Psychological Impacts Stream: Analysis of the key quantitative outcome variables from the first year of Schools Study data collection

Authors

Matthew Carroll

Darryl Maybery

Emily Berger

Sarah Lee

Caroline Gao

Rory Wolfe

1. Introduction:

The Schools Study component of the Hazelwood Health Study aims to determine whether exposure to smoke from the mine fire is associated with psychological trauma and distress in school aged children. The analyses, described in this report, focus on participants' scores on the Children's Revised Impact of Event Scale (CRIES) and any changes in their average National Assessment Program in Literacy and Numeracy (NAPLAN) scores before, and after, the mine fire event.

2. About the outcome measures:

The CRIES-13 (Children and War Foundation, 2005) is a revision of the earlier Impact of Event (IES) scale developed by Horowitz et al. (1979) (Horowitz et al., 1979) to monitor the symptoms of post-traumatic stress. The original IES was developed for adults and was based upon an earlier version of the diagnostic criteria for PTSD in the Diagnostic and Statistical Manual of Mental Disorders (DSM-III) (American Psychiatric Association, 1980)and the adult measure was subsequently revised to include measures of arousal in line with changes in the DSM-IV (American Psychiatric Association, 1994) (resulting in the IES-R scale used in the HHS Adult Survey). In response to this revision, and research indicating that the adult scale was not appropriate for the child population, a revision was made to develop a briefer child appropriate measure with the three sub-scales of intrusion, avoidance and arousal – the CRIES-13 (Children and War Foundation, 2005) which is the scale used by the Schools Study. The CRIES involves 13 items, 4 each for intrusion and avoidance, and 5 for arousal. Each item is scored on a 0 (not at all) to 5 (often) scale with the sub-scale scores being the sum of the relevant items and the total score being the sum of all items. There is some variation in the published literature regarding how to calculate the CRIES scores, with some publications converting the sub-scale and total scores to the 0-5 scale by dividing each score by the number of items. We had initially adopted this approach in our earlier reporting to the department as it makes comparisons between the sub-scales and total scores easier, but following a deeper review of the literature we have seen that the sum of item scores is more common so we are now using this approach.

The NAPLAN is an annual assessment program targeting students in Grades 3, 5, 7 and 9, with separate assessments conducted in the five domain areas of grammar and punctuation, numeracy, reading, spelling, and writing. The program is conducted in all mainstream schools and all students are expected to participate. Students are scored on a scale that spans all year levels, so it is expected that a student will show an increase in each domain score at each subsequent NAPLAN round. The scores themselves are meant to be stable over time, so a score of 700 in 2013 should have the same meaning as a score of 700 in 2015 to enable parents and others to monitor progression. The Australian Curriculum, Assessment and Reporting Authority (ACARA) is the independent authority responsible for managing the NAPLAN program and, following approval from the Monash University Human Research Ethics Committee, provided the study team with the available NAPLAN data for all participating students for which there was parental consent, and where a match on full name and date of birth was possible. This resulted in a dataset of 320 students, representing 98.5% of the participant sample (with 5 students unable to be matched after repeated attempts to cross-reference name and date of birth records).

3. Analytic approach:

An approach to analyse the key quantitative data was developed in consultation with the HHS biostatisticians Prof Rory Wolfe and Dr Caroline Gao and approved by the HHS Project Steering Committee. In line with the Schools Study protocol, the CRIES)was selected as the primary outcome measure to assess the psychological impacts of the event and the change in NAPLAN scores was selected as the most appropriate educational outcome measure.

Because the CSIRO exposure mapping was not available at the time of the analysis being undertaken, it was decided that school location (Morwell versus locations outside Morwell) would be used as a proxy for exposure level, with a commitment to undertaking further analyses once the exposure mapping is complete. The analytic approach selected was multiple linear regression which enabled us to compare Morwell and non-Morwell students on the two key outcome variables while adjusting for other variables that could potentially impact the outcome – in both cases we adjusted for age, gender, and school type (government versus non-government).

