5.0 Study results

5.1 PARTICIPANT CHARACTERISTICS

Table 2 provides a summary of the ages of the children who participated in the study as well as the time they had spent in Mount Isa. The table includes a breakdown by their sex and Indigenous status. The mean age of the sample population was 36 months, 20% were Indigenous and 54% were male. The average length of time that children had resided in Mount Isa was two years and four months.

Table 2: Description of the study samples' age, sex, Indigenous status and time spent in Mount Isa.

	Number	Mean age in months (standard deviation)	Min – Max values
Age (months)			
• All	399	36.1 (13.1)	12-59
• Male	214	36.9 (13.4)	12-59
• Female	183†	35.3 (12.8)	12-59
• Indigenous	82†	37.1 (13. 6)	12-59
• Non-Indigenous	315	35.8 (13.0)	12-59
Months in Mount Isa			
• All	386	28.1 (14.2)	1-60
• Male	210	28.4 (14.8)	1-60
• Female	174	27.8 (13.4)	2-57
• Indigenous	77	32.4 (13.3)	2-59
• Non-Indigenous	309	27.0 (14.3)	1-60

** Please note that numbers do not total 400 due to missing values from the consent forms*
† Female, Indigenous person with age not recorded

Figure 1 (page 23) illustrates where children who participated in the study lived at the time of their blood test. In addition to households where one child was tested, the map also shows the number of households where more than one child (generally a sibling) was tested.

5.2 BLOOD LEAD LEVELS FOR PARTICIPATING MOUNT ISA CHILDREN

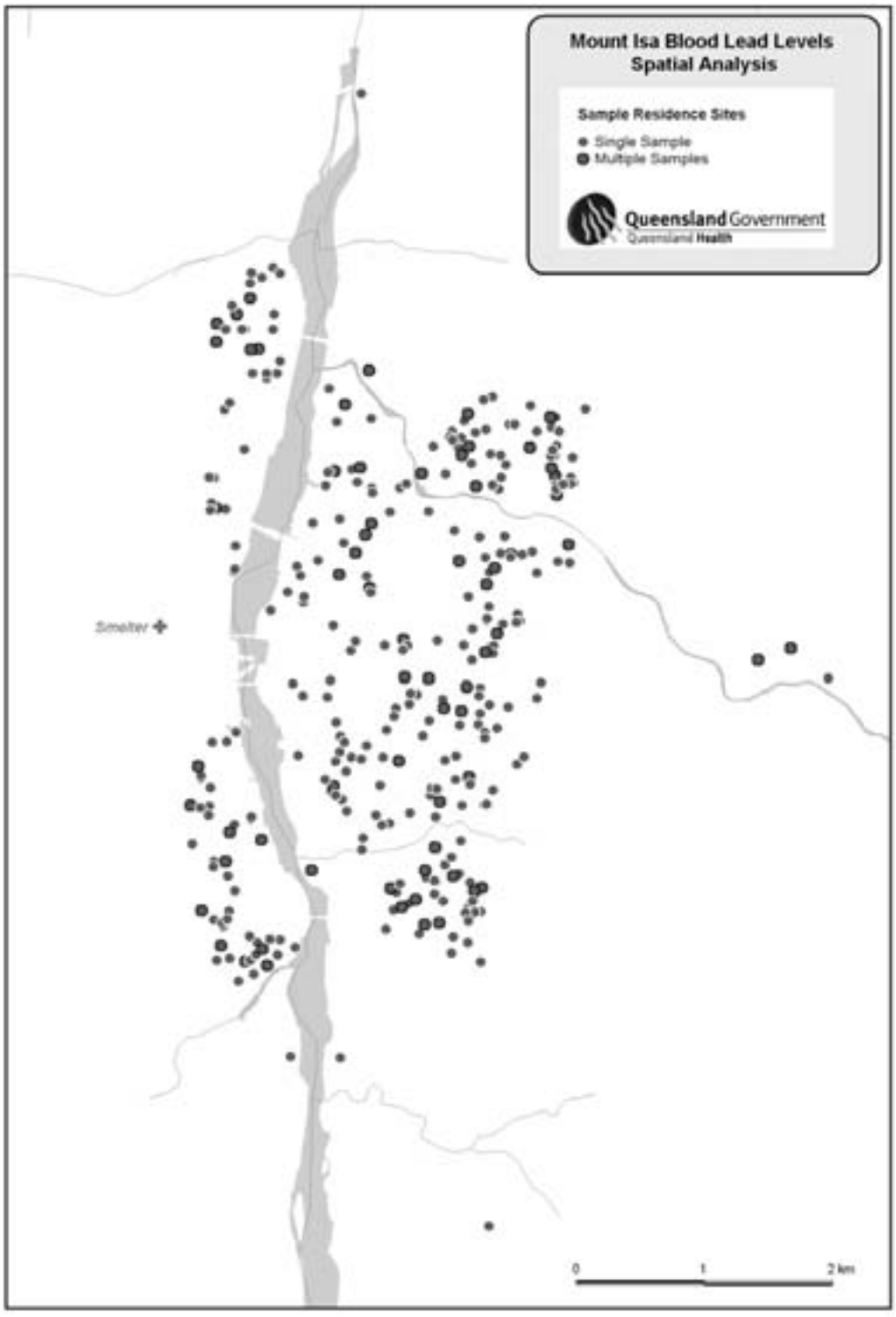
Table 3 shows the geometric mean blood lead levels for the study group with breakdowns by sex and Indigenous status. The geometric mean for the entire group was 5.0 µg/dL (with a minimum value of 1.3 µg/dL and maximum value of 31.5 µg/dL). The geometric mean blood lead for boys was 5.1 µg/dL compared to 4.8 µg/dL for girls. The geometric mean blood lead for Indigenous children was 7.0 µg/dL compared to 4.5 µg/dL for non-Indigenous children.

