Survey Stream:

The Adult Survey aimed to:

1. cross-sectionally investigate the health status of an exposed versus a comparison adult population;
2. compare the incidence rates of long term health outcomes by linking to administrative health datasets in exposed versus comparison populations; and
3. investigate the association between exposure level and risk of long term health outcomes by linking to administrative health datasets using fine resolution exposure metrics developed by CSIRO.

### 7.4.2 Updates on the Adult Survey Stream

#### Developments since the 3<sup>rd</sup> Annual Report

As described in the third Annual Report, the Adult Survey closed recruitment in 2017 with 3,096 participants from Morwell (34%) and 960 participants from Sale (23%). Substantial resources were invested in data cleaning, statistical analyses and write up of preliminary findings comparing health outcomes in Morwell relative to Sale. A report outlining those findings, titled *Hazelwood Health Study Adult Survey, Volume 1 Comparison of Morwell and Sale* was publically released in September 2017. That report can be found on the Hazelwood Health Study website at [www.hazelwoodhealthstudy.org.au/study-findings/study-reports/](http://www.hazelwoodhealthstudy.org.au/study-findings/study-reports/)

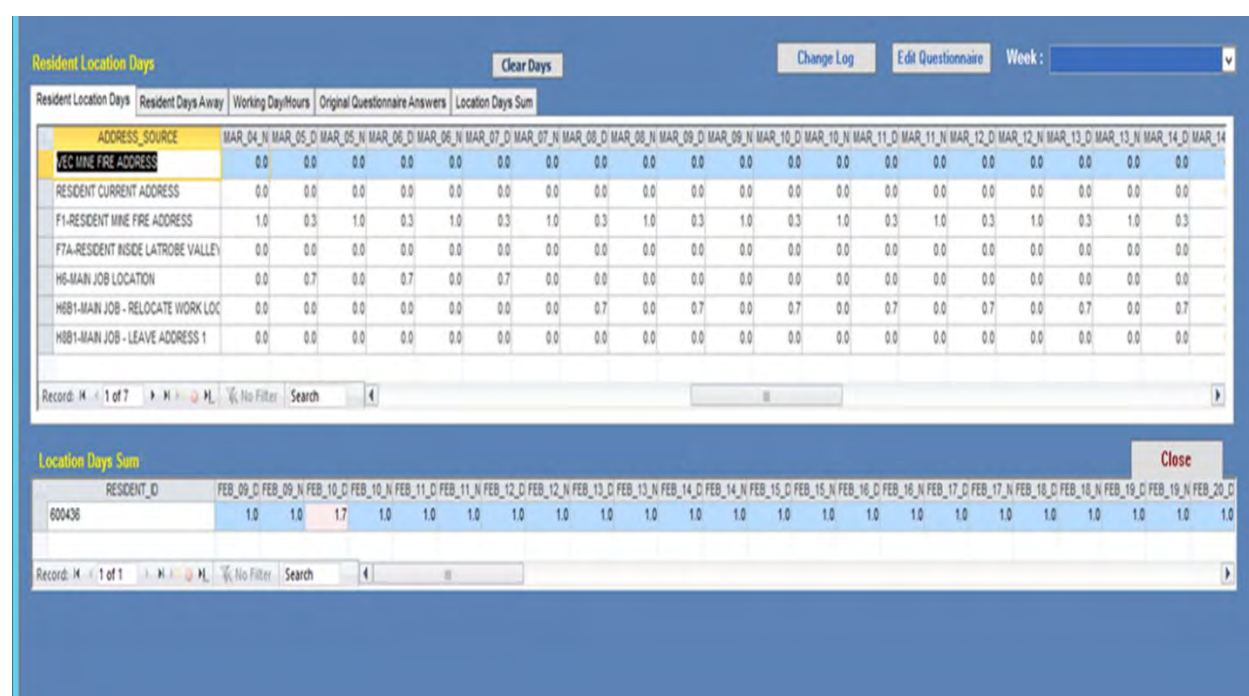
Since that time, the following tasks have progressed:

#### Time-location data cleaning

The researchers have completed the audit and cleaning of the time-location data. That is the address and calendar data provided by Adult Survey participants that informed us where each participant was during each day and each night of the six week mine fire event. These important data allowed us to estimate PM<sub>2.5</sub> exposure for each participant for each address and for each day and night or part thereof. This time-location data cleaning comprised an extensive volume of work that included development of detailed algorithms and decision-trees to be applied to each participant's calendar information. Whilst programmed algorithms were sufficient to code approximately 3,500 of the Adult Survey participant calendars, the remaining 500 or so had to be manually coded. These typically comprised calendars where a participant had provided conflicting information. For example, participants may have recorded that they slept at an address that was not their home in the

2<sup>nd</sup> week of the mine fire (eg. Moe, Inverloch, Phillip Island, Geelong, interstate, overseas etc), but not report any time off work or any relocation of their usual work place. Upon manual review the researchers had to determine the feasibility of that person returning to work from wherever they had travelled. Some participants reported that they relocated to varying addresses, but gave the same dates for each. The researchers had to determine which dates best aligned with which addresses. Where this could not be determined, exposure had to be averaged equally across the varying addresses for those dates. For example, if a participant reported that they stayed in Bendigo on 12 March, and that they stayed in Warragul on 12 March, then that participant would get 0.5 of the PM<sub>2.5</sub> for Bendigo and 0.5 of the PM<sub>2.5</sub> for Warragul for that date.

Figure 4 shows an example of a participant with five addresses reported for the mine fire period; those being the residential address, a relocation address, main job location, main job relocation address and a job leave address. Time at each address for each day and night of the mine fire period are shown as fractions of 12 hours.



**Figure 4 Example of an Adult Survey participant's time fractions at each of five addresses used during the mine fire period**

## Estimation of individual exposure scores

With the time-location data finally cleaned, the researchers have been able to blend the geocoded address data with calendar data and air pollution data modelled by CSIRO, in order to estimate an air pollution exposure score for every Adult Survey participant.



## **Statistical analysis**

The final stages of the statistical analysis plan for the Adult Survey were developed and reviewed by the Project Steering Committee and the relevant members of the Scientific Reference Group in the first half of the year. The analysis plan outlined the ways in which individuals would be categorised as having high, medium, low or no exposure; the confounders to be statistically adjusted for, such as employment in jobs that involved exposure to smoke, fumes, fuels or dusts, and other health-related lifestyle factors such as smoking; and the statistical techniques used to compare groups.

The programming code for the statistical analysis has since been written and run, with the results then going through a process of review, followed by revision and further review. The statistical analysis of these data is now complete.

## **Report on exposure assessment findings**

A report describing the association between category of PM<sub>2.5</sub> and health outcomes self-reported in the Adult Survey has been drafted and is in the final stages of technical review before submission to DHHS.

## **Review of consent for linkage**

Adult Survey data pertaining to participant's consent for linkage with administrative health databases has been reviewed for completeness.

## **Linkage with administrative health databases**

Refer to section 7.5.2 below.

## **7.4.3 Dissemination of findings**

Since the last Annual Report, the Adult Survey has completed the report entitled "Hazelwood Health Study Adult Survey Volume 2: The relationship between Hazelwood mine fire smoke exposure and health outcomes". The Executive Summary is shown in Appendix 1. After the necessary approvals have been obtained that Report will be placed on the Hazelwood Health Study website at <http://hazelwoodhealthstudy.org.au/study-findings/study-reports/>

An abstract on asthma and respiratory symptoms (see Appendix 3), based on the Adult Survey Volume 1 Report, was accepted as a poster presentation by the Annual Scientific Meeting of the American Thoracic Society 2018.

#### 7.4.4 Overview of recruitment

Substantial resources were deployed in an effort to maximise the recruitment of Adult Survey participants. Further effort went in to an analysis plan that carefully corrected for any participation (sampling or selection) bias that might be influencing the results, and also for the confounding effects of health-related risk factors other than the Hazelwood mine fire. Details are in the HHS Adult Survey Volume 1 Report, and the HHS Recruitment Report 2, both available at <http://hazelwoodhealthstudy.org.au/study-findings/study-reports/>.

In summary, recruitment rates were approximately 34% in Morwell (n=3096) and 23% in Sale (n=960). The high rate of non-participation in the Adult Survey rendered the results vulnerable to participation bias. This occurs when participants differed in important ways, such as health status, from the larger population they represented. Comparisons with local community data, showed that both the Morwell and Sale samples appeared to exhibit biases towards women and older people having higher response rates. These are commonly encountered trends for population-based surveys in general. Importantly the direction and strength of the bias appeared very similar for the two communities, which meant that gender and age were unlikely to effect the strength or direction of the results observed in this study. Weighting of results to account for differences between participants and non-participants in gender and age, further minimised the possible bias conferred by these factors and promoted more confidence in the findings.

In Australia, almost one third of ill health, disability and premature deaths can be attributed to lifestyle health risk factors. Therefore, it was important that the Adult Survey assessed likely determinants of health other than the Hazelwood mine fire. The health risk factors that were measured included socioeconomic (eg. employment status, marital status and education), tobacco and passive smoke exposure, alcohol use, exposure to traumatic life events and previous medical history. Compared with Sale, it was observed that the Morwell participants were slightly more likely to be unemployed or unable to work, less highly educated, more likely to be current smokers, but less likely to be risky drinkers. It was important to be confident that any differences observed between Morwell and Sale in cardiovascular, respiratory or psychological health outcomes, were not related to these health risk factors. Therefore statistical adjustments for these core confounders, along with gender and age, were applied throughout the analyses.,

It is not intended that there will be a follow up Adult Survey. Therefore, possible attrition over time is not of concern. Approximately 70% of the Adult Survey participants consented for an indefinite period of time to the researchers linking to their ambulance, hospital and emergency, cancer and death records. The researchers will be able to track the health of

the Adult Survey participants via these records for as long as is permitted by the relevant Ethics Committees and data custodians.

In addition to the identified data linkage, a number of anonymous data extractions have been added to the Hazelwood Health Study Project Plan since its commencement in 2014. Those extractions are described in section 7.5.

#### **7.4.5 Future plans for the Adult Survey Stream**

The upcoming priorities for the Adult Survey include the public release of the Adult Survey Volume 2 Report, describing any association between mine fire related PM<sub>2.5</sub> and self-reported health outcomes, and progression of the identified linkages with administrative health datasets.

The researchers will be meeting to plan further investigation of the existing Adult Survey data.

### **7.5 Hazelinks**

There are two components of Hazelinks: an identified data linkage study and an anonymised data extraction study.

#### **7.5.1 Aims and objectives of the Hazelinks Stream**

##### **Identified linkage with consent**

The identified data linkage aimed to investigate the potential health effects from the Hazelwood mine fire by linking participant information from the Adult Survey (Morwell and Sale) to relevant health databases. These included routinely collected data from ambulance, emergency, hospital, cancer and death registries. The linkage identifies members of the Adult Survey cohort who subsequently develop respiratory or cardiovascular conditions, develop cancer, and/or die.

##### **Anonymised data extraction**

The anonymised data extraction aimed to investigate the short, medium and longer term health effects of exposure from the mine fire smoke across the Latrobe Valley using population wide data. The registries used for data extraction include ambulance, hospital, cancer and death registries. The MBS and PBS data have also been analysed.

## Datasets for identified linkage and data extraction

The identified linkage will be undertaken with datasets 1-5 below, and the anonymised data extraction will be undertaken for datasets 2-7 below.

1. National cancer incidence data from the Australian Cancer Database (ACD) held by AIHW.
2. Victorian cancer incidence data held by the Victorian Cancer Registry (VCR).
3. Hospital admissions and emergency presentations data from the Victorian Admitted Episodes Dataset (VAED) and the Victorian Emergency Minimum Dataset (VEMD) respectively, held by the Victorian DHHS.
4. Ambulance data from the Victorian Ambulance Clinical Information System (VACIS) and the Victorian Ambulance Cardiac Arrest Registry (VACAR) held by Ambulance Victoria.
5. Mortality data from the National Death Index (NDI) held by AIHW.
6. Mortality data from the National Mortality Database (NMD) held by AIHW.
7. MBS data (GP, specialist and consultant attendances) and PBS data for medication use, held by the Commonwealth DHS.

### 7.5.2 Updates on the Hazelinks Stream

#### Identified linkage update

The identifying details for consenting Adult Survey participants have been sent to Ambulance Victoria, the DHHS and the Victorian Cancer Registry. Linked VACIS and VACAR data has been received from Ambulance Victoria for the period 01/01/2009 to 30/12/2017. Linked VAED and VEMD data has been received from the Victorian DHHS for the period 01/01/2009 to 31/01/2018. We are awaiting return of linked VCR data.

#### Data extraction reports, papers and presentations

##### *MBS and PBS report*

Analysis of the anonymous MBS and PBS data has been completed and the findings have been collated into a report entitled “*Medicare Benefits Schedule and Pharmaceutical Benefits Scheme data: Time Series Analyses*”. The report was approved by DHHS and released publically in April 2018. That report is currently being updated. A lay language Research Summary was prepared and is shown at Appendix 2 and on the HHS website at <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/>.

### *MBS and PBS conference presentations*

The findings from the MBS and PBS analyses were presented at the International Society for Environmental Epidemiology 2018 conference in August. The MBS presentation was titled *Brown coal mine fire-related fine particulate matter and medical service utilisation in Australia: a time series analysis*. The abstract is shown in Appendix 3. The PBS presentation was accepted as a poster and was titled *Fine particulate matter and medications dispensed during and after a brown coal mine fire: a time series analysis*. The abstract for that poster is shown in Appendix 3.

### *MBS and PBS papers*

A journal paper based on the analysis of MBS data has been written and approved for public release by DHHS. The paper, titled “*Coal mine fire-related fine particulate matter and medical service utilisation in Australia: a time series analysis from the Hazelwood Health Study*”, was submitted to the *International Journal of Epidemiology*. We are currently reviewing the paper based upon the expert peer review undertaken by that journal. A journal paper based on the analysis of PBS data has also been written and approved for public release by DHHS. The paper, titled *Fine particulate matter exposure and medication dispensing during and after a coal mine fire: a time series analysis from the Hazelwood Health Study*, has been submitted to *Environmental Pollution*. We are also currently reviewing that paper based upon the expert peer review undertaken by the journal.

### *Ambulance attendance report*

Analyses of anonymous ambulance attendance data have been completed for the period July 2010 to March 2015 for all ages in all geographic areas considered to have been exposed. The aims of the analyses were to examine whether:

- ambulance attendances increased during the mine fire period in comparison with the remainder of the analysis period; and
- coal mine fire-related PM<sub>2.5</sub> was related to increased ambulance attendances for respiratory and cardiovascular conditions.

Time series statistical models were used to quantify the associations between daily coal mine fire-related PM<sub>2.5</sub> and ambulance attendances. The findings have been collated into a report titled “*Hazelinks Ambulance Victoria data: Time Series Analyses (First Data Extraction)*”. The report is submitted to DHHS concurrently with this 4<sup>th</sup> Annual Report and will be publicly released upon approval. The Executive Summary is shown in Appendix 1.

### *Emergency presentations and hospital admissions analysis*

A poster presentation based on the findings from the previously released Emergency presentations and hospital admissions analysis report, was presented at the annual

conference of the American Thoracic Society in May 2018. The poster was titled *Emergency Presentations and Hospital Admissions following exposure to smoke from a Coal Mine Fire* and is shown Appendix 3.

### 7.5.3 Publications

Since the last Annual Report, the Hazelinks has published the following Reports, Research Summaries, journal papers and conference abstracts:

#### Technical Reports

- Medicare Benefits Schedule and Pharmaceutical Benefits Scheme data: Time Series Analyses. Currently being updated.

#### Research Summaries (Shown in Appendix 2).

- Use of health services and medications Research Summary. Shown in Appendix 2 and on the HHS website at <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/>.

#### Conference presentations (shown in Appendix 3)

- Johnson AL, Dipnall JF, Dennekamp M, Williamson GJ, Gao CX, Carroll MTC, Dimitriadis C, Ikin JF, Johnston FH, McFarlane AC, Sim MR, Stub DA, Abramson MJ, Guo Y. *Fine particulate matter and medications dispensed during and after a brown coal mine fire: a time series analysis*. Poster presentation at the annual conference of the International Society for Environmental Epidemiology, Ottawa, Canada, August 2018.
- Abramson MJ, Johnson AL, Dipnall JF, Dennekamp M, Williamson GJ, Gao CX, Carroll MTC, Dimitriadis C, Ikin JF, Johnston FH, McFarlane AC, Sim MR, Stub DA, Guo Y. *Brown coal mine fire-related fine particulate matter and medical service utilisation in Australia: a time series analysis*. Oral presentation at the annual conference of the International Society for Environmental Epidemiology, Ottawa, Canada, August 2018.
- Abramson MJ, Dennekamp M, Straney L, Dimitriadis C, Gao CX, Guo Y. *Emergency Presentations and Hospital Admissions following exposure to smoke from a Coal Mine Fire*. Poster presentation at the annual conference of the American Thoracic Society, San Diego, USA, May 2018.

### 7.5.4 Future plans for the Hazelinks Stream

- Linked cancer data yet to be received.

- Analysis plans for identified hospital and ambulance data to be drafted and circulated to PSC for approval.
- The analysis plan for death data extraction to be finalised and circulated for PSC approval.
- Report on the analyses of anonymous ambulance attendance to be approved by DHHS before public release.

## 7.6 Respiratory Stream

### 7.6.1 Aims and objectives of the Respiratory Stream:

The research questions relevant to Respiratory Stream were:

Is there evidence that people in general, and susceptible sub-populations in particular, who were heavily exposed to emissions from the Hazelwood fire, compared with otherwise similar people who were minimally exposed to emissions from the fire:

- a) currently have clinical or sub-clinical respiratory conditions that could be associated with clinically important adverse health consequences in the future?
- b) over time develop clinical or sub-clinical respiratory conditions that could be associated with clinically important adverse health consequences in the future?

The aims of the Respiratory Stream were to determine whether exposure to smoke from the Hazelwood mine fire was associated with:

- respiratory symptoms;
- asthma control and lung inflammation;
- rate of decline in lung function; and
- gas transfer and small airway function.

### 7.6.2 Updates on the Respiratory Stream:

#### Staff Appointments

Mr Thomas McCrabb and Ms Annie Makar, who were appointed to collect the Respiratory Stream data in the clinic, completed their contracts on 23<sup>rd</sup> March 2018 and have since taken up positions elsewhere in respiratory science.

The bookings team, Ms Shantelle Allgood, Kylie Sawyer and Kristine Thomas, completed their contracts for HHS in April/May 2018.



Dr Sasha Taylor joined the HHS team in August 2018. Dr Taylor is currently an Advanced Trainee – Public Health Medicine (Victorian Public Health Medical Training Scheme) in the School of Public Health and Preventive Medicine, Monash University. Dr Taylor is assisting the Respiratory Stream with data analysis, preparing a paper on respiratory symptoms, lung function and markers of asthma control, comparing Morwell and Sale participants.

## **Developments since the 3<sup>rd</sup> Annual Report**

In the period since the 3<sup>rd</sup> Annual Report in November 2017, Respiratory Stream activities include:

- ongoing recruitment of Morwell participants to attend the HHS Respiratory Stream clinic located in the LCHS;
- completion of testing Morwell participants in December 2017;
- close down of the Morwell testing site and subsequent set up of the Sale testing site at the Central Gippsland Health Service in January 2018;
- distribution of invitation packs (and reminders and final letters where applicable) to Sale residents who had been selected for the Respiratory Stream assessments;
- testing of participants at the Sale site (Figure 5) commenced 22 January 2018 and concluded on 16 March 2018;



**Figure 5 Respiratory Stream Coordinator Ms Brigitte Borg (left) with Respiratory Scientists Mr Thomas McCrabb and Ms Annie Makar outside the Sale testing site.**

- review of spirometry and gas transfer factor results for all participants within four weeks of their visit. Where abnormal findings were identified, letters were forwarded to participants with the recommendation that these be taken to their general practitioner for review;



- cleaning and verification of collected data;
- analysis of slow vital capacity measured using the Forced Oscillation Technique data;
- a media release thanking Morwell residents for their participation in the Respiratory Stream testing and encouraging those yet to participate to book was published in the Latrobe Valley Express on 2 November 2017. The article can be found at [http://hazelwoodhealthstudy.org.au/wp-content/uploads/2015/03/IMG\\_0375.jpg](http://hazelwoodhealthstudy.org.au/wp-content/uploads/2015/03/IMG_0375.jpg);
- a media release thanking Morwell residents for their participation in the Respiratory Stream assessments at the conclusion of testing was published in the Latrobe Valley Express on 18 December 2017. The article can be found at <http://www.latrobevalleyexpress.com.au/story/5127507/study-amazed-by-support/?cs=1462>;
- a media event thanking Morwell residents for their participation in Respiratory Stream assessments was published at the conclusion of Morwell testing on 19 December 2017 on the Hazelwood Health Study website. The piece can be found at <http://hazelwoodhealthstudy.org.au/hazelwood-health-study-reaches-lung-function-testing-goal/>;
- a media release to raise awareness of Respiratory Stream testing in Sale was published in the Gippsland Times on 30 January 2018. The article can be found at [http://hazelwoodhealthstudy.org.au/wp-content/uploads/2015/03/20180130\\_GT\\_Respiratory\\_Testing.pdf](http://hazelwoodhealthstudy.org.au/wp-content/uploads/2015/03/20180130_GT_Respiratory_Testing.pdf);
- a media release to raise awareness of Respiratory Stream testing in Sale was published in the Gippsland Times on 27 February 2018. The article can be found at <http://www.gippslandtimes.com.au/story/5250351/study-moves-to-lungs/?cs=1450>;
- a media event thanking Sale residents for their participation in Respiratory Stream assessments was published at the conclusion of Sale testing on 26 March 2018 on the Hazelwood Health Study website. The piece can be found at <http://hazelwoodhealthstudy.org.au/health-study-completes-lung-function-assessments-in-sale/>;
- Social media (Facebook) was utilised to keep residents of Sale and Morwell updated regarding Respiratory Stream activities. Facebook posts can be viewed at <https://www.facebook.com/search/top/?q=hazelwood%20health%20study>
- review of the standard operating procedures (SOPs; protocols) for the Respiratory Stream in preparation for the second round of testing in 2020. The purpose of this is to ensure that what is written in the SOPs reflects what was done in practice;
- development of the data analysis plan has commenced;
- planning has commenced in regard to the dissemination products for the Respiratory Stream data; eg. reports, journal papers etc;
- the first scientific paper reporting upon findings is underway. This comprises a cross-sectional analytic study nested examining any differences in asthma control and

severity between Morwell and Sale. The data have been analysed and the first draft of the paper prepared.

### 7.6.3 Overview of recruitment

Statistical power calculations for the Respiratory testing Stream are shown in Table 2. These assume an FEV1 decline in the non-exposed community (Sale) of mean=23.1 (SD=17.1) ml/year, and a two-sample t-test comparing change between the exposed (Morwell) and non-exposed groups with a significant p-value cut-off of 0.05. To detect a 5ml/y greater FEV1 decline in heavily exposed Morwell residents Table 2 below gives required sample sizes under a range of scenarios.