In the case of NAPLAN data, the analysis focused on the change in NAPLAN scores between 2013 and 2015 (effectively the 2015 score for each of the five domain area minus the score for the same domain in 2013). As outlined in the discussion of the NAPLAN scores below, it was apparent that Morwell students showed a greater average improvement from 2013 to 2015 on all five NAPLAN domain areas compared to non-Morwell students, and that Morwell students were coming from a lower score base in 2013. As noted on the MySchool website, students starting with lower scores tend to make greater gains over time than those starting with higher scores. In order to compensate for this effect, the 2013 domain score was included as an adjustment variable in the analysis to ensure that students with similar scores were compared with each other (a method known as Analysis of Covariance or ANCOVA (Vickers and Altman, 2001)).

In total, six rounds of regression analyses were conducted for each outcome measure, with crude (simply Morwell versus non-Morwell) and adjusted analyses undertaken across all grade levels (Grades 3, 5, 7 and 9), and within primary and secondary school levels. For the CRIES data these analyses were run for the total CRIES score as well as the three sub-scales (Intrusion, Avoidance and Arousal) and the CRIES8 total score which is the sum of the eight CRIES items for intrusion and avoidance only. Exclusion of the five arousal items allowed us to compare the current data with older studies using the earlier version of the CRIES scale which did not include the arousal items. Thus, there were 30 sets of regression analyses conducted for the CRIES.

Similarly, for the NAPLAN scores there were also six rounds of regression analyses for each variable (crude and adjusted for all grades, primary and secondary) and these were reported for each of the five NAPLAN domain areas (Grammar, Numeracy, Read, Spell, Write). So once again, there were 30 regression rounds for the NAPLAN data. All analyses were completed using version 23 of the IBM SPSS statistics package via scripted syntax to enable the analyses to be updated and rerun as needed and to facilitate review by the HHS biostatisticians. Copies of the syntax and the output reports have been stored on the HHS shared drive.

4. Dealing with missing values:

There were few missing values in the CRIES data with 36 missing data points from the 323 participants. As a result it was agreed that missing values would be dealt with by mean substitution, whereby the mean of the remaining items was substituted for the missing items It was noted that in a couple of instances more than one item was missing from within the same CRIES sub-scale and that the remaining sub-scale items were scored higher than the scores for the other sub-scale items, so it was agreed that the missing values should be based on the mean of scores for those items in the same sub-scale rather than the mean of all items from the measure. This is known as mean substitution for subgroups and provides a more accurate estimate and preserves the variance in the data (Acock and Demo, 1994) This resulted in slightly increased sub-scale and total scores than previously reported – but we are confident that this is a more accurate approach. In terms of the NAPLAN data, some students missed the entire testing round (so had no scores for that year) or missed specific test sessions so had missing domain scores. Because of the high level at which the data was missing, it was considered to be inappropriate to try and impute a value for that missing data so instances where a student missed either the 2013 or 2015 NAPLAN round for a domain area were excluded from the analyses.

5. Sample details:

As previously reported in the second HHS Recruitment Report (http://hazelwoodhealthstudy.org.au/study-findings/study-reports/), there were 2138 eligible students in the eligible grades in the 20 participating schools. In total, 323 students participated in the student survey, representing an overall participation rate of 15.1%, with 25% of Morwell students agreeing to participate compared to 12% of non-Morwell students. The breakdown by location and grade is summarised in Table 1. These response rates are consistent with previous research on disaster and trauma in children and youth. It was more challenging to recruit older students, particularly those in Grade 9. The participation rate of parents completing the survey about their children and the family was 65.5% and the participation rate for teachers was 87.1%. Initial analyses to assess sampling bias provided in the HHS Recruitment Report found that there was no clear evidence that students from schools closest to the mine were more likely to participate.