Table 3: Summary of geometric mean blood lead levels by sex and Indigenous status

	No.	Geometric mean blood lead level (95% confidence intervals)	Min – Max values
Blood lead (µg/dL)			
• All	400	5.0 (4.7, 5.2)	1.3-31.5
• Male	214	5.1 (4.8, 5.5)	1.9-31.5
• Female	184	4.8 (4.4, 5.2)	1.3-18.0
• Indigenous	83	7.0 (6.2, 8.0)	1.3-31.5
• Non-Indigenous	315	4.5 (4.3, 4.8)	1.5-22.7

** Please note that numbers do not total 400 due to missing values from the consent forms*

Figure 1: Study participants' home locations at the time of blood testing.



Of the 400 children who had blood lead level tests, 11.3% (45 children) had blood lead levels greater than or equal to 10 µg/dL. Of these, only two had levels above 20 µg/dL (this is the level at which children were referred to a paediatrician for examination and assistance with factors such as diet). The distribution of blood lead levels is shown in Figure 2.

Figure 2: Distribution of blood lead levels (µg/dL) for the study group.

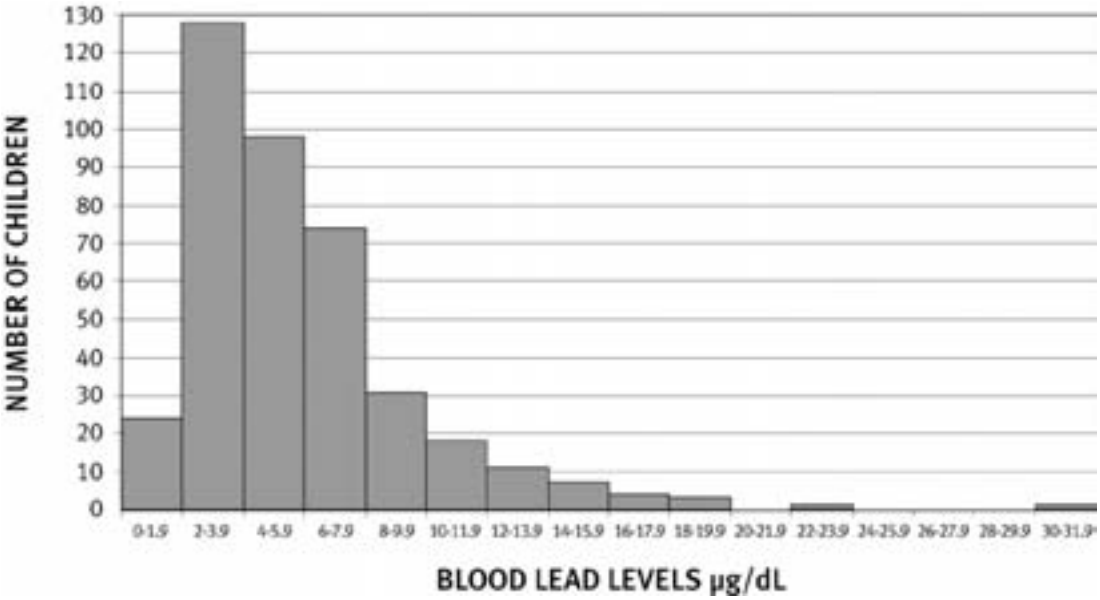


Figure 3 (page 25) shows the domestic locations of children in the study with blood lead levels of less than 10 µg/dL and equal to or greater than 10 µg/dL.

Table 4 (page 26) lists the prevalence of high blood lead ≥10 µg/dL by Indigenous status and sex.

Figure 4 (page 27) illustrates the spatial distribution of blood lead levels in the Indigenous population of children from the study.

Figure 3: Distribution of children with blood lead levels less than 10 µg/dL and those with blood lead levels equal to, or greater than 10 µg/dL.