**Table 2 Respiratory Stream sample size calculations**

	<b>Statistical power 80%</b>	
	<b>Sale</b>	<b>Morwell</b>
	<b>Number required with follow up data at 3<sup>rd</sup> assessment</b>	
Equal numbers in Morwell and Sale	185	185
50% greater numbers in Morwell	154	231
Double numbers in Morwell vs Sale	139	278
	<b>Number to be recruited in to 1<sup>st</sup> assessment*</b>	
Equal numbers in Morwell and Sale	226	226
50% greater numbers in Morwell	188	282
Double numbers in Morwell vs Sale	170	339

- Assumes an 18% drop out per assessment

The Respiratory Stream aimed to recruit 339 participants from Morwell and 170 participants from Sale. The testing schedule allowed for six participants to be tested per day with two respiratory scientists testing participants in parallel. With the clinic being staffed five days per week, this allowed up to 30 participants to be tested each week.

The Respiratory Stream commenced recruitment and testing of Morwell participants in August 2017 and concluded in December 2017. The target was reached, with 346 data sets being collected.

The Respiratory Stream commenced recruitment and testing of Sale participants in January 2018 and concluded in March 2018. The target was reached, with 173 data sets being collected. Testing for the Sale cohort was conducted at Central Gippsland Health Service, Palmerston St Sale (Figure 6).



**Figure 6 Mr Thomas McCrabb and Ms Annie Makar set up lung function equipment at Sale site and a visiting journalist finds out what a lung function assessment is like.**

## **7.6.4 Dissemination of findings**

Since the last Annual Report, the Respiratory Stream has not yet released any Reports, Research Summaries, journal papers or conference abstracts

## **7.6.5 Future plans for the Respiratory Stream**

In the coming months, the Respiratory Stream researchers will be:

- completing the paper on asthma control and severity;
- preparing for the next analysis and write up of Respiratory Stream findings;
- undertaking preliminary planning for the second round of Respiratory Stream testing in 2020.

# **7.7 Cardiovascular Stream**

## **7.7.1 Aims and objectives of the Cardiovascular Stream**

The research questions relevant to Cardiovascular Stream were:

Is there evidence that people in general, and susceptible sub-populations in particular, who were heavily exposed to emissions from the Hazelwood fire, compared with otherwise similar people who were minimally exposed to emissions from the fire:

- a) currently have clinical or sub-clinical cardiovascular conditions that could be associated with clinically important adverse health consequences in the future?
- b) over time develop clinical or sub-clinical cardiovascular conditions that could be associated with clinically important adverse health consequences in the future?

The aims of the Cardiovascular Stream were to determine whether exposure to smoke from the Hazelwood mine fire was associated with:

- blood pressure;
- abnormal Electrocardiographs (ECGs);
- endothelial function (as a marker of early vascular disease); and
- inflammatory markers, such as C-Reactive Protein (CRP).

## **7.7.2 Updates on the Cardiovascular Stream:**

### **Staff Appointments**

Dr Sylvia Pomeroy was appointed to coordinate this Stream in May 2017. She completed substantial work on the testing protocols, clinic requirements and the appointment and training of staff. Dr Pomeroy resigned in early October 2017. HHS Senior Project Manager Dr Jillian Blackman took on Stream coordination responsibilities until Ms Brigitte Borg, Respiratory Stream Coordinator, assumed the role of Cardiovascular Stream coordinator in December 2017 concurrently with her Respiratory Coordinator Stream role.

At the end of March 2018, Ms Elizabeth Dewar and Ms Karen Kilpatrick (Figure 7) completed their roles as ultrasonographers undertaking measurement of participants' endothelial function by Flow Mediated Dilatation (FMD). The Cardiovascular Stream clinic in Morwell closed in April 2018. This coincided with the end of Ms Andrea Taggart's role undertaking anthropometric measures, blood pressure measurement, ECG testing and drawing blood from the research participants. The conclusion of Cardiovascular Stream testing in Morwell also saw the end of Ms Melanie Reeves' and Ms Shantelle Allgood's contracts to greet and consent research participants, administer questionnaires about health, medical history, family medical history and life-style risk factors.

Dr Juliana Betts joined the Cardiovascular Stream testing in March 2018 to assist with data analysis and write up, and also to assist Ms Andrea Taggart with anthropometric measures, blood pressure measurement, ECG testing and to draw blood from the research participants. Dr Juliana Betts is currently an Advanced Trainee – Public Health Medicine (Victorian Public Health Medical Training Scheme) in the School of Public Health and Preventive Medicine, Monash University. Dr Betts also supervised fifth-year medical students Ms Angela Kakishozi and Ms Linda Lee who assisted at the Cardiovascular Stream Clinic during their clinical rotation with the Study, and Mr Roshan Maniam who undertook a literature review on chronic kidney disease.



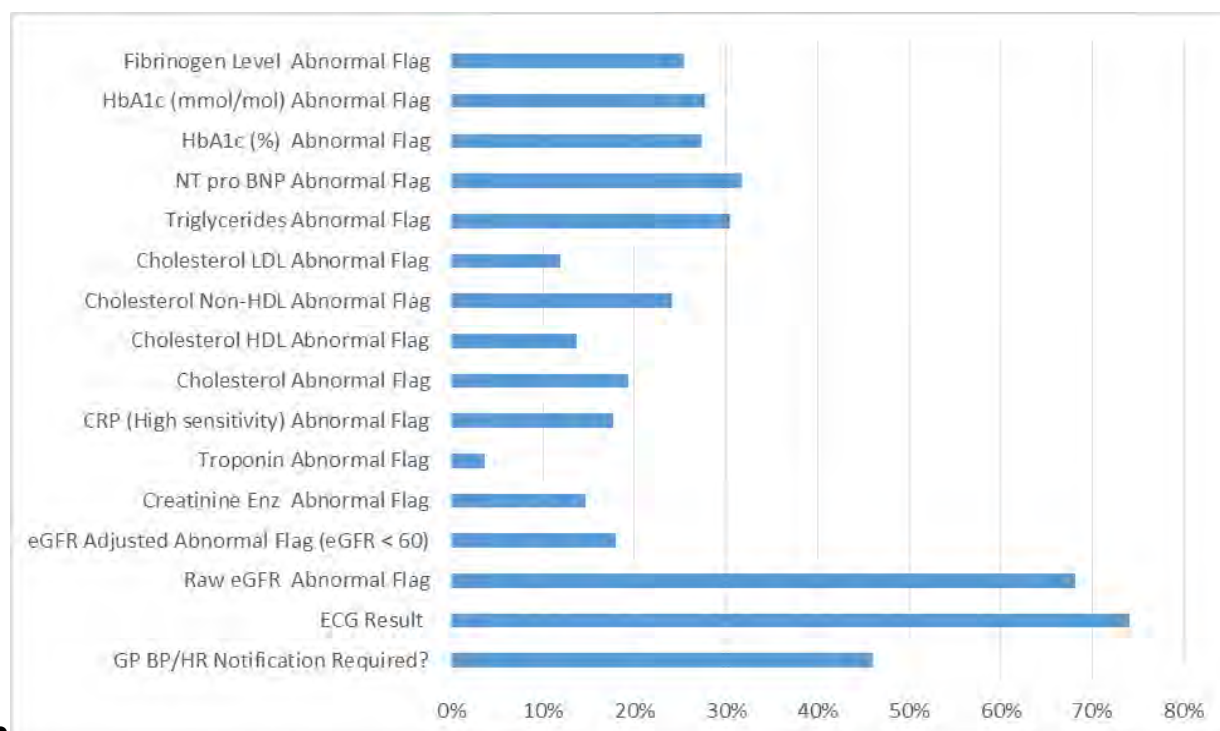
**Figure 7 Sonographers Ms Liz Dewar and Ms Karen Kilpatrick review an ultrasound measure of endothelial function result in the Cardiovascular Stream clinic in Sale**

## **Developments since the 3<sup>rd</sup> Annual Report**

In the period since the 3<sup>rd</sup> Annual Report in November 2017, Cardiovascular Stream activities included:

- meetings with various services for the purpose of sourcing suitable rooms for the clinical assessments in Morwell;
- appointment of a replacement Stream coordinator;
- finalising of all protocols and operating procedures for recruitment and for all tests to be carried out in the clinic;
- organising accommodation for clinical testing staff working in Morwell;
- appointing and training all new clinic staff in regard to the numerous strict SOPs for the participant testing;
- translation of the online diet questionnaire into paper format to improve efficiencies in the clinic;
- manual data entry of the paper-format diet survey questionnaires has been completed;
- completion of testing in Sale (testing concluded 12 January 2018);
- close down of the Sale testing site and subsequent set up of the Morwell testing site at The Healthcare Centre in mid-January 2018;
- distribution of invitation packs (and reminders and final letters where applicable) to selected participants for the Cardiovascular Stream in Morwell;
- testing of participants at the Morwell site commenced 22 January 2018 and concluded on 30 April 2018;

- review of statistical power calculations to reassess the target numbers for FMD measurement in the Morwell cohort;
- reporting of abnormal findings for ECG, pathology and blood pressure to participants' general practitioners. The proportions of participants, for whom abnormal findings letters were generated, are shown in Figure 8. These included inflammatory markers (Fibrinogen), cardiovascular risk factors (HbA<sub>1c</sub>, Triglycerides, Cholesterol), renal function (eGFR) and markers of cardiac damage (Troponin);



**Figure 8 Proportions of Cardiovascular Stream participants for whom abnormal findings letters were generated per test.**

- pack up of Sale testing site in May 2018;
- review of the SOPs for the Cardiovascular Stream in preparation for the second round of testing in 2020. The purpose of this was to ensure that what is written in the SOPs reflected what was done in practice;
- a media event to raise awareness of Cardiovascular Stream testing in Sale was published on the Hazelwood Health Study website on 19 December 2017. The article can be found in Appendix 4 and at <http://hazelwoodhealthstudy.org.au/hazelwood-health-study-closing-in-on-assessment-target/>;
- a media release (see Appendix 5) encouraging invited Morwell residents to book in for Cardiovascular Stream assessments was published by Nine News Gippsland on 2 February 2018. The story can be viewed at: <https://www.youtube.com/watch?v=QpogGJNHsec>;
- a media release (see Appendix 5) encouraging invited Morwell residents to book in for Cardiovascular Stream assessments was published in The Latrobe Valley Express on 5 February 2018. The article can be viewed in Appendix 4 and at

<http://www.latrobevalleyexpress.com.au/story/5208858/bookings-urged-for-study/?cs=1462>;

- a media event to thank Morwell residents for their participation in Cardiovascular Stream testing was published on the Hazelwood Health Study website on 4 May 2018. The article can be found in Appendix 4 and at <http://hazelwoodhealthstudy.org.au/hazelwood-health-study-completes-first-round-of-heart-health-testing-in-morwell/>;
- social media (Facebook) were utilised to keep residents of Sale and Morwell updated regarding Cardiovascular Stream activities. Facebook posts can be viewed at <https://www.facebook.com/search/top/?q=hazelwood%20health%20study>; and
- analyses for two papers on findings have been conducted, with both papers drafted and in the final stages of review.

### 7.7.3 Overview of recruitment

Table 3 below gives required sample sizes under a range of scenarios to detect a 33% increase in mean C-reactive protein (CRP), for example from 3.0 mg/L to 4.0 mg/L, between the non-exposed (Sale) and exposed (Morwell) communities. Calculations assume that analysis will use a two-sample t-test of logarithm-transformed CRP values (CRP usually follows a positively skewed distribution) with a significant p-value cut-off of 0.05. Further it is assumed that the SD of CRP is 1.25 times the mean of CRP (ie. that CRP's coefficient of variation is 1.25). These assumptions are based on summary statistics of CRP in a US general population, Hajat 2015<sup>1</sup>. In practice, if CRP measurement timing is spread over a large portion of the year, it may be necessary to adjust for time of year as CRP has been found to have seasonal variation.

**Table 3 Cardiovascular Stream sample size calculations**

	<b>Statistical power 80%</b>	
	<b>Sale</b>	<b>Morwell</b>
	<b>Number required with follow up data at 3<sup>rd</sup> assessment</b>	
Equal numbers in Morwell and Sale	180	180
50% greater numbers in Morwell	150	225
Double numbers in Morwell vs Sale	135	270
	<b>Number to be recruited in to 1<sup>st</sup> assessment*</b>	
Equal numbers in Morwell and Sale	220	220
50% greater numbers in Morwell	183	275
Double numbers in Morwell vs Sale	165	330



The Cardiovascular Stream aimed to recruit 330 participants from Morwell and 165 participants from Sale. Initially in Sale, the testing schedule allowed for only 4 participants to be tested per day, or about 20 per week. Participant appointments were taking in excess of 2.5 hours to complete. Consequently the researchers looked for efficiencies to shorten the appointment time, so as to increase the number of participants that could be tested each day, whilst not sacrificing important data collection.

It was determined that time efficiencies could be made by asking participants to complete a paper copy of the diet questionnaire following completion of other assessments. Additionally, a change in order of assessments also improved efficiency. These modifications allowed 5 participants to be tested per day with up to 25 being tested per week. Furthermore, a review of statistical power calculations was undertaken in order to clarify how many FMD measurements were required to detect a clinically important difference. Consequently, the target number of FMD measurements in Morwell participants was revised from 329 to 220. When the revised target number of FMD tests had been met, this test was removed from the Morwell clinic testing protocol. This change substantially reduced the time it took to complete testing on each participant, and therefore the number of appointments per week could be increased from 25 to 35.

The Cardiovascular Stream commenced recruitment and testing of Sale participants in October 2017 and concluded in January 2018. The number of participants assessed was just short of target, with 162 data sets being collected. Testing for the Sale cohort was conducted at Central Gippsland Health Service, Palmerston Street Sale.

The Cardiovascular Stream commenced recruitment and testing of Morwell participants in January 2018 and concluded in April 2018. The target was reached, with 336 data sets being collected. Testing for the Morwell cohort was conducted at The Healthcare Centre, Princes Drive, Morwell.

1. Hajat A, Allison M, Diez-Roux AV, et al., Long-term exposure to air pollution and markers of inflammation, coagulation, and endothelial activation: a repeat-measures analysis in the Multi-Ethnic Study of Atherosclerosis (MESA). *Epidemiology*, 2015. 26(3): 310-20.

## **7.7.4 Dissemination of findings**

Since the last Annual Report, the Cardiovascular Stream has not yet released any Reports, Research Summaries, journal papers or conference abstracts

## **7.7.5 Future plans for the Cardiovascular Stream**

In the coming months, the Cardiovascular Stream researchers will be:

- finalising the statistical analysis plan;



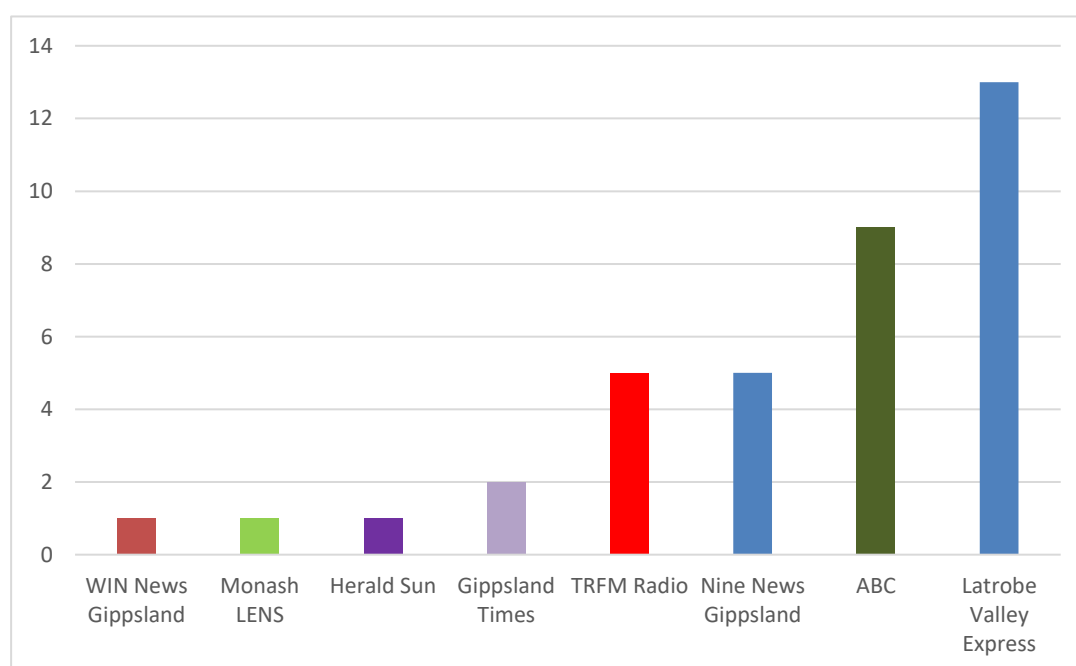
- determining the structure and format of further reports and/or papers to arise from the findings;
- completing the write up of two papers which are currently in the final stages; and
- planning for the second round of testing of the Cardiovascular Stream cohort in 2020.

## 8 Community Engagement

### 8.1 Updates on community engagement activities

#### Developments since the 3rd Annual Report

There has been extensive community engagement over the past year. In particular, there has been substantial coverage of HHS activities in Gippsland media including television, radio, online and print. The study's findings have also featured on state-wide media; eg. ABC Statewide Drive and the Herald Sun. The study is also assisting the ABC's 7.30 Report on a story expected to air in 2019. Study-related article counts across different media agencies since the 3rd Annual Report are shown in Figure 9.



**Figure 9 Numbers of media articles about the Hazelwood Health Study since the 3<sup>rd</sup> Annual Report.**

In response to the increased media attention, the Hazelwood Health Study Media Protocol has been updated and can be found at Appendix 6. Examples of the media releases prepared by the HHS, and examples of the print media featuring the HHS, are shown in

Appendix 5 and Appendix 4 respectively. Links to many of the media items can be found at <http://hazelwoodhealthstudy.org.au/community-links/media/>. Specific community engagement activities that garnered media interest include the following:

- A major media event to promote the 'Our hopes for the future of Morwell' photographic exhibition took place on 13 November 2017 at Switchback Gallery, Churchill. Study researcher Dr Sue Whyte and exhibition photographer Clive Hutchison were central to the event and provided comment. This was covered through both print media, social media and broadcast media. Related coverage can be found at: <http://hazelwoodhealthstudy.org.au/community-links/media/>.
- A media event to promote the findings from the Community Wellbeing Stream's social media analysis took place on 12 December 2017. A video describing the findings was created and distributed via the Hazelwood Health Study website (<http://hazelwoodhealthstudy.org.au/research-areas/community-wellbeing/>) and social media channels including YouTube, Facebook and Twitter.
- Dr Matthew Carroll from the Psychological Impacts Stream was interviewed by the Latrobe Valley Express newspaper in January 2018 regarding the outcomes of the interviews with adult residents of Morwell.
- A media event to promote the findings from the Latrobe Early Life Follow-up Cohort Study took place on 1 February 2018. The findings received state-wide media attention with ABC Statewide Drive Victoria reporting on the findings. Latrobe ELF Study manager Marita Dalton also participated in media interviews.
- Ongoing community updates regarding respiratory and cardiovascular assessments in Morwell and Sale took place up until the Streams completed their data collection in March and April respectively. This was provided in the form of press releases, media coverage and social media posts on Facebook and Twitter.
- Community Wellbeing Stream Lead, Dr Sue Yell, was interviewed by Nine News Gippsland in regard to the photographic exhibition moving to Queens Hall in Parliament House, Melbourne, from 21-24 May (see Figure 10). The event attracted considerable interest, with a large contingent of local residents attending the opening along with key stakeholders from the study, collaborating universities and other agencies.



**Figure 10 Dr Sue Yell being interviewed by Nine News in Gippsland.**

- Dr Emily Berger was interviewed by Nicole Chvastek on ABC Statewide Drive to discuss the specialist school findings. Dr Berger also spoke with ABC Gippsland and the Latrobe Valley Express.
- Dr Emily Berger was interviewed by Nicole Chvastek on ABC Statewide Drive to discuss the specialist school findings. Dr Berger also spoke with ABC Gippsland and the Latrobe Valley Express. Dr Carroll was also interviewed on a number of occasions regarding the same findings.

Other community engagement activities in the last twelve months include the following:

- Meet and greet sessions were held on a weekly basis from 5 March to 6 April at Morwell Neighbourhood House, ReActivate Latrobe Valley and the Latrobe Health Assembly. Flyers containing overviews of the HHS research Streams were created and distributed at the meet and greet sessions and community engagement session. See Figure 11.
- Ongoing liaison took place with state and federal politicians to provide study updates.
- Ongoing liaison took place with communications officers from health and local government regarding disseminating study information through their networks.
- The HHS Psychological Impacts Stream provided three Monash students participating in the Monash Summer Scholarship scheme with the opportunity to work with the Latrobe Health Assembly for a three week period in January/February to produce Research Summaries on an array of health and community-related matters to inform the Assembly's deliberations. See Figure 12.





**Figure 11 HHS Communications and Engagement Adviser Shaun Mallia meeting with members of the community at a meet and greet session held at Morwell Neighbourhood House.**



**Figure 12 Monash Summer Scholars Naish Gawen, Esther Johns and Melissa Bruerton, along with HHS researcher Dr Matthew Carroll, meeting with Monique De Carli and Ian Needham from the Latrobe Health Assembly.**

- The 21 May launch of the photographic exhibition in Queen's Hall in Parliament House attracted an audience of Gippsland residents along with key stakeholders from the study, collaborating universities and other agencies.
- On 30 May we visited the Asbestos Council of Victoria/GARDs local meeting in Newborough and provided an opportunity for members to ask us their questions. We presented on recent findings and discussed future research plans.
- The Community Engagement Session on the 21<sup>st</sup> August 2018 at Morwell RSL Club was attended by over 70 people, making this the largest HHS engagement session to date. Participants had the opportunity to join round table discussions with our lead researchers from the Early Life Follow-Up, Community Wellbeing, Hazelinks, Adult Survey and Psychological Impacts streams. Additionally, we were joined by representatives from the Latrobe Health Authority, Emergency Management Victoria, the Environment Protection Authority Victoria and by the Latrobe Health Advocate.
- The 'Our hopes for the future of Morwell' exhibition is on display in Mid Valley Shopping Centre from October to December.

### **Summary of Social Media activities in the past year**

HHS Website (<http://hazelwoodhealthstudy.org.au>)

Since November, the website has received 11,654 page views from 3,190 user visits.

Facebook (<https://www.facebook.com/hazelwoodhealthstudy>)

Since November, the 77 posts by the Hazelwood Health Study have reached **37,769** users. Over the past year our HHS Facebook page has grown from 211 follows and 200 likes to 272 follows and 257 likes.