Table 1: Participation rates for the student survey by school location and grade

	8 Morwell schools		12 schools outside Morwell		All 20 schools	
Grade	**Eligible**	**participants n (%)**	**Eligible**	**participants n (%)**	**Eligible**	**participants n (%)**
3	174	58 (33.3)	300	55 (18.3)	474	113 (23.8)
5	162	47 (29.0)	278	43 (15.1)	440	90 (20.5)
7	77	16 (20.8)	550	68 (12.4)	627	84 (13.4)
9	90	5 (5.6)	507	31 (6.1)	597	36 (6.0)
Total	**503**	**126 (25.0)**	**1635**	**197 (12.0)**	**2138**	**323 (15.1)**
3+5+7	413	121 (29.3)	1128	166 (14.7)	1541	287 (18.6)
3+5	336	105 (31.3)	578	98 (17.0)	914	203 (22.2)

There was an almost total overlap between the parental consent for students to complete the survey and for the research team to access NAPLAN results for those students. Parental consent was not given for only 7 of the 323 students who completed the survey, and a further 5 were unable to be matched to NAPLAN records. We did, however, receive parental consent for 3 students to access NAPLAN records but not conduct student surveys and consent to access NAPLAN records for a further 11 students from a school which subsequently pulled out of the survey round. As the NAPLAN analysis is largely independent of the survey rounds we thought that it was still appropriate to access the NAPLAN records for these students and maximise our sample size. This resulted in a total NAPLAN sample of 325 students.

6. Descriptive statistics

Table 2 below provides the mean and standard deviation for the CRIES Total and sub-scale scores and for the CRIES8 Total score along with the range of scores for students in each grade within Morwell and non-Morwell schools.

Table 2: Average CRIES scores by location and grade

Sample	CRIES13 Total Mean (SD) range 0-65	Intrusion Mean (SD) range 0-20	Avoidance Mean (SD) range 0-20	Arousal Mean (SD) range 0-25	CRIES8 Total Mean (SD) range 0-40
Morwell					
Grade 3 (n=58)	27.49 (16.59) 0 - 65	8.12 (5.99) 0 - 20	9.62 (6.72) 0 - 20	9.75 (6.84) 0 - 25	17.74 (11.02) 0 - 40
Grade 5 (n=47)	22.11 (16.56) 0 - 59	6.33 (5.94) 0 - 20	8.43 (6.73) 0 - 20	7.35 (7.11) 0 - 25	14.76 (11.06) 0 - 36
Grade 7 (n=16)	10.52 (9.4) 0 - 27.33	2.44 (2.63) 0 - 8	2.81 (4.31) 0 - 15	5.27 (6.11) 0 - 18.33	5.25 (5.59) 0 - 15
Grade 9 (n=5)	16.2 (13.95) 0 - 35	4 (5.43) 0 - 13	1.8 (1.64) 0 - 3	10.4 (7.73) 0 - 19	5.8 (6.65) 0 - 16
Total (n=126)	**22.88 (16.57) 0 - 65**	**6.57 (5.89) 0 - 20**	**8 (6.77) 0 - 20**	**8.31 (7) 0 - 25**	**14.57 (11.16) 0 - 40**
non-Morwell					
Grade 3 (n=55)	25.36 (15.26) 0 - 60	7.72 (5.82) 0 - 20	10.53 (6.12) 0 - 20	7.1 (6.31) 0 - 25	18.25 (10.39) 0 - 40
Grade 5 (n=43)	15.97 (14.14) 0 - 47	4.05 (5.02) 0 - 20	5.19 (5.78) 0 - 20	6.73 (6.25) 0 - 21.67	9.24 (9.81) 0 - 38
Grade 7 (n=68)	10.47 (12.05) 0 - 45	2.85 (4.24) 0 - 18	3.19 (4.63) 0 - 16	4.43 (5.46) 0 - 20	6.04 (8.2) 0 - 32
Grade 9 (n=31)	8.61 (12.41) 0 - 53	2.29 (4.35) 0 - 20	2.26 (4.6) 0 - 16	4.06 (5.11) 0 - 17	4.55 (8.34) 0 - 36
Total (n=197)	**15.59 (14.98) 0 - 60**	**4.4 (5.34) 0 - 20**	**5.56 (6.23) 0 - 20**	**5.63 (5.94) 0 - 25**	**9.95 (10.66) 0 - 40**