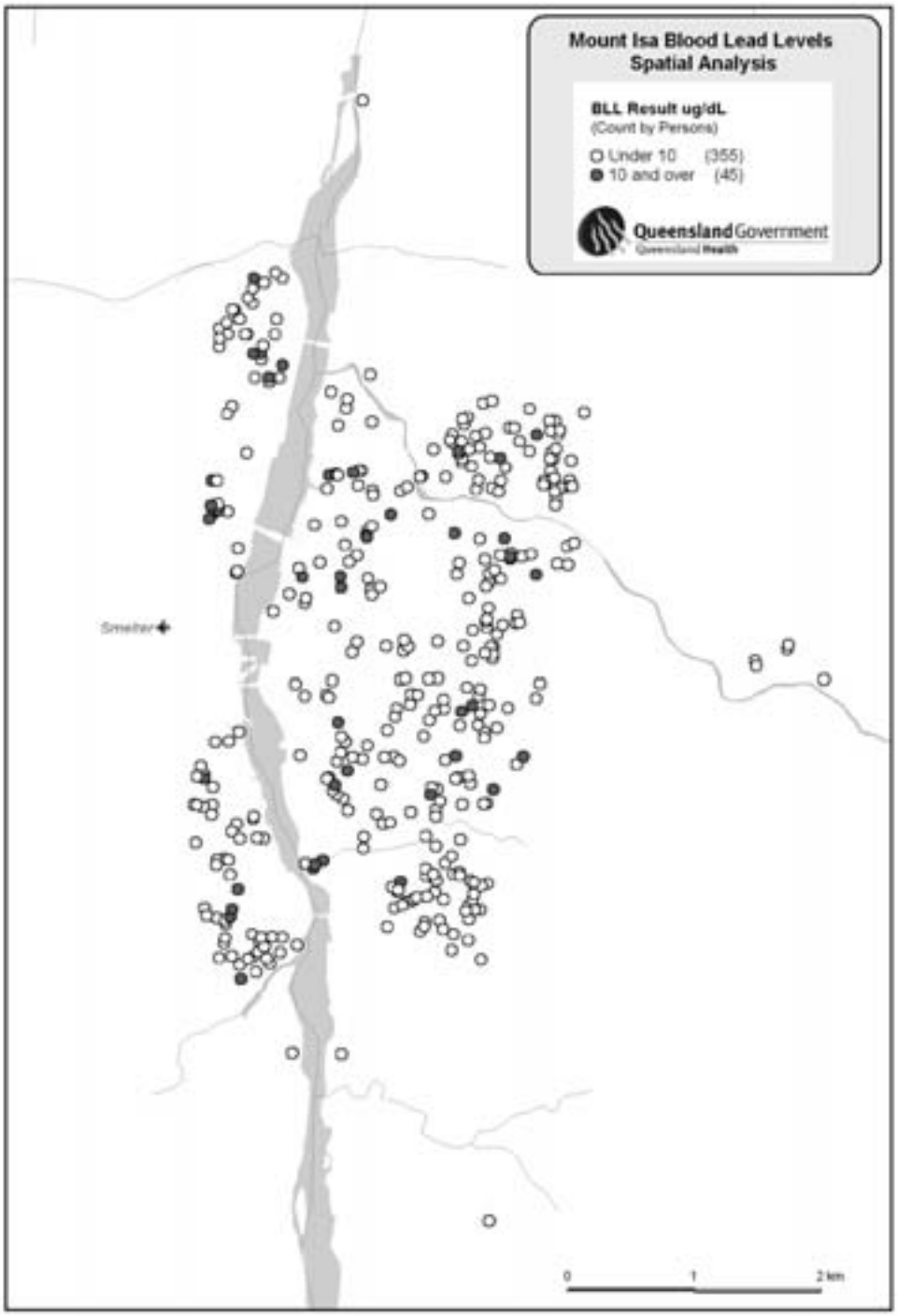


Table 4: Prevalence of high blood lead ≥10 µg/dL by Indigenous status and sex

	Blood lead levels (BLL) ≥10 µg/dL n=45
Indigenous status	
Indigenous	22 (26.5%)*
Non-Indigenous	23 (7.3%)
Sex	
Male	26 (12.1%)
Female	18 (9.8%)

** Percentage relates to the proportion of the study population with elevated blood lead levels.*

Please note that numbers for Sex do not total 45 due to missing values from the consent forms.

Figure 4: The distribution of blood lead levels for the Indigenous and non-indigenous children who participated in the study