Twitter (<https://twitter.com/HazelwoodHS>)

Currently, the @HazelwoodHS account has 211 followers. We have published 43 tweets and gained 100 new followers in the past year. Our reach has increased to 74,517, however, this figure represents the reach gained organically through our own tweets, and mentions from other users.

YouTube (<https://www.youtube.com/channel/UCTY7oS9e2b8sKxRrTfn8OKw/videos>)

Two videos have been posted on our YouTube channel in the past twelve months. The [first video](https://www.youtube.com/watch?v=LVwQBvaNgtM) (<https://www.youtube.com/watch?v=LVwQBvaNgtM>) is a presentation of findings from the Community Wellbeing Stream's analysis of social media use during the 2014 Hazelwood mine fire. The [second video](https://www.youtube.com/watch?v=miBMP7Zb-) (<https://www.youtube.com/watch?v=miBMP7Zb->

[BE](#) is an interview with a study participant, designed to increase participation in the clinical Streams. Collectively, these videos have had 96 views.

## **E-Newsletter**

The inaugural HHS e-newsletter was delivered to 2,140 email addresses on 18 May 2018. The e-newsletter is designed to provide the community with an update on the workings of the HHS, and drive traffic towards our website for further information.

E-Newsletters are distributed on a needs basis, usually coinciding with a major event and/or the release of findings. A subscription button has been added to our social media pages and the website, to allow interested parties to subscribe for updates. To date, 16 people have signed up to receive the newsletter through the website or through our Facebook account. All editions of the e-newsletter are available on our website and are posted to social media simultaneously. To date, only 38 recipients have unsubscribed to the newsletter.

The first edition of the e-newsletter was emailed to all Adult Survey and Psychological Impacts Stream participants who provided an email address, as well as to other interested parties and groups. In the two weeks following its release, the newsletter had been opened by 1,884 recipients (88%), of which 270 recipients had clicked on links for further information. Of these clicks, there were 142 visits to the Hazelwood Health Study website for further information on the Research Summaries and reports for the MBS and PBS time series analysis, with 29 people downloading the full technical report. This is in comparison to the 70 views the website generated on the day of the MBS and PBS time series analysis press release, showing the power of the e-newsletter to reach and engage a wide audience.

The second edition of the e-newsletter was distributed on the 15 August in anticipation of the Community Engagement Session on the 22 August. This special edition invited recipients and residents to attend the engagement session, and to post in their questions for the panellists. In total, this email had 1028 engagements.

The third edition of the e-newsletter was distributed on the 2 November. The timing of this e-newsletter coincides with the release of findings from the Early Life Follow-Up stream. In addition, the e-newsletter covered findings from the Psychological Impacts stream, an update on the August Community Engagement Session, the 'Our hopes for the future of Morwell' on display at Mid Valley Shopping Centre, and the call for expressions of interest from Sale residents to join the Community Advisory Committee.

The e-newsletters can be found on the HHS website at  
<http://hazelwoodhealthstudy.org.au/publications/newsletters/>

## 8.2 Future community engagement plans

The Hazelwood Health Study website is undergoing a major content and navigational overhaul. The website is becoming simpler to use with greater integration with social media platforms, including Facebook, Twitter and YouTube.

Discussions are underway with the Latrobe Health Assembly regarding the opportunity for study researchers to speak with the full Assembly and to participate in relevant working group meetings.

We are currently planning engagement activities in Sale. We are planning on attending meetings hosted by local community groups to present recent findings and answer any questions from the community. We are also planning to appear at a major local shopping centre in Sale to engage with local members of the community and update them on study progress and findings relevant to their community.

## 9 Appendices

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### **Appendix 3**

Abstracts and posters presented at scientific conferences since November 2017 Page 89

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Media releases prepared by the Hazelwood Health Study Page 110

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Revised Media Protocol Version 3.0 Page 123



# Appendix 1

Executive Summaries for Reports submitted since November 2017

### *Executive Summary to The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 1 Description of the cohort and preliminary assessment of possible associations between mine fire emissions and parent-reported perinatal outcomes*

This is the first report of preliminary findings from the Latrobe Early Life Follow-up (ELF) Study, which aims to understand the impacts of exposure to smoke from the 2014 Hazelwood coal mine fire on young children and children born to women who were pregnant during the smoke episode. The ELF Study has three components: (i) studying an identified cohort of children from the Latrobe Valley, (ii) an analysis of de-identified state-wide perinatal data, and (iii) an anonymised data-linkage cohort study of children born in the Latrobe Valley. This report presents some initial results from the identified cohort study. Specifically we present the first findings from the survey completed by the parents or carers of participating children when they enrolled in the study, focussing on birth related outcomes. More results from the survey will be presented in later reports.

Children born from 1 March 2012 until 31 December 2015, whose primary residential address was in the Latrobe City local government area were eligible to enrol in the study. The cohort was designed to have a balance of numbers by the timing of exposure (prenatal exposure, infant exposure, and a comparison group conceived after the fire, with no exposure) and magnitude of smoke exposure (residents of Morwell, which was closest to the fire and had greater smoke exposure, vs residents from the rest of the Latrobe Valley). Recruitment targets were exceeded overall (110% of target) with 548 children enrolled. The approximate balance across exposure groups was achieved with 199 whose mothers were pregnant during the fire, 190 who were aged up to 2 years at the time of the fire, and 159 who were conceived after the fire. All except two children were Australian born. About half (48%) were female, and 31 (6%) identified as Aboriginal and/or Torres Strait Islander.

The mean daily concentration of particulate matter with an aerodynamic diameter less than 2.5 micrometres (PM<sub>2.5</sub>) directly attributable to the mine fire was the primary exposure evaluated in this study. The average and peak daily PM<sub>2.5</sub> for the 51-day period from 9 February 2014 to 31 March 2014, at a spatial resolution of 1x1 km, was derived from an atmospheric transport model. The exposure of pregnant mothers to mine fire smoke was estimated from modelled outputs for their residential addresses during pregnancy. For mothers in Morwell, the average daily smoke-derived PM<sub>2.5</sub> during this period was 18.4 µg/m<sup>3</sup> (range 5.4 - 56.1 µg/m<sup>3</sup>), and the average 24-hour peak was 266.7 µg/m<sup>3</sup> (range 95.1 – 991.3 µg/m<sup>3</sup>). The exposure was much lower for mothers from the rest of the Latrobe valley. Their average daily smoke-derived PM<sub>2.5</sub> was 2.2 µg/m<sup>3</sup> (range 0.1 - 17.4 µg/m<sup>3</sup>), and the average 24-hour peak was 79.9 µg/m<sup>3</sup> (range 5.1 – 617.0 µg/m<sup>3</sup>). Exposure to PM<sub>2.5</sub> from mine fire smoke during pregnancy for the mothers of children born before or conceived after the fire was zero.

Most mothers (81%) were aged between 20 to 34 years at the time of the birth of their child, 13% were 35 years or older, while 4% were 19 years or younger. More than half (60%) had a post-secondary qualification. Stress during pregnancy was reported as being experienced 'sometimes' by 47% of mothers and 'most of the time' by 17% of mothers. Approximately 8% reported consuming alcohol in the first half of pregnancy and 4% during the second half, while smoking at any stage was reported by 18%. The majority of parents reported increased stress in response to the mine fire (74% of mothers and 59% of fathers) and those living closest to the fire reported greater stress in response to the event, than those living further away.

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Of the ELF study cohort of children, 70% were born by vaginal delivery. The mean gestational age was 39.2 weeks with 9% born before 37 weeks of gestation. The mean birthweight of children born at term was 3406 grams (standard deviation 636.8 grams).

After adjusting for the influence of known risk factors for adverse perinatal outcomes, no associations were observed between maternal exposure to the average or peak PM<sub>2.5</sub> from the mine fire and preterm birth, birth weight at term, or being small or large for gestational age (Table 1).

**Table 1. Summary of associations between exposure to poor air quality from the Hazelwood coal mine fire and birth outcomes**

	Adjusted RR <sup>^</sup> (95%CI) per unit increase in average maternal PM <sub>2.5</sub> exposure	Adjusted RR <sup>^</sup> (95%CI) per 10 unit increase in peak maternal PM <sub>2.5</sub> exposure
Preterm birth	1.00 (0.97 to 1.04)	0.99 (0.97 to 1.02)
Low birth weight at term	0.99 (0.96 to 1.03)	0.99 (0.97 to 1.02)
Small for gestational age	0.95 (0.90 to 1.01)	0.97 (0.94 to 1.004)
Large for gestational age	1.01 (0.99 to 1.04)	1.00 (0.99 to 1.02)

<sup>^</sup>Adjusted for child Aboriginality, maternal age, maternal education, maternal smoking in pregnancy and maternal alcohol consumption in pregnancy

We did not observe an association between stress specifically related to the mine fire and adverse perinatal outcomes. However, a number of well-recognised risk factors, including smoking in pregnancy, general stress in pregnancy and lower maternal education, were independently associated with some adverse birth outcomes evaluated in the study cohort.

In summary, these preliminary analyses did not demonstrate an association between maternal exposure to mine fire smoke and adverse birth outcomes. Further studies of perinatal outcomes are planned. These will include an evaluation of birth outcomes in this cohort using improved personal exposure estimates based on more detailed location data than residence during the mine fire, and a separate analysis of de-identified perinatal data for all children in the Latrobe Valley.

### *Executive Summary to The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 2 Investigation of possible associations between exposure to mine fire emissions and indicators of lung function measured three years after the fire*

The Hazelwood open cut coal mine in the Latrobe Valley of Victoria caught fire in February 2014 and burned for nearly six weeks. Several rural towns near the mine were affected by smoke during this period with air quality impacts ranging from minor to severe. The Latrobe Early Life Follow-up (ELF) Study aims to understand the possible influence of exposure to smoke from the fire on the health and development of young children and children born to women who were pregnant at the time. The ELF study has two major streams: an identified cohort study of children from the Latrobe Valley who were recruited during 2015-2016, and a series of anonymous data extraction and data linkage studies.

This Report comprises Volume 2 of a set of reports arising from the Latrobe ELF Cohort Study. Volume 1 described the cohort and the association between mine fire emissions and parent-reported perinatal outcomes. Here we report results of lung function testing of 105 children from the Latrobe ELF Cohort who were exposed to air pollution from the mine fire either prenatally (while in utero), or in infancy (aged from birth to 2 years). Investigation of respiratory outcomes in this age group is important, because the early life period is a critical window for lung development and growth. Exposure to harmful factors during this period could potentially increase the risk of long-term adverse respiratory outcomes. The evidence base for the impacts of early life exposure to outdoor air pollution from background sources, such as traffic, on the lung health of children is small but growing. This study is the first that we were aware of to evaluate possible associations between a relatively short, but serious air pollution event in early life and lung function several years after the event.

We estimated smoke exposure for each child in the study by combining information about the hourly spatial distribution of air pollution with information about the daily activity patterns and location of each child during the fire period. Two exposure metrics were calculated.

1. The average outdoor concentrations of fine particulate matter with an aerodynamic diameter less than 2.5 micrometres (PM<sub>2.5</sub>). This was the mean of the child's geographically assigned 24 hourly exposures throughout the fire period.
2. The peak 24-hour PM<sub>2.5</sub>. This was the highest 24-hour average PM<sub>2.5</sub> exposure calculated for each child during the mine fire period.

In 2017, three years after the fire, we invited ELF study participants to undertake a lung function test that used sound waves to measure the lungs' resistance to air flow and their stiffness. This non-invasive method is known as the Forced Oscillation Technique (FOT). The FOT is a suitable method for measuring lung function in younger children, because it requires minimal cooperation, and no specific breathing manoeuvres. We also tested if these measures changed after the inhalation of salbutamol, a medication commonly used in the treatment of asthma. The results tell us about lung function on the day of testing. However, it is important to note that we cannot tell if a particular child has or is likely to develop a lung problem based solely on the results of a single round of FOT testing. Three measures were reported from the FOT tests:

1. Respiratory system resistance (Rrs): a measure of how much pressure is required to drive a certain airflow through airways. While this measures the resistance of the respiratory system as a

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whole, a larger resistance value compared with the reference value commonly indicates airway constriction, airway obstruction or smaller airways.

2. Respiratory system reactance (Xrs): a measure of lung elasticity or stiffness to a pressure wave delivered. While this measures the properties of the respiratory system as a whole, a larger negative Xrs than the reference value commonly indicates smaller or stiffer lungs.

3. Area under the reactance curve (AX): represents the area under the curve of reactance measured at a range of frequencies from 5 Hertz (Hz) to the resonant frequency, which is the point at which Xrs equals zero. While this measures the properties of the respiratory system as a whole, a larger positive AX value than the reference commonly indicates smaller or stiffer lungs.

Given that lung function is associated with age, sex, height and weight, we obtained Z-scores for each parameter after adjustment for these factors. This is a way to standardise the results so that the results from all children, irrespective of their age, sex or height, can be compared. A Z-score of 1 represents a result that is one standard deviation greater than the mean value for children of the same height, weight, age and sex from a standard reference population, while a Z-score of -1 represents a score that is one standard deviation lower than the mean. In addition, we measured the response to inhaled bronchodilator medication by repeating the FOT testing 15 min after inhalation of 200 µg Salbutamol.

Of the 105 children who completed the FOT tests, six were excluded from the analysis due to poor quality of their data. The remaining 99 children had a mean age of four years and one month. Ten were in the in utero exposure group, five had mixed pre- and postnatal exposure as they were born during the fire period, and 84 were in the postnatal exposure group. The medians of the average and peak PM2.5 exposures during the fire period were 8.0 and 95.6 µg/m<sup>3</sup>, respectively.

Our analysis of the FOT results took into account other factors that are known to affect children's lung function. These were: birthweight, gestational age, environmental tobacco smoke (ETS) exposure, whether their mothers smoked tobacco or drank alcohol during pregnancy, maternal history of asthma, total breastfeeding duration, respiratory medication use in the 24 hours prior to the FOT testing, cold or flu-like illness in the three weeks prior to testing, and indicators of stress and socio-economic status (SES) of their family. Information about some potential risk factors (eg. breastfeeding status) was missing for five participants. We used statistical methods to impute the missing data, so that the results of all participants could be included in the data analysis.

We did not assess the associations between mine fire PM2.5 exposure and lung function in the in utero and mixed exposure groups separately, because the number of children in these groups was not large enough for statistical analysis.

When all participants were combined (n=99) we did not observe significant associations between coal mine fire PM2.5 exposure during infancy and any of the baseline lung function outcome measures. When the 84 children in the postnatal exposure group were evaluated separately, we observed an association between PM2.5 and AX, but not with other lung function measures. Each 10 µg/m<sup>3</sup> increase in average PM2.5 exposure was associated with a change in Z-scores for AX of around 24%, in the direction of worsening lung function (risk difference 0.241, 95% confidence interval; CI 0.011 to 0.471, p=0.044). There was also a weak, but not statistically significant, association between a 100 µg/m<sup>3</sup> increase in peak PM2.5 exposure and AX (0.159, 95% CI -0.003 to 0.321, p=0.058) in the direction of poorer lung function.

## Appendix 1

Separate to the mine fire smoke exposure, we found that maternal smoking during pregnancy was strongly associated with worse lung function. This was indicated by a decreased Xrs (-0.932; 95% CI -1.446 to -0.417,  $p=0.001$ ) and increased AX (0.605; 95% CI 0.054 to 1.155,  $p=0.034$ ) in the whole group. The association was of greater magnitude in the postnatal exposure group alone (Xrs -1.166; 95% CI -1.727 to -0.606,  $p=0.000$ ; AX 0.743; 95% CI 0.110 to 1.375,  $p=0.024$ ).

Our observations suggest that exposure to smoke from the mine fire could have influenced respiratory system reactance in some children who were exposed to the smoke after their birth. These findings are biologically plausible and the results for mean and peak PM<sub>2.5</sub> exposure were consistent with each other. However, the statistical associations were close to borderline and the results should be interpreted cautiously. It is also possible that the results occurred by chance or were influenced by known or unknown confounding factors. While we adjusted for the most important factors such as maternal smoking, environmental tobacco smoke and education as a marker of SES, lower educational attainment was unexpectedly found to have a protective association and might not have been the best indicator for socioeconomic status in this group. The measured changes in lung function associated with the fire smoke exposure were small, and in all but the most extreme exposure scenarios, would be unlikely to be of clinical relevance. Furthermore, reductions in lung function as assessed by FOT, and measured on a single occasion, do not necessarily mean that there is a clinical problem or that one might subsequently develop.

In conclusion, we found some evidence for an association between exposure to increased particulate air pollution during the 2014 coal mine fire and small reductions in one of three measures of lung function. It will be important to follow the progress of children in the study to see if the differences we observed change over time. Further study, including testing the comparison group of non-exposed children when they are old enough, will be important for validating these findings.

### *Executive Summary to The Latrobe Early Life Follow-up (ELF) Cohort Study Volume 3 Investigation of possible associations between coal mine fire emissions and vascular outcomes in the ELF cohort three years after the fire*

The Hazelwood open cut coal mine in the Latrobe Valley of Victoria caught fire in February 2014 and burned for nearly six weeks. Several small rural towns near the mine were affected by smoke during this period with air quality impacts ranging from minor to severe. The Latrobe Early Life Follow-up (ELF) Study aims to understand the possible influence of exposure to smoke from the fire on the health and development of young children and children born to women who were pregnant at the time of the fire. The ELF study has two major streams, an identified cohort study of children from the Latrobe Valley who were recruited during 2015-2016, and a series of anonymous data extraction and data linkage studies.

This Report comprises Volume 3 of a set of reports arising from the Latrobe ELF Cohort Study. Volume 1 described the cohort and results of initial investigations of possible associations between mine fire emissions and parent-reported perinatal outcomes. Volume 2 reported the results of respiratory function testing. Here we report results of blood vessel testing in children from the Latrobe ELF cohort.

Little is known about possible long term cardiovascular effects of time-limited exposure to air pollution during early life, such as that associated with smoke from severe fires. However, it is known that exposure to outdoor air pollution can affect blood vessels and heart health in adults,<sup>1-4</sup> and that parental smoking in early life is linked to poorer vascular health in children.<sup>5,6</sup> In response to community concerns, this study was designed to evaluate if smoke from the mine fire had measurable associations with indicators of blood vessel health in young children.

We tested 248 participants from the Latrobe ELF cohort. They were classified into four groups based on their mother's estimated date of conception as follows:

- (1) The postnatal exposure group. Children who were exposed to smoke from the fire at some point during their infancy (birth – 2 years of age);
- (2) The in utero exposure group. Children whose mothers were pregnant at the time of the fire;
- (3) The mixed exposure group. This was a smaller group of children who were born during the fire and had some exposure both in utero and after birth.
- (4) Not exposed. Children conceived after the fire and not exposed to fire smoke at any stage of their development.

The amount of smoke exposure from the fire was calculated for children in the exposed groups (Groups 1 to 3) based on their, or their mother's, reported locations during the fire period. This information was combined with modelled estimates of the concentration of airborne particulate matter less than 2.5 micrometres in diameter (PM<sub>2.5</sub>) at a spatial resolution of 1 x 1 km. The mean and peak daily PM<sub>2.5</sub> exposures during the fire period (9 February to 31 March 2014) were calculated for each participant.

Three years after the fire, we tested for possible associations between smoke emissions and two main indicators of vascular health:

- The thickness of the inner two layers of the wall of the carotid artery in the neck, and the abdominal aorta. This is known as the arterial intima-media thickness (IMT).



## Appendix 1

- The stiffness of the vascular system assessed by measuring the pulse wave velocity (PWV).

Multivariable linear regression models were used to test for associations between the daily mean and peak PM<sub>2.5</sub> exposures, and these indicators of blood vessel health. The analyses took into account other factors that could potentially influence vascular health, such as children's age, birthweight, maternal tobacco smoking during pregnancy, socioeconomic status, parental diabetes and exposure to environmental tobacco smoke.

There were 42 children in the unexposed group (Group 4). These children were not exposed to fire emissions at any stage of their development. With an average age of just 2 years, it was not appropriate to directly compare their results with those of the older children who had been exposed to smoke from the mine fire.

We did not find any associations between early life exposure to PM<sub>2.5</sub> during the mine fire period and adverse vascular changes when all groups were combined, or in the subgroup of children who were exposed in utero. However, an association between mine fire smoke exposure and stiffer blood vessels, indicated by a higher PWV, was found in the postnatal exposure group of 96 children. For that group, each 10 µg/m<sup>3</sup> increase in exposure to mean PM<sub>2.5</sub> during the fire period was associated with an increase in PWV by 0.1 meter per second. (0.109; 95%CI 0.008 to 0.211; p = 0.035). There was a weaker trend with peak PM<sub>2.5</sub> exposure (0.066; 95%CI -0.008 to 0.141; p = 0.080).

We also found that tobacco smoking during pregnancy was independently associated with a higher IMT of the abdominal aorta among children in the postnatal exposure group and higher IMT of the carotid artery in children in the in utero exposure group.

When we investigated the subgroup of children whose mothers smoked during pregnancy, regardless of their exposure group (pre or postnatal), we found that exposure to higher amounts of mine fire smoke was associated with higher PWV. However, the number of children in this group was small.

While these results suggested that exposure to mine fire emissions could have been associated with increased stiffness of blood vessels in some children, they should be interpreted with caution. The association was only present in one of several outcomes that were evaluated and it is possible that chance or unmeasured or unknown factors could have contributed to the result. It will be important to confirm these findings with further studies that include data from children who were not exposed to the mine fire emissions, when they are old enough. This is currently planned for 2020.

There is normal variation in blood vessel measurements in children. These results do not necessarily mean that children with higher blood vessel stiffness or thickness will develop cardiovascular problems later in life. Blood vessel health in childhood is one of many things, such as genetic make-up, smoking tobacco, stress, diet and physical activity that can influence the risk of cardiovascular disease in adulthood.<sup>7</sup>

In summary, we found that in infants aged up to two years at the time of the fire, exposure to PM<sub>2.5</sub> during the mine fire period was associated with increases in blood vessel stiffness. We also found that tobacco smoking during pregnancy was associated with thicker blood vessels in children. Further assessments are planned for 2020. At that time, we will be able to further evaluate these findings and test for persistence, remission or emergence of blood vessel changes over time.

To request a copy of the full technical report, please call 1800 985 899 or email [contact@hazelwoodhealthstudy.org.au](mailto:contact@hazelwoodhealthstudy.org.au)

### Executive Summary to the report titled Hazelinks Ambulance Victoria data: Time Series

#### Analyses (First Data Extraction)

From 9 February 2014, smoke and ash from a fire in the Morwell open cut brown coal mine adjacent to the Hazelwood power station covered parts of the Latrobe Valley, eastern Victoria, for up to 6 weeks. In response, the Hazelwood Health Study was established in order to monitor any long-term or short-term health effects of that smoke event. This report describes analyses which aimed to answer: 1) whether there were increased ambulance attendances during the mine fire; and 2) whether increases in mine fire-related air pollutants (PM<sub>2.5</sub>) were associated with increased ambulance attendances over subsequent days for cardiovascular and respiratory conditions.