It is apparent from the above table that Morwell students scored more highly on the CRIES measures than those from schools outside Morwell and that younger students scored more highly than older students. These findings will be elaborated further in the regression analyses below.

Table 3 provides the mean NAPLAN domain scores for 2013 and 2015, as well as the change between the two years for Morwell and non-Morwell students. As mentioned above, Morwell students had lower average scores on all five domain areas in 2013 compared to their non-Morwell counterparts and this working up from a lower base resulted in a greater average increase from 2013 to 2015 among the Morwell students. As noted above, this effect is likely to be due to regression to the mean as well as the impact of targeted improvement programs focused on Morwell students. It is also apparent from the table below that the mean change between years was positive for all domains and for both locations – in line with the way that NAPLAN is constructed to show change across years.

Table 3: Mean NAPLAN domain scores for 2013 and 2015 and change in scores in both locations

	Morwell			Non-Morwell		
	2013	2015	Change	2013	2015	Change
Grammar	407.21 (130.09) 0 to 671	433.01 (110.82) 15.6 to 685.8	78.52 (102.51)	489.34 (85.02) 259.1 to 693.3	514.09 (91.58) 264.1 to 797.7	45.67 (57.88)
Numeracy	387.98 (90.7) 215.9 to 702.9	417.59 (98.28) 177.8 to 708.6	83.47 (47.72)	476.58 (82.52) 249.5 to 713.6	505.45 (93.12) 258.6 to 748.5	59.56 (43.21)
Reading	413.91 (101.53) 209.2 to 636.5	432.2 (106.15) 238.5 to 677	72.51 (57.45)	493.49 (89.29) 280.7 to 689.1	519.95 (93.56) 283.4 to 748.6	52.47 (47.54)
Spelling	414.87 (109.86) 191.4 to 644.5	423.91 (115.52) 153.2 to 646.1	72.95 (52.63)	479.23 (95.49) 191.4 to 666.7	504.54 (92.47) 209.5 to 717.3	53.97 (47.02)
Writing	392.76 (92.86) 94.5 to 594.5	419.68 (79.22) 242.7 to 676	66.58 (64.79)	470.53 (73.8) 270.9 to 688.8	496.15 (78.23) 256.6 to 768.5	46.83 (56.17)

7. Regression analyses – CRIES scores:

The tables below summarise the analyses conducted on the CRIES measures, with crude and adjusted analyses across all grades and within Primary and Secondary school levels

Table 4: Regression analyses on Total CRIES

	Morwell Students	Non-Morwell Students	Crude difference between Morwell and non-Morwell		Adjusted difference between Morwell and non-Morwell *	
	Mean (SD)	Mean (SD)	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Across all grades	22.88 (16.57)	15.59 (14.98)	**7.30 (3.78 to 10.82)**	**<0.001**	**3.56 (0.11 to 7.01)**	**0.043**
Primary	25.08 (16.71)	21.24 (15.43)	3.84 (-0.62 to 8.30)	0.091	4.16 (-0.27 - 8.59)	0.065
Secondary	11.87 (10.55)	9.88 (12.13)	2.01 (-3.69 to 7.71)	0.486	0.79 (-5.53 to 7.11)	0.805

* Adjusted for age, gender and school type (government/non-government)

- Location was related with CRIES when analysed across all grades (p=0.043) with Morwell students having higher distress scores.
- Age was related with CRIES across all grades (p=<0.001) with younger students having higher distress scores.