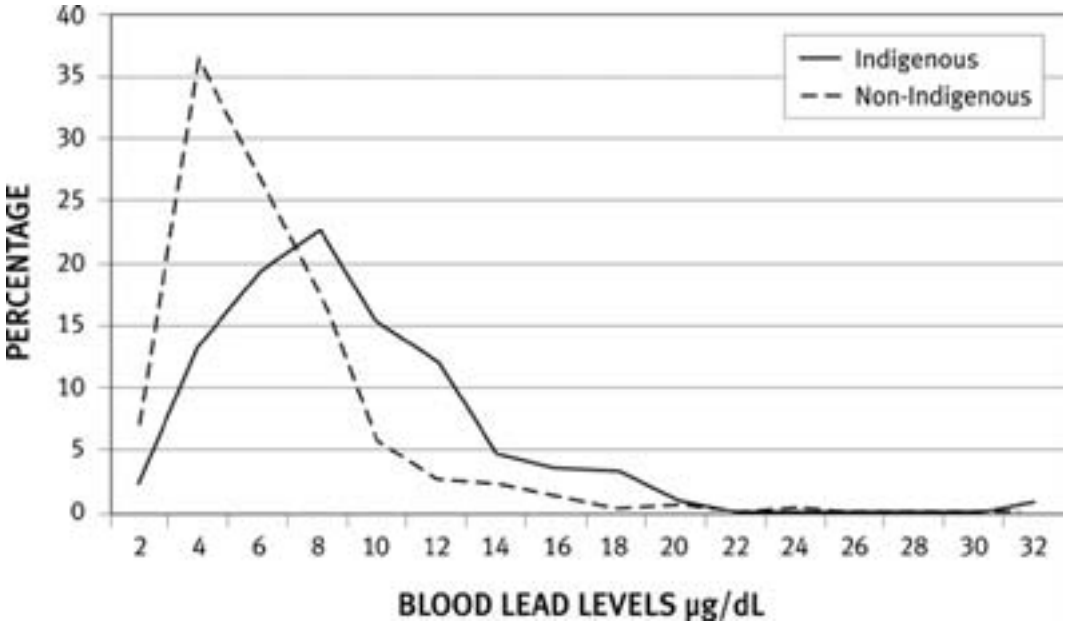
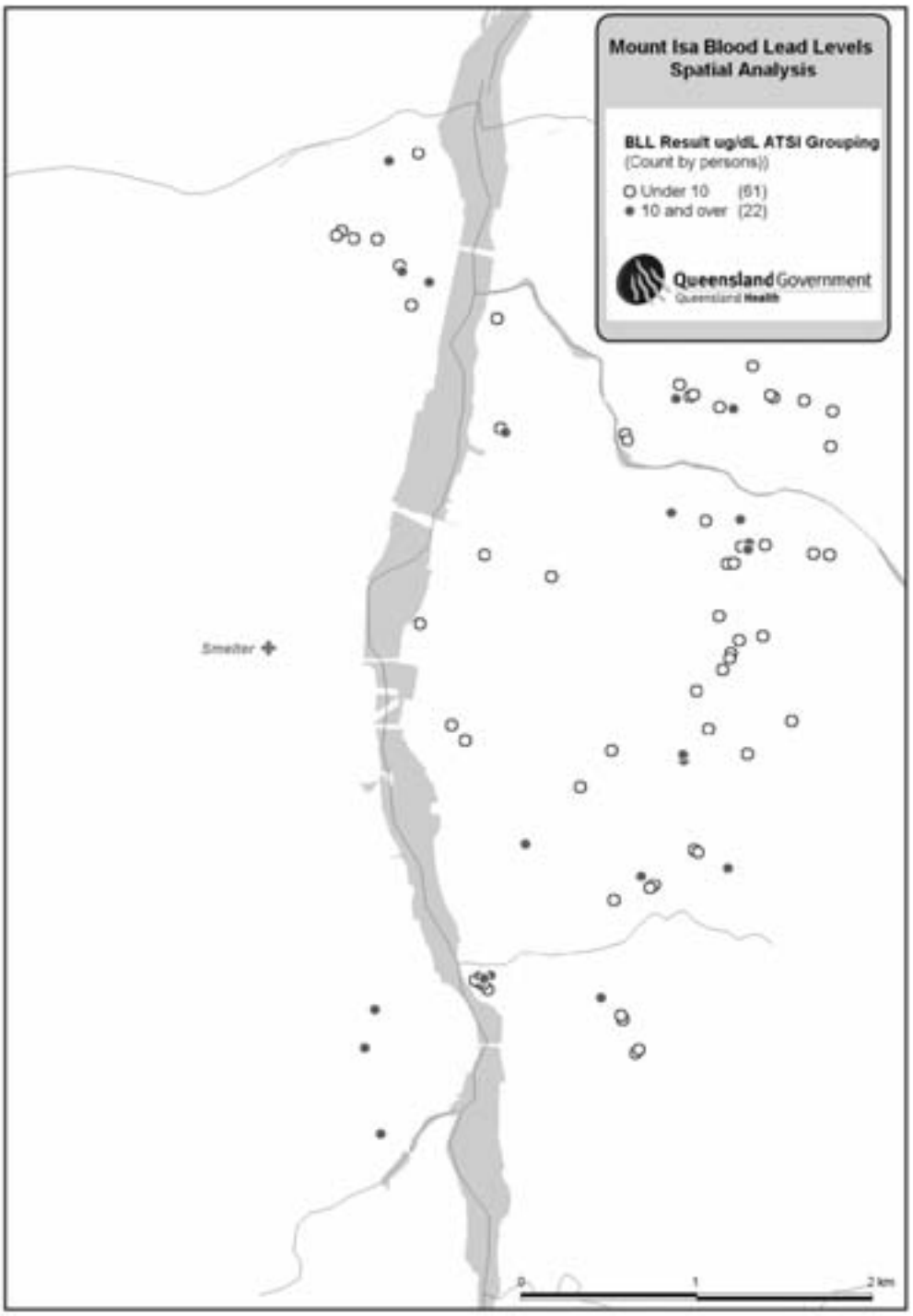


Figure 5: Distribution of Indigenous children with blood lead levels less than 10 µg/dL and those with blood lead levels equal to, or greater than 10 µg/dL.



Logistic regression analyses revealed significant associations between blood lead levels greater than or equal to 10 µg/dL and Indigenous status and age (Table 5). There were no statistically significant associations between high blood lead levels and the variables of sex or time in Mount Isa. Output for this statistical analysis can be found in Appendix 3.1.

Indigenous children were approximately four times more likely to have a blood lead level of greater than or equal to 10 µg/dL than non-Indigenous children (Table 5). With every one month increase in age, children were 4% less likely to have a blood lead level of greater than or equal to 10 µg/dL (Table 5).