The analyses utilised modelled daily concentrations of mine fire-related fine particulate matter with diameter  $\leq 2.5$  micrometers (PM<sub>2.5</sub>). Daily counts of ambulance attendances obtained from Ambulance Victoria were analysed for the period July 2010 to March 2015. Time series models were used to evaluate the relative risk of ambulance attendances during the mine fire in comparison with the *remainder of the analysis period* and to also assess the relative risk of ambulance attendances associated with daily mine fire-related PM<sub>2.5</sub> levels. The models used for these analyses controlled for factors likely to influence ambulance attendance rates including seasonality, long-term temporal trends, day of the week, daily maximum temperature and public holidays.

The main results of the analyses indicated that there was a 15% increased risk for ambulance attendances for *all conditions* and a 41% increased risk for attendances for respiratory conditions during the *mine fire period*, compared with the *remainder of the analysis period* after controlling for influential factors. This corresponds to an estimated total of 236 attendances for *all conditions* and 42 attendances for respiratory conditions associated with the mine-fire during the mine-fire period.

Similar results were identified when assessing the lag-response relationship between mine fire-related PM<sub>2.5</sub> concentrations and ambulance attendances. When assuming that the effect of PM<sub>2.5</sub> lasted for 7 days, an immediate response that lasted for 5 days was identified for ambulance attendances for respiratory conditions, whereas for *all conditions*, the association wasn't apparent until the third day after exposure and lasted for 5 days. Analysis of cumulative relative risk for a number of specified lag day ranges found strong and consistent evidence for an association between mine fire-related PM<sub>2.5</sub> and attendance rates for respiratory conditions. There was weak evidence for *all conditions* when assuming the lag day range of 0-20 days.

Although, this study adjusted for the main confounding factors, there are unknown factors that cannot be controlled for, such as proportion of population leaving the area, which would cause underestimation of the effect. Using simulated PM<sub>2.5</sub> exposure data as well as aggregating data at Statistical Area Level 2 would introduce measurement error of exposure, and therefore, bias effect estimates towards no associations.

## **Appendix 2**

Research Summaries released since November 2017

## Use of health services and medications **Research Summary**

### Analysis aims

The aims of these analyses were to examine whether coal mine fire-related air pollutants were associated with increased use of health services, and increased dispensing of prescription medications, for cardiovascular, respiratory and mental health conditions.

### Meet the team

Michael Abramson

Yuming Guo

Amanda Johnson

Joanna Dipnall

Jillian Blackman

Christina Dimitriadis

The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventive Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research the University of Tasmania, The University of Adelaide and the CSIRO.



### Background

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



### What we found

The analyses found that coal mine fire-related air pollutants, based on concentrations of fine air particulate matter with a diameter of 2.5 thousandths of a millimetre or less (PM<sub>2.5</sub>), were associated with increased health service use and increased rates of dispensing prescription medications in the Latrobe Valley area.

It was estimated that there were an additional 5,137 General Practitioner consultations, 405 cardiovascular medical visits, 174 respiratory health visits and 286 mental health consultations attributed to coal mine-fire related PM<sub>2.5</sub>.

Furthermore, it was estimated that an additional 2,501 cardiovascular medications, 574 respiratory medications and 1,429 mental health related medications were dispensed as a result of coal mine-fire related PM<sub>2.5</sub>.

**A full report describing the findings from this analysis can be found at [hazelwoodhealthstudy.org.au/study-findings/study-reports](http://hazelwoodhealthstudy.org.au/study-findings/study-reports)**



### What we did

Data on health service use in the Latrobe Valley area were obtained from the Medicare Benefits Schedule (MBS) database for the period 1 July 2012 to 30 June 2016. Data on prescription medications dispensed by pharmacists were obtained from the Pharmaceutical Benefits Scheme (PBS) database for the period 1 January 2013 to 31 December 2016. MBS and PBS data were provided by the Commonwealth Department of Human Services.

Hourly coal mine-fire related PM<sub>2.5</sub> concentrations across the Latrobe Valley area were modelled by the Commonwealth Scientific and Industrial Research Organisation Oceans and Atmosphere Flagship. Daily maximum temperatures were collected from the Australian Bureau of Meteorology.

A statistical method called *time series analysis* was used to measure the associations between daily average PM<sub>2.5</sub>, use of health services or dispensing of medications in the Latrobe Valley. These models took into account the influences of other contributing factors such as season, temperature and public holidays.



### Considerations

While the findings suggest there was an increase in the use of medical services and dispensing of medications in the Latrobe Valley associated with the coal mine fire smoke, the data are not sufficient to link any individual case to the mine fire.

There are some limitations to interpretation of these data. Numbers of medications dispensed may not equal numbers of medications taken by recipients. Medications provided over the counter at pharmacies (without a prescription) would not be included in the PBS dataset and medical services that do not qualify for Medicare benefits would not be included in the MBS dataset.

Finally, in this instance measurement of air pollution was limited to PM<sub>2.5</sub> and did not include other possible pollutants such as carbon monoxide.

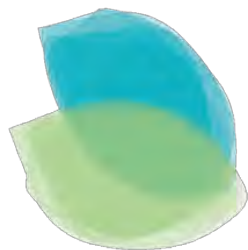
### Where to from here

To complement these findings based on MBS and PBS data, the HHS is currently undertaking clinical examinations and interviews to further assess cardiovascular, respiratory and mental health in smoke effected communities.

The HHS results will be shared with relevant organisations to ensure that findings are used to shape services for the future health of the Latrobe Valley.

**This research was funded by the Victorian Department of Health and Human Services.**





## The Latrobe Early Life Follow-up Cohort Study Vol 1 Research Summary

February 2018

### Analysis aims

We aimed to find out if some pregnancy or birth outcomes in children from the Latrobe Valley were affected by exposure to smoke from the mine fire.

### Meet the team

Fay Johnston  
Shannon Melody  
Marita Dalton  
Amanda Wheeler  
Tierney O'Sullivan  
Grant Williamson  
Martine Dennekamp  
Shyamali Dharmage  
Karen Wills  
Melanie Reeves  
Jane Ford  
Alison Venn  
Christine Roberts

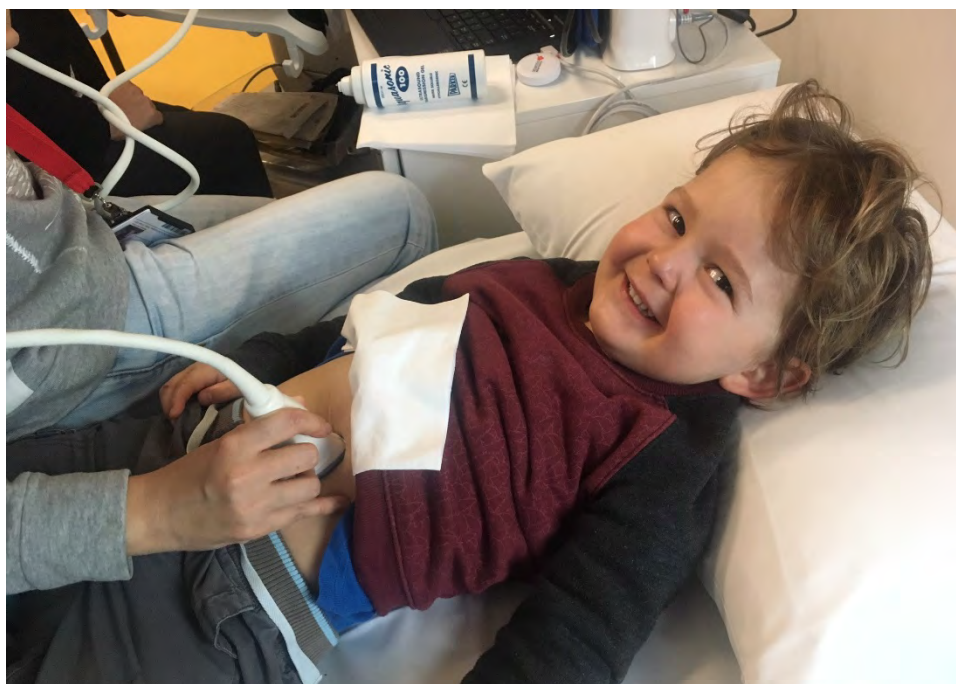
The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventive Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research at the University of Tasmania, The University of Adelaide and the CSIRO.



### Background

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



### What we found

Of the 548 children included in the study, 199 were born to mothers who were pregnant at the time of the fire and 190 were aged less than 2 years at the time of the fire. The remainder were not exposed to fire-smoke either before or after their birth. Most parents (74% of mothers and 59% of fathers) reported that their stress increased in response to the mine fire, especially those living closest to the fire. We did not find an association between mothers' exposure to smoke from the mine fire and birth before full term (37 weeks), birth weight at term, or weight for stage of pregnancy. The analysis took into account the possible influence of risk factors like age of mothers, and smoking during pregnancy.

**A full report describing the findings from this analysis can be found at**  
**[hazelwoodhealthstudy.org.au/study-findings/study-reports](http://hazelwoodhealthstudy.org.au/study-findings/study-reports)**

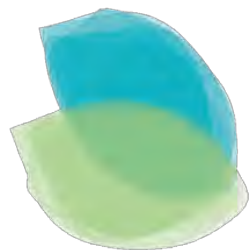
Website: [www.hazelwoodhealthstudy.org.au/study-reports](http://www.hazelwoodhealthstudy.org.au/study-reports)



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@HazelwoodHS



## What we did

We surveyed the parents of a sample children from the Latrobe Valley who were born between 1 March 2012 and 31 December 2015. This period included the coal mine fire in February 2014. We estimated how much smoke each child may have been exposed to by matching their home address with the daily estimated amount of air pollution in that area. We asked the parents to tell us about their own age, education, smoking status and other things that can affect birth outcomes. We also asked the parents to tell us at how many weeks their child was born and their child's weight at birth. We used standard statistical tests to look for possible associations between smoke exposure and birth outcomes.

**This research was led by the Menzies Institute for Medical Research at the University of Tasmania and funded by the Victorian Department of Health and Human Services.**

## Considerations

These initial results are reassuring. If there was an impact on birth outcomes, the size of that impact was not big enough to be detected in this study. However, this study was relatively small. Small studies cannot always identify very small associations that might be present.

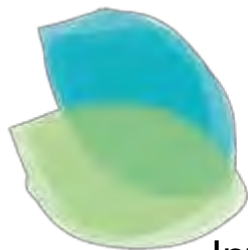
## Where to from here

The next step is to do a larger study of hospital records for babies born in the Latrobe Valley. This will cover the same time-period as our survey. Looking at hospital records will enable us to research a wider range of birth related outcomes, and include a larger number of births.

HHS results will be shared with relevant organisations to ensure that findings are used to shape services for the future health of the Latrobe Valley.







# Hazelwood HEALTH STUDY

## Interviews with Morwell residents about their experiences of the Hazelwood coal mine fire Research Summary

August 2018

### Analysis aims

This study examines the perspectives of Morwell residents regarding the impact of the fire. Of particular interest were the social and psychological impacts of the event which was of both long duration and of anthropogenic (man-made) origin.

### Meet the team

Dr Rebecca Jones

Ms Sarah Lee

Prof Darryl Maybery

Prof Alexander McFarlane

The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventive Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research at the University of Tasmania, the University of Adelaide and the CSIRO.



### Background

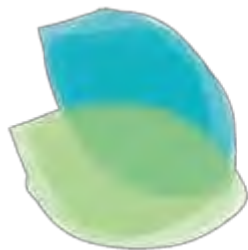
The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



### What we found

There were a range of reactions to the fire from those without a great deal of concern to those who were very preoccupied in an ongoing manner about what happened. The Morwell residents with greatest distress focused their concerns upon fear and confusion during the event, the perceived health effects of the smoke, anger towards authorities and loss of a sense of community and security. One of the significant ways in which people managed these responses was to normalise the event. The long duration and man-made origin of the event created deep uncertainty which exaggerated the impact of the fire. The Morwell interviewees indicated the importance of providing clear and understandable quality information to residents during and after such disasters.



## Considerations

Key strengths of the study include the relatively large qualitative sample and the recruitment of men and women of different ages. However, those who could be contacted and who agreed to participate may have been biased towards residents who were more opinionated about the event. Further, the views of people younger than 40 were not well represented. The interviews were conducted with participants almost three years after the event. While this may have adversely impacted recall of the event it also was able to elicit longer term impacts. Finally, the health impact of the fires need to be considered in the context of the background mental and physical health of the community.

## Where to from here

This research comprises just one part of the HHS Psychological Impacts Stream. Future activities for this stream include the resurveying of Adult Survey participants and analysis of data recently collected from Latrobe Valley school children. Integration of this work with that of the HHS Community Wellbeing Stream will facilitate knowledge about how best to support recovery in the community.

This research was funded by the Victorian Department of Health and Human Services.

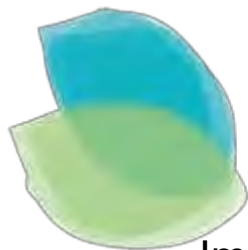


## What we did

Interviewees were selected from Morwell residents who were 18 years and older at the time of the mine fire and who had participated in the HHS Adult Survey. An initial subgroup of 70 people was randomly selected in a way which ensured that both men and women of different ages were invited. Methods used to recruit participants included mail, follow up emails and phone calls. Twenty-six people who could be contacted and consented were interviewed. Most (82%) were aged between 40 and 69 years, with only a few aged 20-39 or 70+. Interviews followed a semi-structured, face to face format. The first part of the interview was designed to prompt recall of the event and of its impacts and the second part focussed on coping both at the time and since the event. Questions included, "What effects did the mine fire have on you at the time?", "Does what happened still affect you?" and "What, if anything, helped you handle the effects of the fire?". Interviews varied in length from 15 minutes to one hour 20 minutes with the majority of interviews being between 30 minutes and one hour.



Photo Credit: Keith Pakenham, Country Fire Authority



# Hazelwood HEALTH STUDY

## Impacts of the Hazelwood mine fire for students and staff from a specialist school which relocated during the smoke event Research Summary

September 2018

### Analysis aims

The primary aim of this study was to examine the impact of the smoke event on wellbeing, educational outcomes and teaching practices for students and staff at a specialist school which relocated during the smoke event. A secondary aim was to explore whether the trauma-informed model of practice already in use at the school provided a framework which assisted students and staff during the event.



### Meet the team

Dr Emily Berger  
Dr Matthew Carroll  
Prof Darryl Maybery  
Mr Dylan Harrison



### Background

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study (HHS) was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



### What we found

Impacts on student wellbeing included increased anxiety and frustration, difficulty adjusting to the relocation environment, reduced sense of safety and a drop in both attendance and schoolwork completion. Increased stress at home was also reported. Staff reported their own frustration and anxiety around the event including difficulty obtaining information. Staff noted that the event created challenges on both a personal and professional level, with some reporting concerns for themselves and their families at the same time as working hard to look after the students. The relocation of the school imposed extra duties upon staff, reduced their access to teaching resources and increased the time spent dealing with behavioural issues.

On a positive note, the school relocation reduced exposure to the smoke and permitted the school to do more outdoor activities with the students. In addition, the school's use of a trauma-informed approach to teaching provided considerable insights into how best to support students during this period.

**This report is being published in the Journal of Child and Adolescent Trauma.**

A copy of the pre-print version of this article is available at [www.hazelwoodhealthstudy.org.au/publications](http://www.hazelwoodhealthstudy.org.au/publications)

Website: [www.hazelwoodhealthstudy.org.au/study-reports](http://www.hazelwoodhealthstudy.org.au/study-reports)

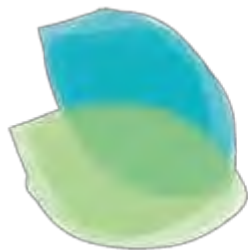


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@HazelwoodHS





## What we did

Eight school staff were interviewed, including administrative, teaching and support personnel. The school caters for students aged 12 to 18 years who have stopped attending, or been excluded, from mainstream education because of traumatic, behavioural, emotional, learning and/or family and relationship challenges. The school uses an evidence informed, three-tiered, trauma-based model of care. Interviews followed a semi-structured, face to face format. The first part of the interview included open-ended questions about the effect of the event on student and staff wellbeing, learning and teaching. The second part focused on coping both at the time and since the event. The interviews were recorded, transcribed, returned to participants for review and then analysed to identify recurring themes.



## Where to from here

This research comprises just one part of the HHS Psychological Impacts Stream. Future activities for this stream include the resurveying of Adult Survey participants and the analysis of data recently collected from Latrobe Valley school children. Integration of this work with that of the HHS Community Wellbeing Stream will facilitate knowledge about how best to support recovery in the community.

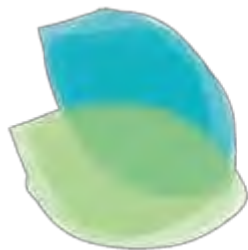
## Considerations

The findings are from one specialist school and are not necessarily reflective of the experiences of all school staff following traumatic experiences. In addition, the unique nature of this prolonged community-wide pollution event means that the issue of relocation may not be applicable to all disaster events in which schools are required to respond. An improvement in the design of the study would be to explore the experiences of the entire school community, including students and families, and to further explore the contribution of parent distress on child outcomes.

The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventive Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research at the University of Tasmania, the University of Adelaide and the CSIRO.

This research was funded by the Victorian Department of Health and Human Services.





September 2018

## Children's perspectives on the impact of the Hazelwood mine fire and subsequent smoke event Research Summary

### Analysis aims

The primary aim of this study was to understand the immediate and ongoing impacts of the mine fire event on the social, emotional and academic well-being of young people. The study also investigated the coping strategies used by young people and their suggestions about what would be helpful in future events.

### Meet the team

Dr Emily Berger

Dr Matthew Carroll

Professor Darryl Maybery



### Background

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study (HHS) was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



### What we found

The interviews revealed that the fire and subsequent smoke left a strong impression on most of the participants, with students talking about the unpleasant smell, how the ash felt in their throat and got into their home and school. In addition to being an unpleasant event, the interviews revealed that the event impacted on some children's social, emotional and academic wellbeing, while other children appeared to have experienced little impact from the event. While a number of students talked about difficulties coping at the time, including anger, stress and anxiety, most indicated that these effects had abated. Some, however, reported still being more alert to cues for fire events. In addition, some students remarked on the educational impacts including change to school routines, absences from school, and the impact of relocation (either at the family or school level).

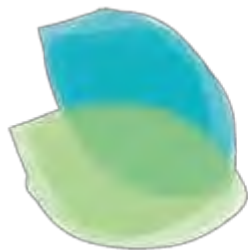
Looking beyond themselves, some reported on the emotional and physical impact of the event on their parents, family and community, including short and long-term health outcomes, impacts on friendships and increased family conflict. Students also talked about how they attempted to minimise these impacts through helping to protect the family home or keeping family members safe at the time of the fire and smoke.

**This report is being published in the Journal of Child and Adolescent Trauma.**

A copy of the pre-print version of this article is available at [www.hazelwoodhealthstudy.org.au/publications](http://www.hazelwoodhealthstudy.org.au/publications)







## What we did

Sixty-nine children and adolescents from seven schools in Morwell and one school in Traralgon were interviewed approximately 1 ½ years after the mine fire. The majority of students were in grade 3, followed by grade 5, year 7 and then year 9. The interviews lasted approximately 30-40 minutes and were conducted face to face with a researcher at the child's school. A semi-structured interview was used to allow for both the researcher and the children to direct the conversation. The interview asked children about the perceived impact of the fire and smoke on them and others, their views on management of the fire and how they coped at the time, as well as whether they experienced any changes at home or school during or following the fire.



## Where to from here

This research comprises one aspect of the HHS Psychological Impacts stream. Future activities for this stream include analysis of a second round of surveys and interviews with students conducted almost four years after the mine fire, and reporting on the impacts for other vulnerable groups including older adults.

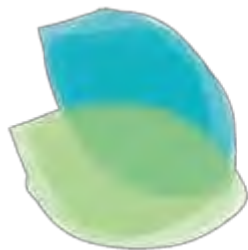


## Considerations

Although a close to representative sample of male and female students from government and independent schools were involved in the interviews, less than one third of parents consented for their child to participate. Therefore the results may not necessarily reflect the experiences of all children and adolescents following the 2014 Hazelwood mine fire.

The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventive Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research at the University of Tasmania, the University of Adelaide and the CSIRO.

This research was funded by the Victorian Department of Health and Human Services.



## Research Summary | The Latrobe ELF Study: Indicators of lung and blood vessel function three years after the fire

October 2018



### Background

#### Analysis aims

Three years after the mine fire event, we aimed to find out if smoke from that fire affected the health of the lungs and blood vessels in very young children from the Latrobe Valley including children whose mothers were pregnant with them at the time.

#### Meet the team

Fay Johnston  
Graeme Zosky  
Graham Hall  
Kazuaki Negishi  
Alison Venn  
Shyamali Dharmage  
Marita Dalton  
Rachel Foong  
Amanda Wheeler  
Shannon Melody  
Grant Williamson  
Tierney O'Sullivan  
Jingyi Shao  
Bing Zhao  
Melanie Reeves  
Katherine Chappell

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history. It caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.

The **Latrobe Early Life Follow up (ELF) Study** is the part of the Hazelwood Health Study that follows the health and growth of children who were younger than two years old when the fire happened. This includes children whose mothers were pregnant with them at the time.



### What we found

#### Blood vessel health

In children who were aged up to two years at the time of the fire, we found weak evidence for a link between higher mine fire smoke exposure and very small increases in blood vessel stiffness, and no evidence for a link with blood vessel thickness. We did not find any links between smoke exposure and blood vessel health in children whose mothers were pregnant with them at the time of the fire.

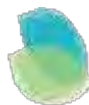
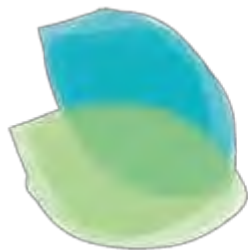
We also found that smoking during pregnancy was linked with thicker blood vessels in children.

#### Lung health

In children who were aged up to two years at the time of the mine fire, we found weak evidence for a link between higher mine fire smoke exposure and slightly increased lung stiffness, but not with other lung function measures. We also found that lung function was reduced in children whose mothers smoked during pregnancy.

**To request a copy of the full technical report, please call 1800 985 899 or email [contact@hazelwoodhealthstudy.org.au](mailto:contact@hazelwoodhealthstudy.org.au)**





## What we did

We tested the blood vessel thickness and stiffness of 248 children using ultrasound. Increases in the thickness or stiffness of blood vessels indicate poorer blood vessel health.

We did a simple lung test on 105 children, known as the forced oscillation technique. It uses small vibrations to see how easily air goes in and out while children are breathing through a tube. We measured the resistance to air flow, the stiffness of the lungs, and if lung function changed after using an asthma puffer containing salbutamol. Fewer children had lung checks than blood vessel checks because many ELF participants were too young for the lung test.