Table 5: Regression analyses on CRIES Intrusion

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	**Mean (SD)**	**Mean difference (95% CI)**	**p-value**	**Mean difference (95% CI)**	**p-value**
Across all grades	6.57 (5.89)	4.40 (5.34)	**2.17 (0.92 to 3.43)**	**0.001**	0.96 (-0.28 to 2.21)	0.129
Primary	7.32 (6.00)	6.11 (5.75)	1.21 (-0.42 to 2.84)	0.144	1.32 (-0.29 to 2.94)	0.108
Secondary	2.81 (3.40)	2.67 (4.26)	0.14 (-1.84 to 2.12)	0.888	-0.12 (-2.32 to 2.08)	0.913

* Adjusted for age, gender and school type (government/non-government)

- Age was related with CRIES across all grades (p=<0.001) with younger students having higher distress scores.

Table 6: Regression analyses on CRIES Arousal

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	**Mean (SD)**	**Mean difference (95% CI)**	**p-value**	**Mean difference (95% CI)**	**p-value**
Across all grades	8.31 (7.00)	5.63 (5.94)	**2.68 (1.24 to 4.12)**	**<0.001**	**1.87 (0.38 to 3.36)**	**0.014**
Primary	8.67 (7.03)	6.94 (6.25)	1.73 (-0.11 to 3.58)	0.066	1.77 (-0.10 to 3.64)	0.063
Secondary	6.49 (6.70)	4.31 (5.33)	2.20 (-0.49 to 4.88)	0.108	1.22 (-1.74 to 4.17)	0.416

* Adjusted for age, gender and school type (government/non-government)

- Location was related with CRIES across all grades (0.014) with Morwell students having higher distress scores.
- Age was related with CRIES across all grades (p=0.002) with younger students having higher distress scores.

Table 7: Regression analyses on CRIES Avoidance

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	**Mean (SD)**	**Mean difference (95% CI)**	**p-value**	**Mean difference (95% CI)**	**p-value**
Across all grades	8.00 (6.77)	5.56 (6.23)	**2.45 (1.00 to 3.90)**	**0.001**	0.73 (-0.66 to 2.12)	0.302
Primary	9.09 (6.72)	8.19 (6.51)	0.90 (-0.94 to 2.73)	0.337	1.07 (-0.75 to 2.88)	0.247
Secondary	2.57 (3.83)	2.89 (4.61)	-0.32 (-2.48 to 1.83)	0.766	-0.31 (-2.70 to 2.08)	0.800

* Adjusted for age, gender and school type (government/non-government)

- Age was related with CRIES across all grades (p=<0.001) with younger students having higher distress scores.

Table 8: Regression analyses on Total CRIES 8 (the sum of the 8 CRIES items for intrusion and avoidance only, with the 5 arousal items excluded)

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	**Mean (SD)**	**Mean difference (95% CI)**	**p-value**	**Mean difference (95% CI)**	**p-value**
Across all grades	14.57 (11.16)	9.95 (10.66)	**4.62 (2.18 to 7.07)**	**<0.001**	1.69 (-0.65 to 4.03)	0.156
Primary	16.41 (11.09)	14.30 (11.04)	2.11 (-0.96 to 5.17)	0.177	2.39 (-0.62 to 5.40)	0.119
Secondary	5.38 (5.69)	5.56 (8.23)	-0.18 (-3.95 to 3.59)	0.923	-0.43 (-4.61 to 3.76)	0.840

* Adjusted for age, gender and school type (government/non-government)

- Age was related with CRIES across all grades (p=<0.001) with younger students having higher distress scores.

Summary of the above CRIES findings:

Total CRIES was higher for the Morwell school children than their counterparts in schools elsewhere in Latrobe City when adjusted for age, gender and school type. This finding was mostly driven by results for the primary school children. Specifically, similarly to the analysis of all grades, a difference between the two locations was seen when the analysis was restricted to primary school children, whereas there was only a small difference between locations when restricted to secondary school children.