We worked out how much smoke each child had been exposed to by looking at where the child was each day during the fire and how polluted the air was in the area.

When we analysed the data we took into account other factors that can affect blood vessel and lung function such as age, sex, height, weight and exposure to tobacco smoke.



## Where to from here?

Further studies are needed to confirm these results. ELF participants born during 2015 were not included in the lung health testing because they were mostly too young to participate. They are an important group because they were never exposed to the mine fire smoke. Their inclusion in the testing planned for 2020 will improve the ability of the ELF study to identify, with more certainty, possible lung health impacts linked with exposure to the mine fire smoke.

HHS results will be shared with relevant organisations to ensure they are used to shape services for the future health of the Latrobe Valley

**The Latrobe ELF Study is led by the Menzies Institute for Medical Research at the University of Tasmania with collaborators from Melbourne University and the Telethon Kids Institute.**

**The HHS is led by Monash University with collaborators from Menzies, Federation University, The University of Adelaide, and CSIRO.**



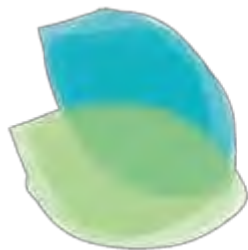
## Considerations

The evidence for a link between mine fire smoke exposure and the stiffness of blood vessel or lungs was present but not strong. We cannot rule out the possibility that the results occurred by chance, or were due to other unmeasured factors that can affect blood vessel or lung health.

Blood vessel stiffness and thickness varies among healthy children. Greater stiffness does not automatically mean that children will later develop blood vessel or heart problems. Stiffer or thicker blood vessels are two of many things, including genetic make-up, smoking tobacco, stress, diet and physical activity that can influence the risk of heart disease in later life.

Lung function varies a lot between children and from day to day. Lower than expected results on the day of testing do not automatically mean that there are lung problems. However, children with symptoms like shortness of breath, wheezing, or frequent coughing should always have these checked by a doctor.





## Research Summary

### Adult psychological outcomes following the Hazelwood mine fire: A mixed methods study

November 2018

#### Analysis aims

This study assessed the psychological impacts of six weeks of exposure to smoke and ash from the Hazelwood mine fire. The study compared residents from the most exposed community (Morwell) with those from a similar, but minimally-exposed, control community (Sale).

#### Meet the team

Professor Darryl Maybery  
Rebecca Jones  
Matthew Carroll  
Joanna F Dipnall  
Emily Berger  
Alexander McFarlane



#### Background

The fire in the Morwell open cut brown coal mine adjacent to the Hazelwood Power Station blanketed the town of Morwell and the surrounding area in smoke and ash for six weeks in February and March 2014. The smoke event was recognised as one of the most significant air quality incidents in Victoria's history, with the concentration of smoke contaminants reaching high levels.

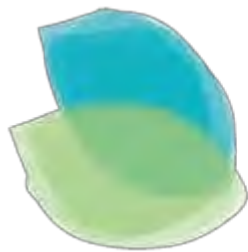
The smoke event caused considerable community concern within Morwell and the broader community. In response to these concerns, and following extensive community consultation, the Hazelwood Health Study (HHS) was established to examine the impacts of the mine fire. The HHS involves multiple research streams targeting different health outcomes and different vulnerable groups.



#### What we did

This analysis combined two different sets of findings. Firstly, outcomes from the Adult Survey of 3091 participants in Morwell and 960 in Sale completed more than two years after the event. Secondly, information from face-to-face interviews with 26 of the Morwell Adult Survey participants. The survey included a measure of posttraumatic stress symptoms associated with the mine fire, a measure of general distress and information on mental health diagnoses. The interviews explored the psychological impacts more deeply, particularly the posttraumatic stress symptoms.





## What we found

In a self-report survey, Morwell residents scored higher than Sale residents on a measure of symptoms of posttraumatic stress associated with the mine fire event. Morwell residents also scored higher on a measure of general distress. Results indicated that, on average, the Hazelwood mine fire continued to generate moderate levels of distress in the local community more than two years after the event. However, there was considerable diversity in the response, from no impact to severe distress. These findings were supported by qualitative interviews. Half of the interview participants reported no psychological impact at the time of the mine fire event, nine reported impacts at the time which had dissipated by the time of the interviews, and the remaining four reported still being psychologically impacted three years post-event. Intrusive thoughts were the most frequently reported symptom of posttraumatic stress. The interviews highlighted the increased vulnerability of people with pre-existing mental health concerns. It appears that diagnosis of PTSD has been more common in Morwell since the mine fire; however, total numbers are too small to be certain.

To request a copy of the full report, please call 1800 985 899 or email [contact@hazelwoodhealthstudy.org.au](mailto:contact@hazelwoodhealthstudy.org.au)



## Considerations

While all attempts were made to ensure that the Adult Survey participants were representative of their communities, participants tended to be older and more advantaged than non-participants. In addition, the self-report nature of the survey may have reduced the reliability of the responses. Finally, the small sample used for the interviews may have restricted the range of possible responses. Therefore, the results may not necessarily reflect the experiences of all adults following the 2014 Hazelwood mine fire.



## Where to from here

This research comprises one aspect of the HHS Psychological Impacts stream. Future activities for this stream include follow up surveys and interviews with adults and with school-aged children, and targeted analysis of the existing data to look at specific factors such as age, prior mental health history, and prior exposure to traumatic events.

***The Hazelwood Health Study is a collaborative program of research led by the Monash University Schools of Public Health and Preventative Medicine and Rural Health in partnership with Federation University, the Menzies Institute for Medical Research at the University of Tasmania, the University of Adelaide and the CSIRO.***

***This research was funded by the Victorian Department of Health and Human Services.***

## **Appendix 3**

Abstracts and posters presented at scientific conferences since  
November 2017



Abstract submitted to the Australian Association of Gerontology (AAG) Conference in Perth, WA – 8-10/11/2017.

**Beyond vulnerability: Older people as active participants in disaster responses**

The 2014 Hazelwood coal mine fire in Australia burned for a 45 day period, resulting in a significant smoke event which impacted the adjacent town of Morwell and nearby communities.

We undertook a study of policy-driven decisions made during the mine fire which explored the impact of the smoke event on older people living in the Morwell community. We were able to gain an understanding of older residents' experiences using a mix of research methodologies. We combined the findings from focus groups with over 90 local older people and interviews with 17 decision-makers and service providers, with reviews of relevant literature and government policies.

It was apparent that the messaging during the event was problematic, with much of the communication being one-way, overly technical, and coming from state-level spokespeople rather than trusted voices within the community. The messaging was seen as potentially alienating to older people, with references to 'vulnerable older people'. While considerable support was provided during the event, much of it was targeted at people already in receipt of services, missing that much larger group of robust older people living independently in the community but who may have benefited from support during the event.

In contrast to the messaging re vulnerable older people, the feedback from older residents and the agencies supporting them, was that older people tended to be more stoic and able to draw upon experiences from previous disasters, with learnings they could share with the wider community.

Rather than seeing older people as passive recipients of support, it was suggested that older people need to be involved in disaster preparation and response. This could include involving older residents in the development of disaster plans, identifying age-relevant spokespeople, and utilising existing community groups to disseminate information and involve the older community in a two-way discussion.



Abstract submitted to the Aging and Society Research Network Conference Nov 2017.

**The impact of the Hazelwood mine fire in Australia on older people: review of policy-driven decisions made at the time**

The 2014 Hazelwood open-cut brown coal mine fire in Australia burned for a period of 45 days. While there was initial concern about the fire directly impacting the community, the focus quickly shifted to health impacts of exposure to the smoke and other toxins.

We were able to gain an understanding of older residents' experiences using a mix of research methodologies. We combined the findings from focus groups with over 90 local older people and interviews with 17 decision-makers and service providers, with reviews of relevant literature and government policies.

It was apparent that little attention was paid to the voices of older people, especially those usually robust older people living independently in the community. The apparent mismatch between existing policies and the extended and dynamic nature of the smoke event prompted the development of policy on the run. This led to confusion, mixed messaging and erosion of community trust in government. The recurring issue arising throughout the research process was the requirement to listen to and include the concerns of older people.

This review has important implications for stakeholders, best practice policy development and program planning to improve preparedness for, and response to, a future disaster event.

### Adults Exposed to Coal Mine Fire Smoke Report More Asthma and Respiratory Symptoms Than Those Not Exposed

M. J. Abramson<sup>1</sup>, J. Blackman<sup>1</sup>, M. Carroll<sup>2</sup>, C. Dimitriadis<sup>1</sup>, A. Del Monaco<sup>1</sup>, M. Dennekamp<sup>1</sup>, S. Denny<sup>2</sup>, C. X. Gao<sup>1</sup>, J. Walker<sup>2</sup>

<sup>1</sup>Epidemiology & Preventive Med, Monash University, Melbourne, Australia, <sup>2</sup>School of Rural Health, Monash University, Churchill, Australia.

**Rationale:** A fire burned in the Hazelwood open cut brown coal mine for 6 weeks in 2014, showering the nearby town of Morwell with smoke and ash. The aims of the Hazelwood Health Study included assessing whether Morwell adults, who were heavily exposed to smoke from the fire, experienced more respiratory symptoms compared to adults from the town of Sale, who were minimally exposed.

**Methods:** Eligible people were aged 18 years or older at the time of the mine fire and lived in Morwell or selected areas in Sale. Contact details drawn from the electoral roll identified 9,448 and 4,444 eligible registered residents in Morwell and Sale respectively. These residents were offered the option of completing the Hazelwood Adult Survey in one of three ways: telephone interview, online or paper questionnaire. Recruitment commenced in May 2016 and concluded in February 2017. In total, 3,096 (33%) Morwell residents and 960 (23%) Sale residents participated in the survey. To minimise the confounding effects of other health risk factors, multivariable log binomial or Poisson regression models were fitted to adjust for differences between Morwell and Sale participants in terms of gender, age, education, employment and smoking.

**Results:** The differences between Morwell and Sale, in self-reported pre- and post-mine fire rates of asthma and respiratory symptoms in the past 12 months, are summarised in the Figure. Self-reported doctor diagnosed asthma since the mine fire, as well as current respiratory symptoms, were all more common among Morwell compared with Sale participants. Amongst asthmatics, symptoms were also more severe in Morwell compared to Sale. The risks of irritant symptoms from the chest and nose, consistent with chronic bronchitis and rhinitis, were also higher among Morwell participants.

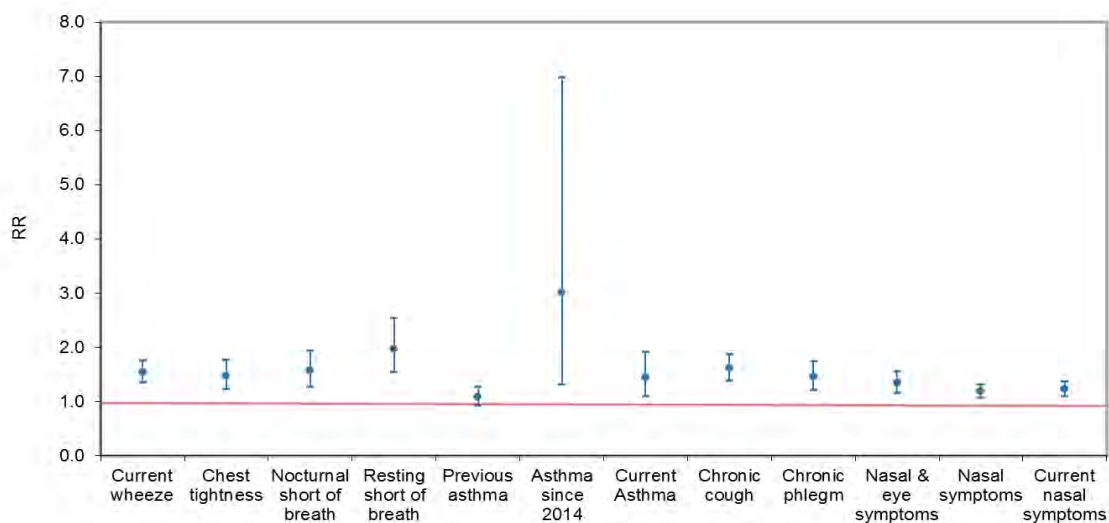


Figure: Adjusted rate ratios and 95% Confidence Intervals for self-reported asthma and current respiratory symptoms



**Conclusions:** This analysis of the Hazelwood Adult Survey provides the first available evidence of continuing adverse effects of the Hazelwood mine fire on asthma and respiratory symptoms among adults in Morwell. Future analyses will include linked administrative health datasets, such as ambulance and emergency presentations and hospital admissions, which should be less prone to recall bias. Clinical sub-studies, commencing data collection in the second half of 2017, will further complement the current work. The self-report data will be supplemented with clinical data including respiratory function tests.

### **An assessment of early life exposure to coal mine fire smoke and children's lung health**

Jingyi Shao<sup>1</sup>, Graeme R. Zosky<sup>2</sup>, Graham L. Hall<sup>3</sup>, Amanda J. Wheeler<sup>1</sup>, Marita Dalton<sup>1</sup>, Shyamali Dharmage<sup>4</sup>, Rachel Foong<sup>3</sup>, Grant Williamson<sup>5</sup>, Tierney O'Sullivan<sup>1</sup>, Fay H. Johnston<sup>1</sup>

**Introduction/Aim:** In 2014, emissions from a fire in an open cut coal mine caused markedly increased concentrations of fine particulate matter (PM<sub>2.5</sub>) in the Latrobe Valley of Victoria, Australia, for approximately six weeks. We aimed to evaluate the impacts of infant (<2 years of age) exposure to mine fire emissions on lung function measured three years after the fire.

**Methods:** Hourly PM<sub>2.5</sub> from the fire at 1x1 km<sup>2</sup> was derived from an atmospheric transport model. Daily average and maximum PM<sub>2.5</sub> were assigned to participants' residential address during the fire. Lung function was evaluated using the forced oscillation technique (FOT), which generated z scores for resistance (Rrs) and two measures of reactance as follows: (1) Reactance at a frequency of 5Hz, (Xrs) and (2) area under the reactance curve (AX). We used generalised linear models, adjusted for maternal smoking in pregnancy and maternal stress during the fire to assess associations between PM<sub>2.5</sub> exposure and lung function.

**Results:** 71 children, with a mean age of 4.3±0.6 (SD) years were included. Median [IQR] daily PM<sub>2.5</sub> exposures were 6.8 [1.9-12.7] µg/m<sup>3</sup> (average) and 107.4 [60.4-167.0] µg/m<sup>3</sup> (maximum). The baseline mean (SD) z scores were Rrs 0.6 (0.8), Xrs 0.8(0.9) and AX 0.7(1.0). A 10µg/m<sup>3</sup> and 100µg/m<sup>3</sup> increase in average and maximum PM<sub>2.5</sub> respectively was independently associated with z scores for AX coefficient (95%CI): Average PM<sub>2.5</sub>: 0.23 (0.02 to 0.44); Maximum PM<sub>2.5</sub>: 0.13 (0.00 to 0.25), but not with the other measures of lung function. Maternal smoking was strongly associated with Xrs<sub>5</sub>: 1.15 (0.60 to 1.69) and AX: 0.89 (0.30 to 1.48), while maternal stress during the fire was protective for Xrs<sub>5</sub>: -0.62 (-1.19 to -0.06).

**Conclusion:** Exposure to coal mine fire emissions during infancy may be associated with reduced lung reactance. Further research is required to validate these findings.

**Grant Support:** Department of Health & Human Services, Victoria

**Declaration of Interest Statement:** The authors declared no competing interests.

Exposure to smoke from a coal mine fire during infancy and lung function three years after the event

<sup>1</sup>J. Shao<sup>1</sup>, G. R. Zosky<sup>2</sup>, G. L. Hall<sup>3</sup>, A. J. Wheeler<sup>1</sup>, M. Dalton<sup>1</sup>, S. Dharmage<sup>4</sup>, R. Foong<sup>3</sup>, G. Williamson<sup>5</sup>, T. O'Sullivan<sup>1</sup>, F. H. Johnston,

<sup>1</sup>Menzies Institute for Medical Research, University of Tasmania, Hobart, Australia, <sup>2</sup>School of Medicine, Faculty of Health, University of Tasmania, Hobart, Australia, <sup>3</sup>Children's Lung Health Telethon Kids Institute, School of Physiotherapy and Exercise Science Curtin University, Centre for Child Health Research, University of Western Australia, West Perth, Australia, <sup>4</sup>Allergy and Lung Health Unit, Melbourne School of Population and Global Health, University of Melbourne, Carlton, Australia, <sup>5</sup>School of Biological Sciences, University of Tasmania, Hobart, Australia.

### *Abstract:*

**BACKGROUND:** In 2014, emissions from a fire in an open cut coal mine caused markedly increased concentrations of fine particulate matter (PM<sub>2.5</sub>) in the Latrobe Valley of Victoria, Australia, for approximately six weeks. We aimed to evaluate the lung function of infants who were less than two years of age when exposed to the air pollution from the fire.

**METHODS:** Daily average and maximum PM<sub>2.5</sub> exposures were calculated for each participant according to their daily location throughout the fire period. Lung function was measured three years after the fire using the forced oscillation technique. The primary outcomes were z scores for resistance at 5Hz (Rrs5), a measure of airways obstruction, and two indicators of lung stiffness, reactance at 5Hz (Xrs5) and the area under the reactance curve (AX). We used generalised linear models, adjusted for maternal smoking in pregnancy, maternal stress during the fire and maternal education to assess associations between PM<sub>2.5</sub> and lung function.

**RESULTS:** We tested 83 children, who had a mean age(SD) of 4.3(0.5) years at the time of follow up. Median [IQR] average PM<sub>2.5</sub> exposure was 8.9 [7.2-19.3] µg/m<sup>3</sup> and maximum PM<sub>2.5</sub> was 29.0 [16.1-49.9] µg/m<sup>3</sup>. The mean(SD) z scores of participants were Rrs 0.6 (0.8), Xrs -0.8(0.9) and AX 0.7(0.9). A 10µg/m<sup>3</sup> increase in average PM<sub>2.5</sub> exposure during the fire period was independently associated with z scores for Rrs 0.18 (95%CI 0.01,0.34, p=0.038), Xrs -0.20 (-0.36, -0.04, p=0.015), and AX, 0.25 (0.07 to 0.42, p=0.006). In addition, maternal smoking in pregnancy was strongly associated with measures of reactance Xrs5: -1.25 (-1.75, -0.76, p=0.000) and AX: 0.97 (0.42, 1.51, p=0.001).

**CONCLUSION:** Exposure to a period of reduced air quality during infancy was associated with reductions in lung function measured three years after the event. The possible long term clinical implications or reversibility of these changes is not known. Further research is required to validate these findings.

### **Smoking during pregnancy significantly increases the risk of early atherosclerosis: a study from coalmine smoke exposure**

Bing Zhao<sup>1</sup>, Fay H. Johnston<sup>1</sup>, Marita Dalton<sup>1</sup>, Grant Williamson<sup>2</sup>, Tierney O'Sullivan<sup>1</sup>, Kazuaki Negishi<sup>1</sup>

**Introduction:** Early life exposure to air pollution has been associated with increased risk of atherosclerosis. However, the role of maternal cigarette smoking during pregnancy in modifying the impacts is not known.

**Purpose:** This study aimed to assess associations between vascular structure and function in children and exposure to poor air quality while in utero or during infancy (<2 years), and the influence of maternal smoking during pregnancy

**Methods:** We used data from our cohort study of children who were exposed to smoke from a coalmine fire that burned for 6 weeks in 2014 in Victoria, Australia. Three years after the exposure, we evaluated carotid/abdominal intima-media thickness (IMT) and pulse wave velocity (PWV) of the children. An atmospheric transport model was used to obtain hourly fine particulate matter (PM<sub>2.5</sub>) from the fire at 1x1 km<sup>2</sup>. Daily average (AVE) and maximum (MAX) PM<sub>2.5</sub> exposure levels were calculated based on participants' residential addresses during the fire. We investigated the potential interaction with maternal smoking in linear regression models.

**Results:** The study involved 154 children (age 3.9 ± 0.8 years, 51% boys) (Table). Median [IQR] daily maximum PM<sub>2.5</sub> level was 112.1 [121.6], with daily average of 8.8 [10.0] µg/m<sup>3</sup>. Far wall carotid IMT was 0.50 ± 0.03 mm and 0.41 ± 0.07 mm for abdominal aorta, with PWV of 4.2 ± 0.5 m/s. Although there were no significant associations between PM<sub>2.5</sub> exposure and PWV/IMT in the entire population, there were significant interactions by maternal cigarette smoking status during pregnancy (Figure). Smoking status modified the relationships (a) between daily AVE PM<sub>2.5</sub> and PWV (p=0.016); (b) between daily MAX PM<sub>2.5</sub> and PWV (p=0.028); and (c) between daily AVE PM<sub>2.5</sub> and Abdominal IMT (p=0.038). Only children whose mothers smoked cigarettes during pregnancy had significant positive associations between PM<sub>2.5</sub> and PWV.

**Conclusion:** Our findings suggest that the impact of exposure to coal mine fire emissions on the vascular health of a foetus and infant is influenced by maternal cigarette smoking during pregnancy.

**Grant Support:** Department of Health & Human Services, Victoria

**Declaration of Interest Statement:** The authors declared no competing interests.

### **Fine particulate matter and medications dispensed during and after a brown coal mine fire: a time series analysis**

**Background:** Very few studies have examined the impacts of coal mine fire smoke on human health.

The aim of this study was to assess the association between prolonged mine fire smoke PM<sub>2.5</sub> exposure from a coal mine fire that burned over a six week period in 2014 and medications dispensed across five localities in South-eastern Victoria, Australia. Maximum hourly mine fire-related PM<sub>2.5</sub> concentrations were estimated to reach 3700 µg/m<sup>3</sup>.

**Methods:** Spatially resolved PM<sub>2.5</sub> concentrations were retrospectively modelled using The Air Pollution Model, a dispersion model coupled with a chemical transport model (TAPM-CTM). Data on medications dispensed were collected from the Pharmaceutical Benefits Schedule database for 2013-2016. Poisson distributed lag time series analysis was used to examine associations between daily mine fire-related PM<sub>2.5</sub> concentrations and daily counts of medications dispensed for respiratory, cardiovascular and mental health conditions. Confounding variables included: seasonality, long-term trend, day of the week, maximum ambient temperature and public holidays.

**Results:** Positive associations were found between mine fire-related PM<sub>2.5</sub> and increased risks of medications dispensed for respiratory, cardiovascular and mental health conditions, after lag 2-5 days. A 10 µg/m<sup>3</sup> increase in coal mine fire-related PM<sub>2.5</sub> was associated with a 15% (95%CI 8-23%) increase in respiratory medications dispensed, a 12% (9-16%) increase in cardiovascular medications dispensed and a 17% (12-22%) increase in mental health medications dispensed.

**Conclusions:** Mine fire PM<sub>2.5</sub> exposure was associated with increased medications dispensed for respiratory, cardiovascular and mental health. These findings can help to develop the public health response in the event of future mine fires.

### **Brown coal mine fire-related fine particulate matter and medical service utilisation in Australia: a time series analysis**

**Background:** There is a knowledge gap as to whether coal mine fire smoke has adverse health risks.

This study aimed to assess the association between coal mine fire-related PM<sub>2.5</sub> and health service utilisation across five localities in South-eastern Victoria, Australia after wildfires ignited a coal mine fire which burned for six weeks in 2014. Areas in the immediate vicinity of the mine were estimated to experience hourly mine fire-related PM<sub>2.5</sub> concentrations of up to 3700 µg/m<sup>3</sup>.

**Methods:** Data on medical service utilization between 2012 and 2016 were collected from the Medicare Benefits Schedule; a national database of use of medical services. Spatially resolved PM<sub>2.5</sub> concentrations were retrospectively modelled using The Air Pollution Model (TAMP), a dispersion model, coupled with a Chemical Transport Model. Poisson distributed lag time series analysis examined the association between daily mine fire-related PM<sub>2.5</sub> concentrations and medical service utilization for respiratory, cardiovascular and mental health conditions. Confounders included seasonality, long-term trend, day of the week, maximum ambient temperature and public holidays.

**Results:** Positive associations were found between mine fire-related PM<sub>2.5</sub> and all medical service types, after lag 2-5 days. A 10 µg/m<sup>3</sup> increase in PM<sub>2.5</sub> was associated with a 19% (95%CI 16-22%) increase in the risk of long and short General Practice consultations, 29% (17-42%) increase in cardiovascular services, 27% (10-46%) increase in respiratory services and 13% (4-22%) increase in mental health consultations.

**Conclusions:** Coal mine fire-related PM<sub>2.5</sub> exposure was associated with increased use of medical services for respiratory, cardiovascular and mental health. These findings can inform the development of future public health policy responses in the event of major air pollution episodes.

### **Birth outcomes following maternal exposure to the Hazelwood coal mine fire**

**Authors:** Shannon Melody, Marita Dalton, Martine Dennekamp, Amanda Wheeler, Shyamali Dharmage, Karen Wills, Melanie Reeves, Jane Ford, Tierney O'Sullivan, Grant Williamson, Alison Venn, Christine Roberts & Fay Johnston

**Background:** Little is known about the perinatal harms associated with maternal exposure to acute, short-term periods of outdoor air pollution, such as that resulting from bushfires or coal mine fires. The 2014 Hazelwood coal mine fire in Victoria was an unprecedented event that produced some of the most extreme concentrations of fine particulate matter (PM<sub>2.5</sub>) ever measured in Australia. **Objectives:** This study aims to understand the impacts of maternal exposure to smoke from the 2014 Hazelwood coal mine fire on perinatal outcomes, including fetal growth and gestational maturity. **Methods:** families from the Latrobe Valley who were exposed in early childhood, in utero or conceived after the fire (not exposed) were recruited. Exposure, covariate and outcome data was gathered through a comprehensive baseline survey. Average and peak coal-mine fire attributable PM<sub>2.5</sub> was assigned to maternal pregnancy address using a chemical transport model developed by CSIRO collaborators. **Results:** 548 children participated; 199 were exposed in utero. Average and peak maternal PM<sub>2.5</sub> mine fire exposure was 7.1 and 68.1 µg/m<sup>3</sup> respectively. Maternal exposure to coal mine-fire attributable PM<sub>2.5</sub> was not associated with fetal growth restriction or preterm birth. Smoking in pregnancy and maternal stress in pregnancy were associated with decrements in birth weight and increased risk of term low birth weight, small for gestational age and preterm birth. **Conclusions:** no adverse perinatal outcomes were observed in association with the maternal exposure to the Hazelwood coal mine fire, however further study is underway utilising a complete deidentified cohort from administrative perinatal data.

**Speaker biography:** Dr Shannon Melody is a PhD candidate (University of Tasmania) and Public Health Physician working on the Latrobe Early Life Follow-up (ELF) Study, which aims to understand the possible health and developmental impacts of the 2014 Hazelwood coal mine fire in Victoria on pregnant women and young children.

**Acknowledgement:** This study was funded by the Victorian Department of Health and Human Services. The abstract presents the views of the authors and does not represent the views of the Department.



## Is Early Life Exposure to Coal Mine Fire Smoke Associated with Childhood Respiratory, Atopic and Infective Illnesses?

Jingyi Shao, Graeme R. Zosky, Amanda J. Wheeler, Shyamali Dharmage, Marita Dalton, Grant J. Williamson, Tierney O'Sullivan, Katherine Chappell, Fay H. Johnston

**RATIONALE:** A coal mine fire (09/02/2014-31/03/2014) caused markedly increased emissions of fine particulate matter (PM<sub>2.5</sub>) in the Latrobe Valley of Victoria, Australia over six weeks. Evidence of health effects following early life exposure to high dose, medium duration pollution events is limited. We evaluated the impacts of exposure to mine fire emissions prenatally or during infancy on health outcomes decided *a priori* including general practitioner (GP) attendances, dispensations of prescribed asthma inhalers, steroid skin creams, and antibiotics during the first year of life or the year following the fire.

**METHODS:** Participants were assigned to three mine fire exposure groups according to birth date: prenatal exposure (01/04/2014-31/12/2014), infant exposure (01/03/2012-09/02/2014) and no exposure (01/01/2015-31/12/2015). The latter group were conceived and born following the fire. Participants' daily average and peak mine fire specific PM<sub>2.5</sub> exposures were estimated using chemical transport modelling at a resolution of 1x1 km<sup>2</sup> based on address diaries. Outcome data were obtained from the Australian Medicare Benefits Schedule and Pharmaceutical Benefits Scheme. We used multiple negative binomial regression models to assess risks of the outcomes associated with every 10 µg/m<sup>3</sup> increase in average PM<sub>2.5</sub> or 100 µg/m<sup>3</sup> increase in peak PM<sub>2.5</sub> exposure, respectively, while adjusting for age, tobacco smoke exposure, maternal prenatal stress and maternal education. The effects of prenatal and infant exposures were assessed separately, with the no exposure group included in both analyses.

**RESULTS:** 286 children were included: 77 with no exposure, 88 with prenatal exposure and 121 with infant exposure. In the infant exposure analysis, every 10- and 100-unit increase in average PM<sub>2.5</sub>, and peak PM<sub>2.5</sub> exposures, was associated with increased likelihood of antibiotics being dispensed during the year following the fire: adjusted incidence rate ratio 1.21 (95%CI 1.01, 1.44, *p*=0.028) and 1.14 (1.01, 1.28, *p*=0.035) respectively, but not with the other outcomes. There were no significant associations in the prenatal exposure group.

**CONCLUSION:** Infant exposure to coal mine fire emissions was associated with increased prescribing of antibiotics. This could have reflected increased childhood infections in the year following the fire.

This study was funded by the Victorian Department of Health & Human Services. The abstract presents the views of the authors and does not represent the views of the Department.

# Adults exposed to Coal Mine Fire Smoke report more Asthma and Respiratory Symptoms than those not exposed

MJ Abramson<sup>1</sup>, J Blackman<sup>1</sup>, M Carroll<sup>2</sup>, C Dimitriadis<sup>1</sup>, A Del Monaco<sup>1</sup>, M Dennekamp<sup>1</sup>, S Denny<sup>2</sup>, CX Gao<sup>1</sup>, J Walker<sup>2</sup>  
1. School of Public Health & Preventive Medicine, Melbourne, Vic, AU; 2. School of Rural Health, Churchill, Vic, AU

## Hazelwood Health Study 4th Annual Report

### BACKGROUND

- A fire burned in an open cut brown coal mine in the Latrobe Valley of Eastern Victoria for 6 weeks in February-March 2014, showering the nearby town of Morwell with smoke and ash (Figure 1).
- The aims of the Hazelwood Health Study included assessing whether Morwell adults, who were heavily exposed to smoke from the fire, experienced more respiratory symptoms compared to adults from the town of Sale, who were minimally exposed.
- National Environment Protection Measure for fine particles ( $PM_{2.5}$ ) of  $5\mu g/m^3$  exceeded on 23 days at southern Morwell and 12 days at eastern Morwell during the 45 days the fire burned (Figure 2).
- Sale in Eastern Victoria chosen as the comparison community because it was a rural town with similar demographic characteristics. There were no exceedances of the  $PM_{2.5}$  National Environment Protection Measure in Sale.

### METHODS

- Eligible people were aged 18 years or older at the time of the mine fire and lived in Morwell or selected areas in Sale.
- Contact details drawn from the Victorian electoral roll identified 9,448 and 4,444 eligible registered residents in Morwell and Sale respectively. Best available sampling frame because electoral registration is compulsory in Australia.
- Residents were offered the option of completing the Hazelwood Adult Survey in one of three ways: telephone interview, online or paper questionnaire.
- Respiratory Questions were based on the European Community Respiratory Health Survey (Burney et al 1994). Asthma severity was estimated with the symptom score developed by Pekkanen et al (2005).
- Recruitment commenced in May 2016 and concluded in February 2017. 3,096 (33%) Morwell residents and 960 (23%) Sale residents participated in the survey.

- Prevalence estimates were weighted by gender and 5 year age groups
- To minimise confounding effects of other health risk factors, multivariable log binomial or Poisson regression models were fitted to adjust for any remaining differences between Morwell and Sale participants in terms of gender, age, education, employment and cigarette smoking.

- Results are presented as Rate Ratios (RR) with 95% confidence intervals (95%CI)

### RESULTS

- Comparison of participants with community data from the Australian Bureau of Statistics indicated that women and people aged over 50, were slightly over-represented among participants. However this occurred in both Morwell and Sale.
- Differences between Morwell and Sale, in self-reported pre- and post-mine fire rates of asthma and respiratory symptoms (wheeze, chest tightness, shortness of breath, cough and phlegm) in the past 12 months, are summarised in Figure 3.
- Self-reported doctor diagnosed asthma since the mine fire, as well as current respiratory symptoms, were all more common among Morwell compared with Sale participants (Table).

- Among asthmatics, symptoms were also more severe in Morwell compared to Sale (Table).
- The risks of irritant symptoms from the chest and nose, consistent with chronic bronchitis and rhinitis, were also higher among Morwell than Sale participants.

Respiratory symptom or condition	Morwell participants Weighted %	Sale participants Weighted %	PR/RR	Adj RR (95% CI)	p-value
Current wheeze	42.3%	25.8%	1.64	1.54 (1.36, 1.75)	<0.001
Chest tightness	26.8%	16.4%	1.63	1.48 (1.23, 1.78)	<0.001
Nocturnal shortness of breath	20.0%	11.4%	1.74	1.58 (1.28, 1.94)	<0.001
Resting shortness of breath	20.1%	8.9%	2.26	1.98 (1.54, 2.54)	<0.001
Previous asthma	25.7%	23.3%	1.11	1.10 (0.93, 1.29)	0.265
Asthma since 2014	2.0%	0.6%	3.49	3.02 (1.31, 6.97)	0.009
Current Asthma	11.5%	7.4%	1.56	1.46 (1.10, 1.92)	0.008
Chronic cough	30.7%	17.3%	1.77	1.62 (1.39, 1.88)	<0.001
Chronic phlegm	25.1%	15.1%	1.66	1.46 (1.22, 1.75)	<0.001
Nasal & eye symptoms	30.2%	21.9%	1.38	1.35 (1.16, 1.56)	<0.001
Nasal symptoms	49.5%	41.4%	1.19	1.19 (1.08, 1.31)	<0.001
Current nasal symptoms	44.0%	35.3%	1.25	1.23 (1.10, 1.37)	<0.001
Amongst asthmatics: Pekkanen asthma score	Weighted mean (SD) 3.64 (2.06)	Weighted mean (SD) 2.85 (1.84)	Mean diff 0.79	Adj mean diff (95% CI) 0.59 (0.26, 0.91)	p-value <0.001

### CONCLUSIONS

- This analysis of the Hazelwood Adult Survey provides evidence of continuing adverse effects of the mine fire on asthma and respiratory symptoms among adults in Morwell.
- An important strength was the inclusion of a comparison group of adults who were similar in terms of their regional location and socio-demographic indices.
- Statistical adjustments for gender, age, education, employment and smoking also reduced potential confounding.
- A methodological limitation was the reliance on self-reported health measures. The risk of differential recall was minimized by utilising validated questionnaires
- Other analyses include linked administrative health datasets, such as emergency presentations and hospital admissions (see Poster A2616), should be less prone to recall bias.
- Recently completed clinical sub-studies complement the current work. The self-report symptom data will be supplemented with clinical data including respiratory function tests.

### ACKNOWLEDGMENTS

- The Hazelwood Health Study is funded by the Victorian Department of Health & Human Services. The findings are the views of the authors and not the Department
- Figure 1 is reproduced with permission of Keith Pakenham, Country Fire Authority

### REFERENCES

- Burney P et al. The European Community Respiratory Health Survey. Eur. Respir. J. 1994; 7(6):954-60
- Pekkanen J et al. Operational definitions of asthma in studies on its aetiology. Eur Respir J 2005; 26(1):28-35



Figure 1. Hazelwood coal mine fire front at night, February 2014

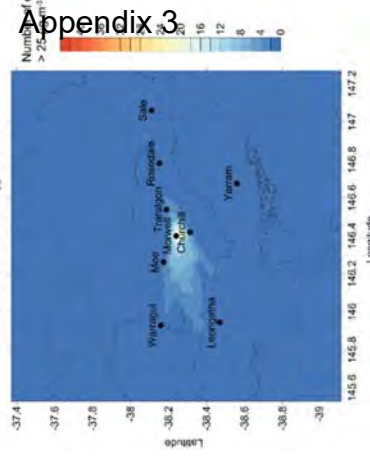


Figure 2. Distribution of 24 (out of 45) when the National Environment Protection Measure for  $PM_{2.5}$  was exceeded

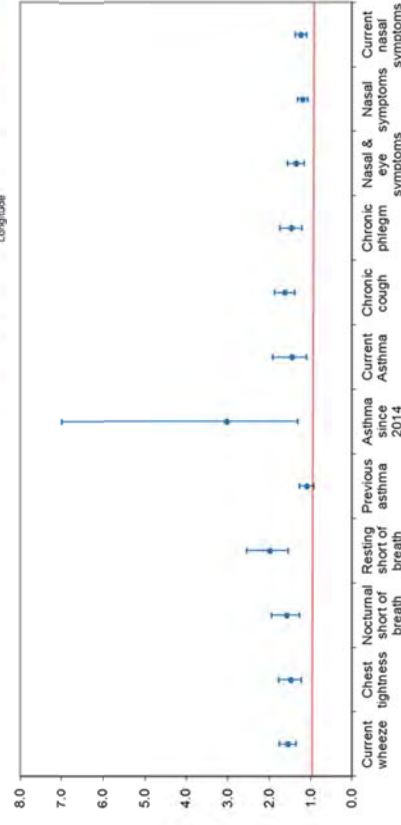


Figure 3: Adjusted rate ratios and 95% Confidence intervals for self-reported asthma and current respiratory symptoms

# Emergency Presentations and Hospital Admissions following exposure to smoke from a Coal Mine Fire

Michael J Abramson<sup>1</sup>, Martine Dennekamp<sup>1</sup>, Lahn Straney<sup>1</sup>, Christina Dimitriadis<sup>1</sup>, Caroline X Gao<sup>1</sup>, Yuming Guo<sup>1</sup>

<sup>1. Department of Epidemiology & Preventive Medicine, School of Public Health & Preventive Medicine, Melbourne, Vic, AU</sup>

## BACKGROUND

- A fire burned in an open cut brown coal mine for 6 weeks in 2014, spreading smoke and ash throughout the Latrobe Valley of Eastern Victoria (Figure 1).
- There is extensive evidence that ambient urban air pollution is related to deaths and hospital admissions for cardiovascular and respiratory diseases
- However there is much less evidence of health effects from coal mine fire smoke
- The aim of this analysis was to examine whether coal mine fire-related fine particles (2.5 µm diameter (PM<sub>2.5</sub>)) were associated with increased risks of emergency presentations or hospital admissions for cardiovascular and respiratory diseases.

## METHODS

- We analysed daily concentrations of coal mine PM<sub>2.5</sub> and the daily counts of emergency department presentations and hospital admissions for the fire-impacted areas (Figure 2), between January 2009 and June 2016.
- Concentrations of PM<sub>2.5</sub> in the Latrobe Valley for the duration of the fire were estimated by a chemical transport model coupled with a conformational cubic atmospheric model (Emerson et al 2016).
- Data on emergency presentations were obtained from the Victorian Emergency Minimum Dataset held by the Department of Health and Human Services (DHHS).
- Data on hospital admissions were obtained from the Victorian Admitted Episodes Dataset also held by the DHHS.
- Principal diagnoses were coded to ICD10. Respiratory Diseases included Asthma, COPD, pneumonia and acute bronchitis. Cardiovascular diseases included Ischaemic Heart Disease, Cerebrovascular Disease and other Atherothrombotic diseases. Injuries were chosen as a control condition.
- Daily maximum temperatures were collected from Australian Bureau of Meteorology time series statistical models (quasi Poisson Generalised Additive Mixed Models with distributed lags) were used to quantify the associations between daily coal mine fire-related PM<sub>2.5</sub> and emergency presentations or hospital admissions, while controlling for seasonality, day of the week, daily maximum temperature, long-term temporal trends and area variation.
- Analyses were conducted using the statistical software package R (Version 3.3.2)
- Results are presented as cumulative Relative Risks (RR) with 95% confidence intervals (95%CI) over a 7 day lag period

## RESULTS

- Median [Interquartile range] fire generated PM<sub>2.5</sub> was 22.2 [9.7-38.5] µg/m<sup>3</sup> in Monwell, compared with 0.19 [0.04-0.61] to 2.7 [0.84-6.3] µg/m<sup>3</sup> elsewhere in the Latrobe Valley and 0.02 [0-0.05] µg/m<sup>3</sup> in Foster.
- We found increased rates of emergency presentations for asthma/COPD, and all respiratory diseases during the coal mine fire period, in comparison with non-fire periods (Figure 3 top panels, Table). However there was no evidence of increased rates for cardiovascular diseases or injuries (Figure 3 mid & bottom panels, Table).
- The cumulative effects of fire-related PM<sub>2.5</sub> on hospital admissions were not statistically significant for any condition (data not shown).
- Emergency presentations for asthma/COPD and all respiratory diseases, and hospital admissions for asthma/COPD were increased by 21% (95%CI 8-36%), 12% (4-21%) and 16% (0-36%) respectively, for each 10 µg/m<sup>3</sup> increase in coal mine fire-related PM<sub>2.5</sub>.
- There were 14 (95%CI 6-20) additional emergency presentations for asthma/COPD and 22 (8-34) for all respiratory diseases attributable to coal mine fire-related PM<sub>2.5</sub> in the fire impacted areas.



Figure 1. Hazlewood coal mine fire front at night, February 2014



Figure 2. Geographical boundaries of emergency presentation and hospital admissions records included in the analysis

Condition	RR	95% CI	p-value
Asthma and COPD	1.21	1.08 - 1.36	0.001
All respiratory diseases	1.12	1.04 - 1.21	0.004
Atherothrombotic diseases	1.00	0.84 - 1.18	0.956
All cardiovascular diseases	0.94	0.83 - 1.05	0.272
Injury	0.97	0.91 - 1.04	0.445
All conditions	1.05	1.02 - 1.07	<0.001

Table. Cumulative relative risks of daily emergency presentations associated with 10 µg/m<sup>3</sup> increase in fire-related PM<sub>2.5</sub>

## Appendix 3

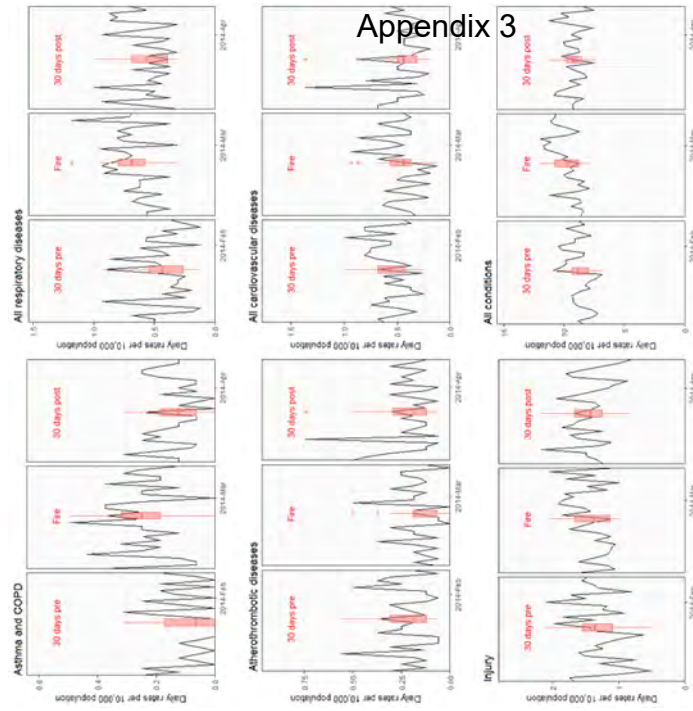


Figure 3. Daily time series of emergency presentations in all impacted areas during 30 days before and 30 days after the fire. Red bar is the boxplot of distribution of daily rates

## CONCLUSIONS

- These time series analyses have shown associations between coal mine fire-related PM<sub>2.5</sub> and use of hospital services for respiratory, but not cardiovascular diseases.
- Further analyses are being conducted to examine the effects of other air pollutants, particularly carbon monoxide on health outcomes.

## ACKNOWLEDGMENTS

- The Hazlewood Health Study is funded by the Victorian Department of Health & Human Services. The findings are the views of the authors and not the Department
- Figure 1 is reproduced with permission of Keith Pakenham, Country Fire Authority

## REFERENCE

Emmerson KM, Reisen F, Lohar A, Williamson G, Cope ME. Air Quality Modelling of Smoke Exposure from the Hazlewood Mine Fire, Melbourne: CSIRO Oceans & Atmosphere Flagship; 2016.



# Fine particulate matter and medications dispensed during and after a brown coal mine fire: a time series analysis

Appendix 3

Amanda L. Johnson, Joanna F. Dipnall, Martine Dennekamp, Grant J. Williamson, Caroline X. Gao, Matthew T.C. Carroll, Christina Dimitriadis, Jillian F. Ikin, Fay H. Johnston, Alexander C. McFarlane, Malcolm R. Sim, Dion A. Stub, Michael J. Abramson\*, Yuming Guo

\*Presenting author, Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University, Melbourne, Australia. Email: michael.abramson@monash.edu

**Aim:** Assess the association between prolonged PM<sub>2.5</sub> smoke exposure from a brown coal mine fire and medications dispensed.