8. Regression analyses - Change in NAPLAN domain scores from 2013 to 2015:

The tables below summarise the analyses conducted on the NAPLAN domain scores, with crude and adjusted analyses across all grades and within Primary and Secondary school levels.

Table 9: Regression analyses on Change in NAPLAN Grammar score from 2013 to 2015

	Morwell Students	Non-Morwell Students	Crude differences between Morwell and non-Morwell		Adjusted differences between Morwell and non-Morwell *	
	Mean change 2013 to 2015 (SD)	Mean change 2013 to 2015 (SD)	Difference in mean change (95% CI)	p-value	Difference in mean change (95% CI)	p-value
Across all grades	78.52 (102.51)	45.67 (57.88)	**31.31 (9.48 to 53.14)**	**0.005**	-2.43 (-21.79 to 16.93)	0.805
Primary	103.97 (89.68)	78.59 (52.87)	25.40 (-8.01 to 58.82)	0.134	5.46 (-32.08 to 21.17)	0.684
Secondary	3.87 (104.05)	33.11 (54.92)	-28.21 (-61.79 to 5.38)	0.099	-25.60 (-60.17 to 8.96)	0.145

* Adjusted for 2013 NAPLAN score, age, gender and school type (government/non-government)

- School type was related with change in NAPLAN scores across all grades (p=0.001) with non-government schools having a larger increase.

Table 10: Regression analyses on Change in NAPLAN Numeracy score from 2013 to 2015

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	Mean (SD)	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Across all grades	83.47 (47.72)	59.56 (43.21)	**23.13 (9.86 to 36.40)**	**0.001**	-3.40 (-15.34 to 8.55)	0.575
Primary	101.17 (37.19)	89.79 (37.38)	11.40 (-5.06 to 27.87)	0.172	2.91 (-20.30 to 14.47)	0.739
Secondary	37.66 (41.60)	46.79 (39.10)	-9.46 (-30.91 to 11.99)	0.384	-8.46 (-30.24 to 13.32)	0.443

* Adjusted for 2013 NAPLAN score, age, gender and school type (government/non-government)

- Age was related with change in NAPLAN scores across all grades (p=0.007) with younger students having a larger increase.
- Gender was related with change in NAPLAN scores across all grades (p=0.012) with males having a larger increase.

Table 11: Regression analyses on Change in NAPLAN Read score from 2013 to 2015

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	Mean (SD)	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Across all grades	72.51 (57.45)	52.47 (47.54)	**19.22 (4.38 to 34.07)**	**0.011**	-2.27 (-16.65 to 12.11)	0.756
Primary	88.36 (49.51)	80.48 (57.59)	7.88 (-15.66 to 31.42)	0.507	0.27 (-24.77 to 24.23)	0.982
Secondary	27.96 (56.04)	41.78 (38.33)	-13.66 (-35.39 to 8.08)	0.216	-18.44 (-40.02 to 3.14)	0.093

* Adjusted for 2013 NAPLAN score, age, gender and school type (government/non-government)

- Age was related with change in NAPLAN scores across all grades (p=0.012) with younger students having a larger increase.

Table 12: Regression analyses on Change in NAPLAN Spell score from 2013 to 2015

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	Mean (SD)	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Across all grades	72.95 (52.63)	53.97 (47.02)	**18.09 (3.76 to 32.42)**	**0.014**	-3.89 (-16.16 to 8.39)	0.533
Primary	88.84 (41.94)	95.29 (43.42)	-6.46 (-25.40 to 12.49)	0.500	-10.88 (-27.71 to 5.95)	0.202
Secondary	26.33 (54.31)	38.21 (38.05)	-11.46 (- 32.93 to 10.01)	0.292	-12.09 (-34.39 to 10.22)	0.285

* Adjusted for 2013 NAPLAN score, age, gender and school type (government/non-government)

- Age was related with change in NAPLAN scores across all grades (p=0.001) with younger students having a larger increase.