## METHODS

### Study Location

Morwell open cut brown coal mine, Latrobe Valley, Victoria, SE Australia



### Data

Medication dispensing:

- Daily counts of dispensed prescription medications
- 3 health groups: Respiratory, Cardiovascular & Mental Health
- January 2013 – December 2016
- All ages
- De-identified

PM<sub>2.5</sub> Exposure:

- Daily average mine fire-related PM<sub>2.5</sub> concentrations
- Modelled by CSIRO Oceans & Atmosphere Flagship, using The Air Pollution Model coupled with a Chemical Transport Model (TAPM-CTM)

### Statistical Analysis

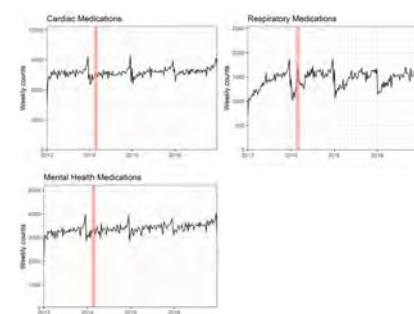
- Nonlinear distributed lag time series Poisson regression
- Controlled for: seasonality, long-term trend, day of the week, maximum ambient temperature & public holidays



Mine fire smoke plumes over the Morwell township

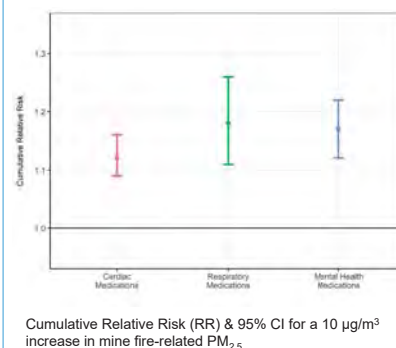
Source: Mike Keating, <http://www.sciencedirect.com/science/article/pii/S0166516215300707>

### Weekly time series plots



Raw unadjusted weekly time series for medications dispensed counts for the Latrobe Valley; 1 Jan 2013 – 31 Dec 2016  
Note: Red bars indicate the fire period

### Associations between PM<sub>2.5</sub> and Medications Dispensed



## STRENGTHS

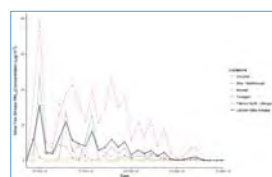
- This is the first known report of health care utilisation following a mine fire event and provides direct evidence of the impact of coal mine fire smoke on human health
- The modelled PM<sub>2.5</sub> concentrations were spatially and temporally resolved and available for the complete duration of the fire, allowing exposure to be measured as accurately as possible
- Medication dispensing data was sourced from a comprehensive government administrative dataset providing confidence in the quality and objectiveness of the data
- The use of a distributed lag model allowed the delayed and nonlinear effects of PM<sub>2.5</sub> to be examined

## LIMITATIONS

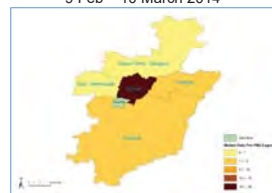
- These findings were for the Latrobe Valley population as a whole and were not specific to any individual
- PM<sub>2.5</sub> concentrations were aggregated at the Latrobe Valley level, potentially the RR for Morwell residents who experienced the highest concentrations may have been stronger
- Not all medications that could be prescribed for cardiovascular, respiratory or mental health conditions were included in the analysis
- Air pollutants analysed were limited to PM<sub>2.5</sub> and did not include other possible pollutants

## RESULTS

### Exposure Concentrations

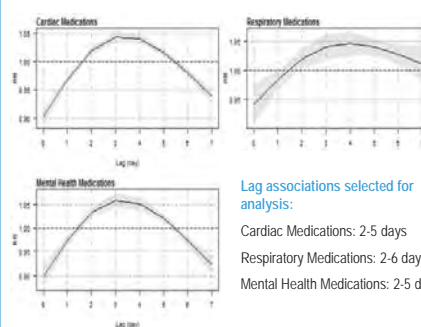


Daily average mine fire-related PM<sub>2.5</sub>  
9 Feb – 10 March 2014



Map of the Latrobe Valley showing the location of the coal mine and median daily PM<sub>2.5</sub> concentrations for the 5 regions

### Modelling of the Lag Structure



Lag associations selected for analysis:

Cardiac Medications: 2-5 days

Respiratory Medications: 2-6 days

Mental Health Medications: 2-5 days

Associations (RR and 95% CI) between medication dispensing and a 10 µg/m<sup>3</sup> increase in mine fire-related PM<sub>2.5</sub> at lags of 0-7 days, after controlling for seasonality, public holidays, day of the week, long-term trend and daily maximum ambient temperature

## CONCLUSION

Coal mine fire PM<sub>2.5</sub> smoke was associated with increased dispensing of medications for cardiovascular, respiratory & mental health conditions.

## ACKNOWLEDGMENTS

### Funding

This research was funded by the Victorian Department of Health and Human Services. These findings present the views of the authors and do not represent the views of the department.

### Medication Dispensing Data

Medication Dispensing data were provided by the Commonwealth Department of Human Services, from the Pharmaceutical Benefit Scheme (PBS) dataset.

### Hazelwood Health Study

The Hazelwood Health Study is a large program of work that comprises a number of research streams in addition to this Hazelinks stream. Those research streams are run by a multidisciplinary group of academic and professional staff from several institutions including Monash University, the University of Tasmania, Federation University, University of Adelaide and the Commonwealth Scientific and Industrial Research Organisation. All of these staff are thanked for their contribution to this collaborative work.

## **Appendix 4**

Print media featuring the Hazelwood Health Study since November 2017

news

news@lvexpress.com.au

# Hazelwood Health Study making progress

THE Monash-based Hazelwood Health Study recently released its annual report for 2017, citing the progress of its research streams aimed at tracking the long-term health effects of the 2014 Hazelwood mine fire.

The report says a publicly released Hazelinks report showed increased rates of emergency presentations and

hospital admissions for asthma and all respiratory diseases during the mine fire, which burnt for 45 days.

Another analysis found an increased rate of mesothelioma and bladder cancer in males in the Latrobe Valley, and elevated liver, lung and blood cancers in women.

In 2017, preliminary analyses in The Latrobe Early Life Follow-Up

Study found no association between mine fire smoke exposure and birth outcomes.

Researchers in the Psychological Impacts Stream interviewed 27 Morwell residents, three years after the smoke event and thematic analysis is underway.

A photographic exhibition *Our hopes for the future of Morwell*

launched in November as part of the Community Wellbeing Stream.

In July, the study won the 2017 Monash University Faculty of Medicine, Nursing and Health Science Dean's Award for Excellence in Research - Economic and Social Impact.

For the full report, visit [hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au)



## Giffard West fire

IT took aerial water units from the Department of Land, Water and Environment and CFA firefighters several hours to control a blaze which took hold in the Giffard West area on Sunday.

Aircraft finished bombing the blaze by 5pm Sunday and it was deemed to be no further risk.

It is believed the blaze, 6km from Giffard West, may have been caused by a camp fire that had not been extinguished properly.

The spokeswoman said the fire did not threaten houses or livestock.

## Announcement by Fonterra a confidence boost

THE world's largest exporter of dairy products, Fonterra, has shown its confidence in doing business in Gippsland with a multi-million-dollar investment in manufacturing plant upgrades.

Eastern Victoria Region MLC Harriet Shing said the investment included a \$7 million expansion at Fonterra's Darnum nutritional plant.

"[The] investment will create an additional 500 million litres of processing capacity, allowing Victorian dairy farmers to grow their production and ensuring all farmers have a home for their milk," she said.

Along with creating ongoing jobs once the sites are expanded, more jobs will be created during the construction phase.

"Victoria is Australia's home of manufacturing — a diverse industry that provides jobs, high-quality exports and substantial economic growth," Ms Shing said.

"Food and beverage manufacturing is thriving, with employment steadily increasing over recent years.

Ms Shing said the announcement was a huge vote of confidence in our Gippsland dairy industry from Fonterra, a world leader in Australia's \$2 billion consumer cheese industry.

"We know local farmers have had some tough times, but today's announcement is a win for them and our local community as a whole," she said.

# Lung study will also guide future Sale health needs

LUNG function assessment of adults who lived in Sale during the 2014 Hazelwood mine fire are underway.

About 370 Sale residents who completed the adult survey have been invited by the Hazelwood Health Study to participate in the free, specialised assessments that began last week.

The aim is to take a snapshot of respiratory symptoms, lung health and asthma management in Gippsland.

During the two-hour visits, residents will complete a series of simple breathing tests and surveys under the supervision of a trained respiratory



Hazelwood Health Study Respiratory Scientist Tom McCrabb helps a participant through a series of breathing tests.

scientist.

Hazelwood Health Study respiratory coordinator Brigitte Borg said it was important as many people possible who were approached participated.

"Not only does their participation help the researchers measure the impact of the mine fire smoke, it also provides vital information about the respiratory health profile in Sale itself," Ms Borg said.

"This helps to guide long-term health service needs specific to the Sale area."

Assessments are being held at Central Gippsland Health in Sale.

Sale residents who choose to take part in the testing will be compensated for their time with a \$50 gift card.

Information on how to participate was included in the mail-out.

Participants will also be invited to undergo the

same assessments two more times — in three years, and again in six years from now.

The repeated visits will help researchers look for changes in lung health over time.

Those who choose to participate this time however, will be under no obligation to participate in the future.

Lung function assessments carried out in Morwell ended late last year, with 347 participants tested. Researchers are hoping for an equally good response in Sale.

Residents invited to participate should phone the Hazelwood Health Study bookings team on 1800 985 899.

The research is funded by the Victorian Department of Health and Human Services.

For information about the Monash University-led Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)



Hazelwood Health Study respiratory coordinator Brigitte Borg says results from the lung health testing will help guide long-term health service needs in Sale.

# Munro residents upset at meeting cancellation



# ABC NEWS

## Hazelwood mine fire linked to spike in doctor visits and prescription medication use

ABC Gippsland By Emma Field

Posted Tue 10 Apr 2018, 2:32pm



PHOTO: Morwell was covered in smoke and ash during the mine fire. (ABC News: Kathy Lord)

**RELATED STORY:** Morwell residents seven times more likely to have heart attack since Hazelwood fire

**The Hazelwood mine fire in 2014 has been linked to a spike in doctor visits by Latrobe Valley residents, as well as a jump in rates of prescription medicine being dispensed.**

**RELATED STORY:** Mine fire 'likely' contributed to an increase in deaths in Latrobe Valley

That is according to new findings from the Hazelwood Health Study released today.

The Monash University-led health study, which is being funded by the Victorian Government, found there were an extra 5,137 visits to GPs in the Latrobe Valley in a month when the coal mine fire was alight in 2014.

This included 405 cardiovascular visits, 174 respiratory visits and 286 mental health consultations.

The fire burned inside the mine for 45 days and shrouded Morwell and surrounding towns in smoke and ash.

Study researcher Yuming Guo said the increase in GP visits was attributed to the fine particles emitted by the coal fire four years ago.

"The Hazelwood health study was established to monitor any long-term health effect of that smoke event," he said.

"For [every] 10 microgram per cubic metre increase in coal mine fine particles, there was a 70 per cent increase in health service visitors, including 29 per cent cardiovascular services and 27 per cent respiratory services."

**Mental health prescriptions increase** The study estimated there was an extra 1,429 mental health-related medications being dispensed during the period examined, along with an additional 2,501 cardiovascular prescription medications and 574 respiratory medications. Mr Guo said the study would continue to monitor the long-term effects from the fire.

"Our study provided some evidence that the coal mine fire is a health risk in the Latrobe Valley," he said. "In future we want to look at carbon monoxide, which is also a type of pollution, so we want to look at this type of pollution in the future." Topics: industrial-fires, health, morwell-3840

news

www.lvexpress.com.au

# Mine fire GP visits, medication link

By HEIDI KRAAK

AN INCREASE in health service use and rates of dispensed prescription medication in the Latrobe Valley are linked to coal mine fire-related air pollutants, a Hazelwood Health Study report has revealed.

Commissioned by the Victorian Department of Health and Human Services, the Monash University-led Hazelwood Health Study is tasked with investigating the potential long-term health effects on residents impacted by the 2014 Hazelwood mine fire.

Hazelwood Health Study's Dr Yuming Guo said there were an estimated additional 5137 general practitioner consultations, 405 cardiovascular visits, 174 respiratory visits and 286 mental health consultations attributed to coal mine-fire related PM2.5 air pollution.

PM2.5 refers to fine particles with a diameter of 2.5 thousandths of a millimetre or less.

"We analyse the relationship between air pollution and the daily health outcomes," Dr Guo said.

"We also estimated that an additional 2501 cardiovascular



Huge Impact: The 2014 Hazelwood mine fire burnt for 45 days.

medications, 574 respiratory medications and 1429 mental health-related medications were dispensed as a result of the PM2.5 air pollution during the mine fire period."

Researchers obtained health service data from the

Medicare Benefits Schedule and data on prescription medications dispensed from the Pharmaceutical Benefits Scheme, the Commonwealth Scientific and Industrial Research Organisation Oceans and Atmosphere Flagship

modelled hourly coal mine-fire related PM2.5 concentrations across the Latrobe Valley area, and the Bureau of Meteorology provided daily maximum temperatures.

From there, a statistical method called time series

analysis was used to measure the associations between daily average PM2.5, use of health services or dispensing of medications in the Latrobe Valley.

Dr Guo said this particular study was important because other studies conducted by

Hazelwood Health Study had not looked specifically at coal mine fire-related PM2.5.

"We conducted this study to examine if there is any impact on coal mine fire-related PM2.5 outcomes," he said.

"We found there is clear evidence that coal mine fire-related PM2.5 was significantly associated to the usage of health service and medication dispenses for all types of outcomes, short term, long term, GP and also for mental health.

"However, the data were not enough to link any individual case to the fire."

To see the full report, the *Medicare Benefits Schedule and Pharmaceutical Benefits Scheme data: Time series analyses report*, visit [www.hazelwoodhealthstudy.org.au/study-findings/study-reports](http://www.hazelwoodhealthstudy.org.au/study-findings/study-reports).

Researchers from the Monash University-led Hazelwood Health Study are also running clinical assessments in Morwell and Sale and conducting interviews that will further assess cardiovascular, respiratory and mental health in smoke-affected communities.

news



**Coming up roses:** Friends of the Garden's Delma Matthews and Bev Maguire display their photograph in the Hazelwood Health Study exhibition.

photograph supplied

## Hopes in parliament

THE Hazelwood Health Study's photographic exhibition which allowed Morwell community groups and advocates to express their wishes for the town's future will be displayed for a week in Parliament House.

Hazelwood Health Study community wellbeing research lead and exhibition organiser Sue Yell said it was meaningful for the community to know it was a sitting week when the works were displayed so every day politicians filing into Parliament through Queen's Hall could view the community's aspirations.

"There's been so much negative press I guess around [the Morwell] community but this is a really positive story so it's really great to show how the community is resilient and bouncing back," Dr Yell said.

The exhibition features the hands of

local residents and community group members holding an object which symbolises their aspirations for the future of the town.

Dr Yell said it captured the diversity of the community and revealed the wishes of groups such as Morwell Swimming Club and "the really vibrant" Morwell Centenary Rose Garden.

"I really hope it will challenge some preconceptions [about Morwell]," Dr Yell said.

She said, even though the community experienced hardship, the people were not defined by it.

*Our hopes for the future of Morwell* was displayed at Switchback Gallery in Churchill last year and will be on display at Queen's Hall from May 21 to 25.

## **Appendix 5**

Media releases prepared by the Hazelwood Health Study since  
November 2017





Wednesday 24 January, 2018

## Heart health study underway in Morwell

Critical assessments measuring heart and blood vessels of adults who lived in Morwell during the 2014 Hazelwood mine fire are underway.

Across January and February, the Hazelwood Health Study will randomly invite 780 Morwell residents who completed the Adult Survey to participate in free, specialised assessments that began on Monday 22 January.

The two-hour appointment will include completing questionnaires, measurements and tests administered by trained researchers in private rooms. These include blood pressure, an electrical recording of the heart (ECG), ultrasound measurements of an artery in the arm and some simple blood tests.

Hazelwood Health Study researcher Brigitte Borg said the assessments will take a snapshot of the health of the hearts and blood vessels of adults living in Morwell.

"It is vital that we assess as many people as possible. Whether young or old, well or unwell, we need you to participate," Ms Borg said.

"The study needs to include people who were in Morwell but not exposed to the mine fire event, just as much as people who were exposed."

Assessments are being held in the study clinic at The Healthcare Centre, Morwell.

Morwell residents who choose to take part in the testing will be compensated for their time with a \$50 gift card. Information on how to participate was included in the mail-out.

They will also be invited to undergo the same assessments on two further occasions; once in three years and again in six years from now.

The repeated visits will help researchers look for changes in heart and blood vessel health over time. Those who choose to participate this time however, will be under no obligation to participate in the future.

Heart and blood vessel assessments carried out in the comparison community of Sale ended earlier this month with 162 participants tested.

Residents invited to participate should phone the Hazelwood Health Study bookings team on 1800 985 899.

This research is funded by the Victorian Department of Health and Human Services.

For more information about the Monash University-led Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)

### **NOT FOR PUBLICATION**

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HHS Researcher Brigitte Borg

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Wednesday 24 January, 2018

## Lung health study underway in Sale

Lung function assessment of adults who lived in Sale during the 2014 Hazelwood mine fire are underway.

Approximately 370 Sale residents who completed the Adult Survey have been invited by the Hazelwood Health Study to participate in the free, specialised assessments that began on Monday 22 January.

The aim is to take a snapshot of respiratory symptoms, lung health and asthma management in Gippsland.

During the two-hour visits, residents will complete a series of simple breathing tests and surveys under the supervision of a trained respiratory scientist.

Hazelwood Health Study Respiratory Coordinator Brigitte Borg said it was important as many people of those approached participated as possible.

"Not only does their participation help the researchers measure the impact of the mine fire smoke, it also provides vital information about the respiratory health profile in Sale itself," Ms Borg said.

"This helps to guide long-term health service needs specific to the Sale area."

Assessments are being held at Central Gippsland Health Service in Sale.

Sale residents who choose to take part in the testing will be compensated for their time with a \$50 gift card. Information on how to participate was included in the mail-out.

They will also be invited to undergo the same assessments on two further occasions; once in three years and again in six years from now.

The repeated visits will help researchers look for changes in lung health over time. Those who choose to participate this time however, will be under no obligation to participate in the future.

Lung function assessments carried out in Morwell ended late last year with 347 participants tested. The researchers are hoping for as good a response in Sale.

Residents invited to participate should phone the Hazelwood Health Study bookings team on 1800 985 899.

This research is funded by the Victorian Department of Health and Human Services.

For more information about the Monash University-led Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)

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Thursday 1 February, 2018

## First findings focusing on mother and baby health released

A Hazelwood Health Study analysis has found no association between exposure of pregnant women to mine fire smoke and earlier delivery or the birth weight of babies in the Latrobe Valley.

The finding is featured in the first volume of the Early Life Follow-Up Cohort Study report that looked at whether Hazelwood mine fire smoke exposure affected pregnancy or birth outcomes in children from the Valley.

HHS researcher Dr Fay Johnston said her team did not find an association between mothers' exposure to smoke from the mine fire and birth before full term (37 weeks), birth weight at term or weight for stage of pregnancy.

"This preliminary analysis took into account the possible influence of risk factors like age of mothers and cigarette smoking during pregnancy," Dr Johnston said.

"While these initial results are reassuring, this study was relatively small and small studies cannot always identify weak associations that might be present."

Researchers surveyed 548 children from the Latrobe Valley who were born between 1 March 2012 and 1 December 2015.

This analysis was conducted by the Menzies Institute for Medical Research at the University of Tasmania as part of the larger, Monash University-led Hazelwood Health Study.

Researchers estimated how much smoke each child may have been exposed to by matching their home address with the daily estimated amount of air pollution in that area during the mine fire period.

They also found other well-recognised factors, including smoking in pregnancy and the amount of general stress during pregnancy were correlated with lower birth weights in babies in this study .

"It is important to stress that this report only presents some initial findings from the survey completed by parents or carers of participating children. More results will be presented in later reports," Dr Johnston said.

Researchers will now complete a larger study of hospital records for babies born in the Latrobe Valley. This will cover the same time period of the survey.

This research was funded by the Victorian Department of Health and Human Services.

To view a summary of these findings, visit [www.hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries](http://www.hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries), or to view the full technical report, visit [www.hazelwoodhealthstudy.org.au/study-findings/study-reports](http://www.hazelwoodhealthstudy.org.au/study-findings/study-reports)

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P: 0408 266 652

Friday 16 March 2018

### **Hazelwood Health Study meet and greet**

Latrobe Valley residents will have the opportunity to learn about the Hazelwood Health Study at a series of community meet and greets.

The Monash University-led study was formed following the 2014 Hazelwood mine fire to identify potential health outcomes for people who may have been exposed to smoke from the fire.

The study's Communications and Engagement Adviser, Shaun Mallia, will be based at multiple Morwell locations during the next few weeks and available to speak with members of the community about the study.

On Thursday 22 March, Shaun will be based at the Latrobe Health Assembly office at Suite 1/256 Commercial Road, Morwell.

On Thursday 29 March, he will be based at Morwell Neighbourhood House at 48 Beattie Crescent, Morwell.

On Thursday 5 April, you can chat with Shaun at the ReActivate Latrobe Valley office at 226 Commercial Road, Morwell.

He will be available from 9am to 5pm and interested residents can make an appointment by phoning 0438 152 751 or 5122 7382 – or just drop in for a casual chat. Alternatively, residents should feel free to call Shaun at any time to chat about the study.

Additional dates and locations elsewhere in the Latrobe Valley and in Sale will be posted on the study website at [hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au) or Facebook page at [www.facebook.com/hazelwoodhealthstudy](https://www.facebook.com/hazelwoodhealthstudy)

#### **NOT FOR PUBLICATION**

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Monday 26 March 2018

## **Health study completes lung function assessments in Sale**

Lung function health assessments in Sale have closed with the Hazelwood Health Study testing 174 residents.

Respiratory scientists from the Study have been testing Sale residents to find out whether exposure to smoke from the 2014 Hazelwood mine fire is associated with respiratory symptoms, or changes in lung health or asthma control.

Sale residents have been included as an important comparison community to Morwell residents who were more highly exposed. However, the research also provides vital information about the respiratory health profile of the Sale community. Testing completed in Sale on 16 March.

“On behalf of the Hazelwood Health Study, I would like to extend our thanks to the Sale community for their ongoing support and hospitality,” Respiratory Stream Coordinator Brigitte Borg said.

“The members of this community have rallied to support these assessments, which have helped to ensure the ongoing success of the Study.

“Residents who participated in the testing will be invited to undergo the same assessments on two further occasions; once in three years and again in six years from now.”

Results from the Sale assessments will be compared to tests completed in Morwell last year.

Cardiovascular health testing was also carried out in Sale last year with assessments currently underway in Morwell and expected to be completed by early May.

This research is funded by the Victorian Department of Health and Human Services.

For more information about the Monash University-led Hazelwood Health Study, visit [hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au)

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EMBARGOED until Tuesday 10 April, 2018

### **Coal mine fire-related air pollution increased health service use, study finds**

Coal mine fire-related air pollutants from the 2014 Hazelwood mine fire have been linked to a rise in health service use and increased rates of dispensing prescription medications in the Latrobe Valley.

These findings were made after Hazelwood Health Study researchers related daily coal mine-fire related air pollution simulations conducted by the Commonwealth Scientific and Industrial Research Organisation to data provided by the Commonwealth Department of Human Services on health service use and prescription medication dispensed by pharmacists in the Latrobe Valley.

“It was estimated from 9 February 2014 to 10 March 2014 that there were an additional 5137 General Practitioner consultations, 405 cardiovascular visits, 174 respiratory visits and 286 mental health consultations attributed to coal mine-fire related PM<sub>2.5</sub> (fine particles with a diameter of 2.5 thousandths of a millimetre or less) air pollution,” HHS researcher Associate Professor Yuming Guo said.

“We also estimated that an additional 2501 cardiovascular medications, 574 respiratory medications and 1429 mental health-related medications were dispensed as a result of the PM<sub>2.5</sub> air pollution during the mine fire period.

“These findings showed clear evidence that PM<sub>2.5</sub> air pollution was significantly associated with an estimated increase in health service use and the dispensing of respiratory, cardiovascular and mental health medications, however, the data were not enough to link any individual case to the fire.”

Associate Professor Guo said in this instance, the examination of air pollution was limited to fine particulate matter (PM<sub>2.5</sub>) and did not include other possible pollutants such as carbon monoxide.

However, these findings will help fill in knowledge gaps that exist regarding the impact of open cut brown coal mine fire smoke exposure on health service and prescription medication usage.

“They will also be helpful in developing and introducing strategies to plan cardiovascular, respiratory and mental health services for any possible future coal mine fire air pollution in the Latrobe Valley or similar communities,” Associate Professor Guo said.

Researchers from the Monash University-led Hazelwood Health Study are also running clinical assessments in Morwell and Sale and conducting interviews that will further assess cardiovascular, respiratory and mental health in smoke-affected communities.

The *Medicare Benefits Schedule and Pharmaceutical Benefits Scheme data: Time series analyses report* is available at [www.hazelwoodhealthstudy.org.au/study-findings/study-reports](http://www.hazelwoodhealthstudy.org.au/study-findings/study-reports)

For more information about the Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)

This research was funded by the Victorian Department of Health and Human Services.

#### **NOT FOR PUBLICATION**

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HHS Researcher Associate Professor Yuming Guo

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EMBARGOED until Friday 4 April, 2018

4<sup>th</sup> May 2018

## **Hazelwood Health study completes first round of heart health testing in Morwell**

The Hazelwood Health Study has completed heart and blood vessel health assessments in Morwell, testing more than 330 people.

Testing finished on April 30<sup>th</sup> and marked the end of the first phase of the study's clinical assessments.

"Thank you to all the residents who took part in the assessments. The staff have appreciated your support and the time you committed to the testing," Hazelwood Health Study Clinical Stream Coordinator Brigitte Borg said.

"The Morwell residents who participated in the testing will be invited to undergo the same assessments on two further occasions; once in 2020 and again three years from then."

Ms Borg said the repeated assessments will help researchers look for changes in heart and blood vessel health over time in residents who lived in Morwell during the 2014 Hazelwood mine fire.

However, those who participated this time will be under no obligation to participate in the future.

As part of the assessment process, letters were sent to participants' nominated GPs if their tests revealed anything unusual, such as high blood pressure.

Local GP, Dr Ian Webb, thanked the study for sending the reports that he said has helped with the ongoing treatment of his patients.

"The letters were very informative and encouraged further discussion between doctor and patient," Dr Webb said.

"While we were aware of existing conditions in a number of instances, some of the assessments identified issues requiring further follow up with the patient.

"I appreciate the study's work in ensuring anything out of the ordinary health-wise during the assessments was brought to our attention."

Health assessments were also undertaken in the comparison community of Sale. Researchers will now begin analysing the data from these assessments, as well as the respiratory health assessments which finished earlier in the year, and expect to release findings associated with the testing later this year. For more information about the Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)

This research was funded by the Victorian Department of Health and Human Services.

### **NOT FOR PUBLICATION**

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14 May 2018

## **Morwell exhibition to be showcased at Parliament House**

An exhibition featuring the hopes and dreams of the Morwell community will make its way to the halls of the Victorian Parliament in May.

Following a successful showing at Switchback Gallery in Churchill last year, the 'Our hopes for the future of Morwell' photographic exhibition will be showcased at Queen's Hall from 21-25 May.

The exhibition was developed by the Federation University Australia-led Community Wellbeing research stream of the Hazelwood Health Study in collaboration with Morwell Neighbourhood House and Gippsland Centre for Art and Design at FedUni.

It will feature 28 photographs of community groups and members holding objects symbolising their hopes for the future of Morwell.

The project came to fruition following extensive consultations with local groups about ways to strengthen community wellbeing and recovery post Hazelwood mine fire and power station closure.

Community groups and members chose to be photographed with images that symbolise their hopes for the future. The resulting photographic images express their contributions to a positive conversation about the future for Morwell.

The exhibition will be launched at 5pm on Monday 21 May. The launch will be co-hosted by Hazelwood Health Study lead agency Monash University and study research partner Federation University Australia.

The event will be attended by a significant number of the local community, media and Members of Parliament.

"Taking the exhibition to Spring Street is important because it demonstrates that this community, which has suffered a number of setbacks including the Hazelwood mine fire, and the subsequent closure of the mine and Hazelwood power station, is showing resilience and optimism in the face of adversity," Dr Sue Yell, Community Wellbeing Research Lead and exhibition organiser, said.

"Featuring this exhibition at Victoria's State Parliament will shine a much-needed positive light on this vibrant community, and will also show them that their voices are heard beyond the Latrobe Valley."

There are plans for the exhibition to be shown in Dungog in the Hunter Valley later this year, and to put it on display locally in Morwell.

"The Latrobe Valley's communities are innovative, close-knit and extraordinarily resourceful, and it's important to recognise our strengths and opportunities through events like this exhibition," Harriet Shing, Member for Eastern Victoria Region, said.

For more information about the Hazelwood Health Study, visit [hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au)

### **NOT FOR PUBLICATION**

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Hazelwood Health Study enquiries: Melissa Peppin 03 5122 7102





14 August 2018

## Engage with the Hazelwood Health Study

The Hazelwood Health Study is inviting Latrobe Valley and Sale residents to participate in an upcoming community engagement session.

The engagement evening will be held at the Morwell RSL, 52 Elgin Street Morwell VIC 3840, on 22 August 2018, commencing at 6.30pm.

Community member and chair of the Community Advisory Committee, Carolyn Boothman, encourages locals to attend the session as it provides a vital opportunity for people to meet the researchers and discuss the process and findings to date.

"There are many different research streams to the study, with a lot of people involved in the different streams, so it is an ideal opportunity to find out what the study focuses on and what the findings are to date."

This year, we will be joined by the Latrobe Health Advocate, Jane Anderson; the Executive Officer of the Latrobe Health Assembly, Ian Needham; Deputy Commissioner of Emergency Management Victoria, Tony Murphy; and Manager of Environmental Public Health for the EPA Victoria, Bronwyn Green.

"It is really important that we all understand each other's roles and responsibilities otherwise some people get quite confused" Professor Judi Walker, HHS Principal Co-Investigator (Gippsland) said. "The study is now producing results we can share with the community and these organisations so their involvement in our annual community engagement session this year is very valuable", she said.

The Hazelwood Health Study is a long-term independent study led by Monash University in conjunction with its study partners – Federation University Australia, the University of Tasmania's Menzies Institute for Medical Research, the University of Adelaide and the CSIRO.

The study is funded by the Victorian Department of Health and Human Services. For more information about the session, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au) or [www.facebook.com/HazelwoodHealthStudy](https://www.facebook.com/HazelwoodHealthStudy)

### **NOT FOR PUBLICATION**

For more information, contact:

General enquiries re the study and the engagement session: Melissa Peppin P 5122 7102

Local Community member – HHS Community Advisory Committee Chair: Carolyn Boothman P 0419 526 709

HHS Principal Co-Investigator (Gippsland): Professor Judi Walker P 03 6429 3158



EMBARGOED until Monday 10 September, 2018  
6th September 2018

## **Hazelwood Health Study completes an investigation of the impacts of the Hazelwood mine fire on a specialist school which relocated during the smoke event**

The Hazelwood Health Study has completed an investigation of the impacts of the 2014 Hazelwood mine fire on wellbeing, educational outcomes, and teaching practices for students and staff at a specialist school which relocated during the smoke event.

"We would like to thank all teachers and administrative staff who gave their time to describe their experiences of the smoke event," Monash University researcher Dr Emily Berger said.

Dr Berger said that analysis of the interviews with students suggested that the smoke event had adversely impacted on student wellbeing, including increased feelings of anxiety and frustration, difficulty adjusting to the relocation environment, a reduced sense of safety, as well as increased levels of stress at home.

"Having to cope with these challenges likely contributed to the drop in both attendance and schoolwork completion reported during this time."

School staff also experienced anxiety and frustration around the event, particularly in relation to having concerns for themselves and their families at the same time as working hard to look after their students.

"Relocation of the school imposed extra duties upon staff, reduced their access to teaching resources, and increased the time spent dealing with student concerns. The smoke event affected teachers at the school on both a professional, and personal, level."

On a positive note, Dr Berger said that relocating the school during the event had reduced exposure to smoke for students and teachers, and that the school had been proactive in its response by taking the opportunity to engage students in a variety of outdoor activities away from the smoke.

"The school's use of a trauma-informed approach to teaching provided considerable insights into how best to support students during future emergency events, particularly those requiring an extended relocation period."

For more information about the Hazelwood Health Study, visit [www.hazelwoodhealthstudy.org.au](http://www.hazelwoodhealthstudy.org.au)

This research was funded by the Victorian Department of Health and Human Services.

### **NOT FOR PUBLICATION**

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2 October 2018

## **Our Hopes for the Future of Morwell exhibition on show at Mid Valley**

AN exhibition featuring the hopes and dreams of the Morwell community is on show to the local community for the next two months.

Following successful showings at Switchback Gallery in Churchill last year, and at State Parliament in May this year, the 'Our hopes for the future of Morwell' photographic exhibition will be on show at Mid Valley Shopping Centre in Morwell.

The exhibition was developed by the Federation University-led Community Wellbeing research stream of the Hazelwood Health Study in collaboration with Morwell Neighbourhood House and Gippsland Centre for Art and Design at Federation University Australia.

It features 24 photographs of community groups and members holding objects symbolising their hopes for the future of Morwell.

The project came to fruition following extensive consultations with local groups about ways to strengthen community wellbeing and recovery post Hazelwood mine fire and power station closure.

Community groups and members chose to be photographed with images that symbolise their hopes for the future. The resulting photographic images express their contributions to a positive conversation about the future for Morwell.

"This exhibition evolved from research into recovery from the Hazelwood mine fire. We listened and clearly heard that people wanted to do something positive about Morwell and to be a part of the conversations about the future," Health Study researcher Dr Sue Whyte said.

The photographs, taken by Clive Hutchison, also feature an accompanying caption written by each participating group describing what the object represents for them.

The exhibition will be on show from October through to early December.

"This exhibition is important because it demonstrates that this community, which has suffered a number of setbacks including the Hazelwood mine fire, and the subsequent closure of the mine and Hazelwood power station, is showing resilience and optimism in the face of adversity," Dr Sue Yell, Community Wellbeing Research Lead and exhibition organiser, said.

For more information about the Hazelwood Health Study, visit [hazelwoodhealthstudy.org.au](http://hazelwoodhealthstudy.org.au)

### Media enquiries:

For further information or photo opportunities contact:

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HHS Administrative Officer Melissa Peppin

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29<sup>th</sup> October 2018

EMBARGOED until 29/10/2018

## First findings focusing on children's lung and blood vessel health released

A Hazelwood Health Study analysis has found weak evidence for a link between higher mine fire smoke exposure and small increases in lung stiffness in children who were aged up to two at the time of the fire. Lung stiffness was one of three indicators of lung health that were measured in the study.

The analysis also found weak evidence for a link between higher mine fire smoke exposure in children who were aged up to two at the time of the mine fire and slightly increased blood vessel stiffness, although these changes were very small.

Reassuringly, no associations were seen between mine fire smoke exposure and any of these health outcomes in children whose mothers were pregnant with them at the time of the fire. However the research did show that cigarette smoking during pregnancy was clearly linked with both blood vessel and lung changes in children.

HHS researcher Dr Fay Johnston cautioned that although the results were suggestive of a possible link between mine fire smoke exposure during infancy and lung or blood vessel health, the evidence was not strong.

"We cannot rule out the possibility that the results occurred by chance, or were due to other unmeasured factors that can affect blood vessel or lung health," Dr Johnston said.

"We need to do further studies to confirm these results. It is possible that these results will change as children get older, so it is important to follow their progress to see if changes in lung or blood vessel function continue or go away."

The lung tests were carried out on 105 children. They involved using small vibrations to see how easily air goes in and out while children breathed through a tube. The heart tests involved using ultrasounds to test the blood vessel thickness and stiffness of 248 children.

The research team estimated how much mine fire smoke each child had been exposed to by looking at where the child (or mother if pregnant at the time) was each day during the fire and how polluted the air in the area was.

This analysis was conducted by the Menzies Institute for Medical Research at the University of Tasmania as part of the larger, Monash University-led Hazelwood Health Study.

This research was funded by the Victorian Department of Health and Human Services.

To view a summary of these findings, visit <http://hazelwoodhealthstudy.org.au/study-findings/fact-sheets-and-summaries/> or to request a copy of the full technical reports, please call 1800 985 899 or email [contact@hazelwoodhealthstudy.org.au](mailto:contact@hazelwoodhealthstudy.org.au)

### **NOT FOR PUBLICATION**

### **EMBARGOED UNTIL 29/10/2018**

For more information, contact:

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(or Prof Graeme Zosky (respiratory) and Dr Kazuaki Negishi (cardiovascular) Menzies Institute for Medical Research **P: 6226 7700**)

HHS Administrative Officer Melissa Peppin **P: 5122 7102**

HHS Senior Project Manager Dr Jill Blackman: **P: 0422 330 718**

# Appendix 6

Revised Media Protocol Version 3.0



## MEDIA PROTOCOL

### Background

Monash University has been contracted by the Victorian Department of Health and Human Services (DHHS) to undertake a comprehensive study of the long-term health of residents following exposure to the smoke from the Hazelwood coal mine fire.

The project involves considerable engagement with stakeholders locally, nationally and internationally, as outlined in the HHS Community Stakeholder and Engagement Strategy. Key to this engagement are the leads of each of the research streams, who make up the study's Project Steering Committee. It is expected that Stream Leads will be required to release information about study activities and findings through the media.

### The Protocol

It is important there is a **coordinated approach** to media interactions in response to ad hoc media enquiries or planned media activities resulting from release of Reports or Papers.

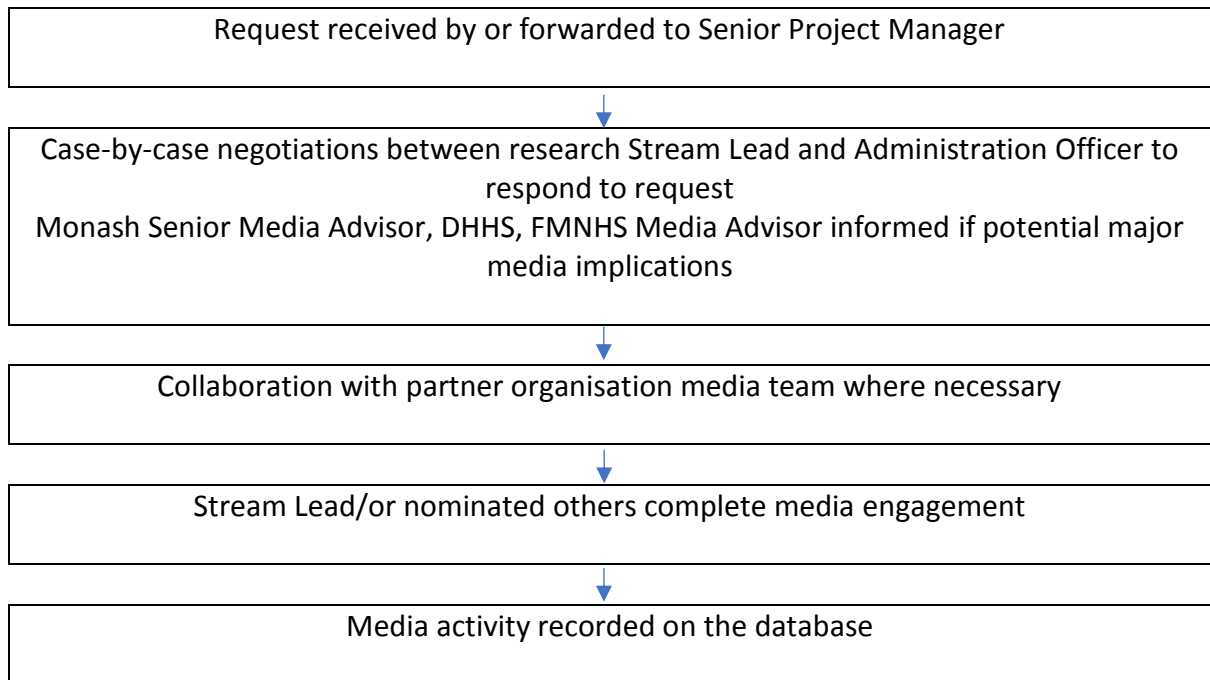
- The **Senior Project Manager** is responsible for coordination of all media activities through the **Administration Officer (Gippsland)**.
- **Research Stream Leads** are the designated spokespeople for their streams. Stream Leads will need to use their judgement regarding the seriousness, contentiousness and urgency of the request for comment. The HHS will collaborate with partner organisations' media teams where necessary.
- **State, national and international** media releases will be managed through Monash Strategic Marketing and Communications.
- **Local (Gippsland)** media releases will be managed through the Administration Officer. Should there be a **local media event** this will be managed on a case-by-case basis by Wordwise Communications.
- The outcomes of all media interactions, including the release and any subsequent interviews, will be tracked on the project **media database** maintained by the Administration Officer.
- Monash Strategic Marketing and Communications, DHHS, and the Monash Faculty of Medicine, Nursing and Health Sciences will be kept informed of all **major media activities**.
- All media responses should follow the HHS **Flowchart for ad hoc media requests** or the **Flowchart for planned media releases** as appropriate.

*All team members, including those from sub-contracted organisations, are required to follow this protocol.*

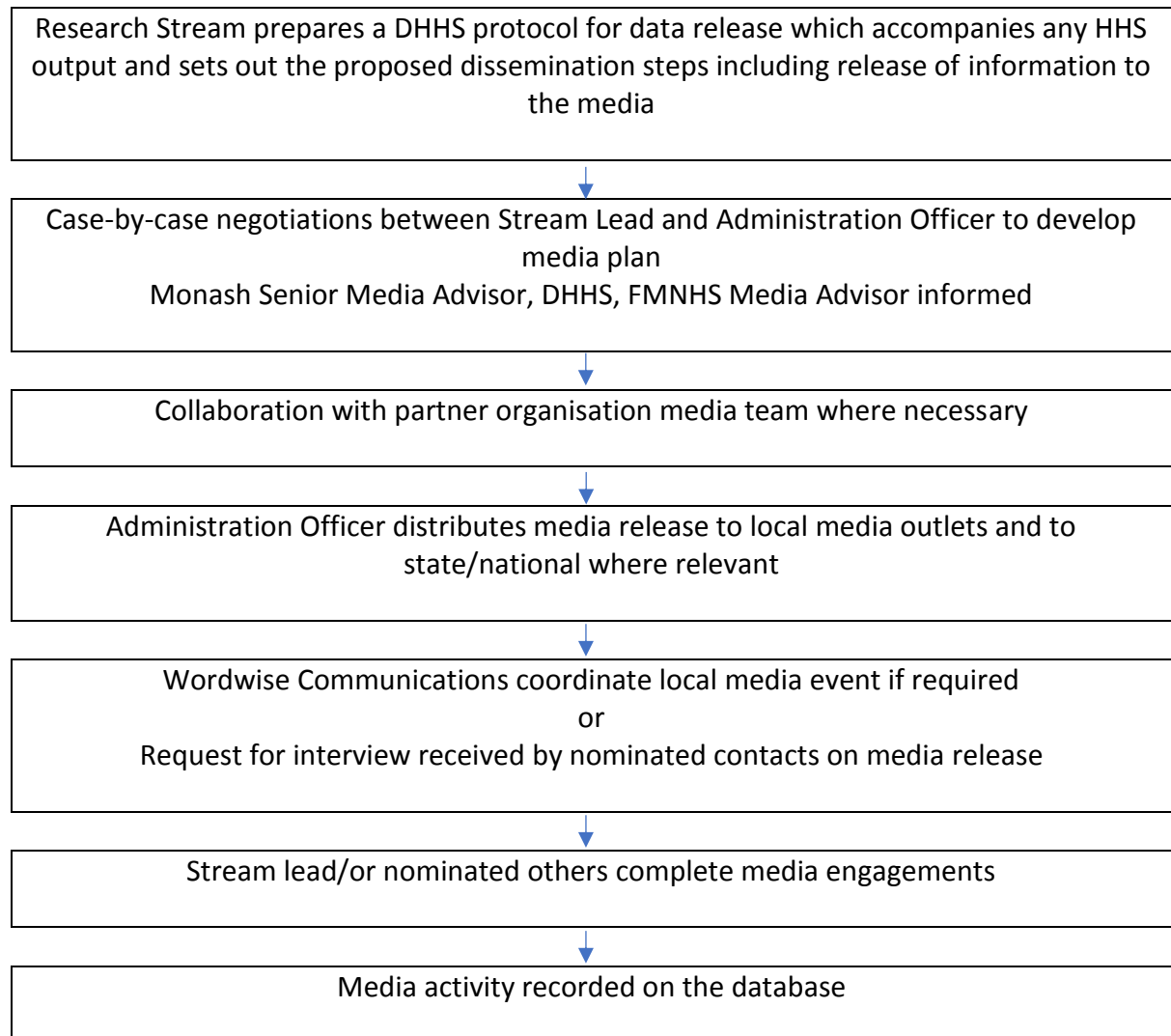
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## Flowchart for ad hoc media enquiries



## Flowchart for planned media activities



#### Document History

Version Number	Date	Contact	Brief description
1.0	16 November 2018	Hazelwood Health Study Senior Project Manager	Submitted to DHHS in fulfilment of 22 <sup>nd</sup> contractual milestone
1.1	1 April 2020	Hazelwood Health Study Senior Project Manager	Addition of omitted collaborator on the contributors page