Table 13: Regression analyses on Change in NAPLAN Write score from 2013 to 2015

	Morwell Students	Non-Morwell Students	Crude differences		Adjusted differences *	
	Mean (SD)	Mean (SD)	Mean difference (95% CI)	p-value	Mean difference (95% CI)	p-value
Across all grades	66.58 (64.79)	46.83 (56.17)	**18.79 (1.40 to 36.18)**	**0.034**	-9.40 (-25.35 to 6.55)	0.247
Primary	85.33 (58.73)	67.17 (37.70)	18.20 (-3.94 to 40.33)	0.106	-1.08 (-20.12 to 17.96)	0.911
Secondary	7.66 (45.49)	38.69 (60.30)	-29.41 (-60.98 to 2.17)	0.068	**33.71 (3.16 to 64.25)**	**0.031**

* Adjusted for 2013 NAPLAN score, age, gender and school type (government/non-government)

- Gender was related with change in NAPLAN scores across all grades (p=0.032) females having a larger increase.

9. Summary of the above NAPLAN findings:

For the unadjusted NAPLAN results there is a large and consistent difference in the change in NAPLAN scores from 2013 to 2015, with Morwell students showing a greater increase than students from schools elsewhere in Latrobe City. This difference, however, largely disappears once the findings are adjusted for 2013 NAPLAN score, age, gender and school type. The 2013 NAPLAN scores for each domain were included in the above adjusted analyses to ensure that students with similar scores were compared with each other, compensating for the issue of regression to the mean whereby low scoring students in 2013 are more likely to improve in2015 compared to high scorers.

From the adjusted analysis of "all grades"(i.e. including all participants), there was no evidence of an impact of location (Morwell vs non-Morwell) but there was evidence in general of an impact of age, gender and school type on NAPLAN scores across the different NAPLAN domains.

In order to ensure that the larger change between NAPLAN rounds observed in Morwell students participating in the study was typical of their full school grade cohort, we examined *My School* data across the participating schools and calculated the change in scores for each NAPLAN year across each school in the region from 2013 to 2015. For example, we compared the difference between 2013 grade 3 students' scores from a particular school to their grade 5 scores in 2015. The rationale for this analysis was that while some children come and go from the school, the bulk would remain and this would allow a comparison of NAPLAN scores for all students in the region for that year by grade over the two years spanning the mine fire event. The findings are shown in Table 14.

Table 14: Difference in NAPLAN domain scores for equivalent cohorts from 2013 to 2015 for Morwell and non-Morwell schools

Location of school	Reading	Persuasive writing	Spelling	Grammar and punctuation	Numeracy
Morwell	76.83	81.67	83.83	73.83	99.67
non-Morwell	61.80	53.87	71.47	52.60	79.27
Difference	15.03	27.80	12.36	21.23	20.40

This descriptive analysis of the full year cohort data for these schools, taken from the *My School* website, shows the same higher increase for Morwell children relative to the non-Morwell children on all NAPLAN domains, consistent with data seen in our participants. While this provides a useful touchstone on the data, it does not equate to a real comparison between the students participating in the study and rest of their school by grade cohort. To do the latter we need access to de-identified NAPLAN data for the participating schools. We are in discussion with the Department of Education and Training regarding access to this data, including access to data for a wider geographic area which would also allow us to look at area level changes following the mine fire event.

10. Next steps:

The above analyses informed the development of a 2-page summary of the key findings from year one of the Schools Study (see Appendix Y), along with qualitative analysis from the student interviews. This summary document will be used as part of recruitment for the second round of data collection and will be disseminated to parents and schools as well as the local media.

Further analysis is taking place regarding the other variables that were part of the round 1 survey and once exposure metrics are available we will be able to reanalyse the CRIES and NAPLAN data along with the other variables.

11. References

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