Table 5: Odds ratios and 95% Confidence Intervals calculated from logistic regression model

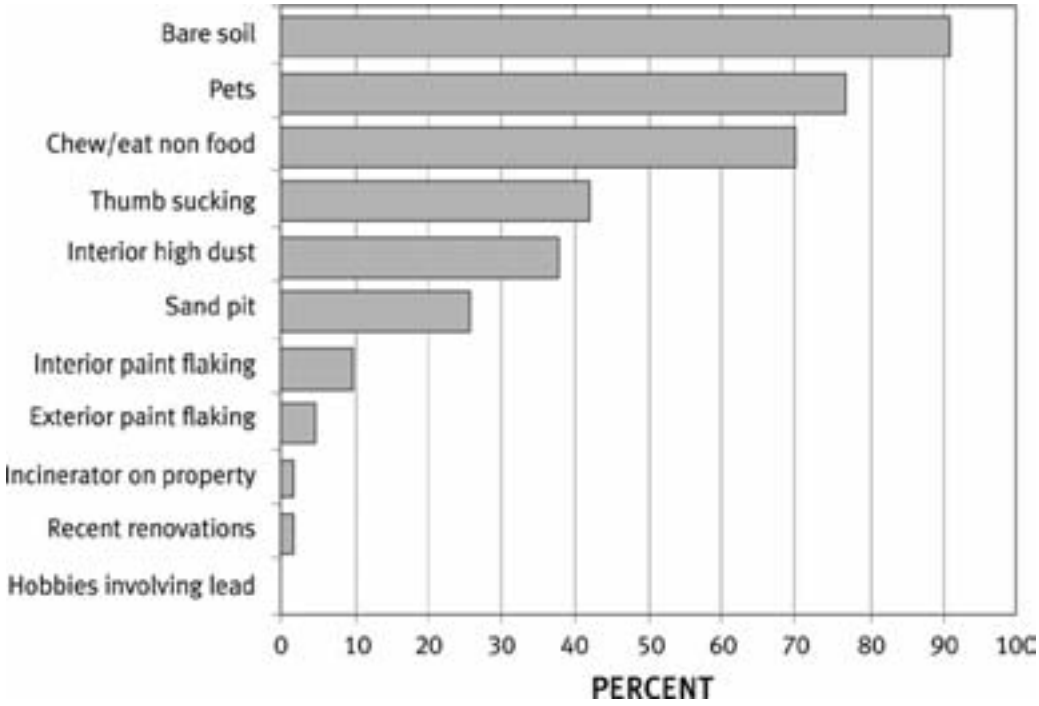
Variable	Odds ratio (95% confidence intervals)	P value
Age at test (months)	0.96 (0.92, 0.99)	0.022
Indigenous status	4.34 (2.20, 8.57)	<0.000
Sex	1.39 (0.71, 2.73)	0.337
Time in Mount Isa (months)	1.03 (0.99, 1.07)	0.159

5.3 HOUSEHOLD FACTORS

The homes of children with a blood lead level greater than or equal to 10 µg/dL (n=45) were audited to identify potential risk factors for elevated blood lead levels in children. Figure 5 shows the occurrence of some of the key risk factors for those children whose blood lead levels were over 10 µg/dL. Behaviours or other factors potentially influencing lead exposures that were common within this elevated blood lead group were: chewing/eating non food, residing in a property with bare soil and pet ownership. For those properties with bare soil the mean percentage of bare soil was 20%, with a minimum of 5% and maximum of 80%.

As indicated by the environmental audit (provided in Appendix 2), additional variables were measured in the audit. However they have not been included in this report as they were collected for the purposes of individual follow up and intervention.

Figure 6: The most frequent risk factors for lead exposure identified for those children with blood lead levels greater than or equal to 10 µg/dL.



6.0 Discussion

Figure 1 (page 23) shows the locations of all the children who provided blood lead samples for this study. The map shows that individuals who participated in the study were evenly distributed across the Mount Isa community.

The geometric mean for the entire study group was 5 µg/dL, with a maximum of 31.5 µg/dL. This is very similar to the results of the 1995 Australian survey where the geometric mean reported was 5.05 µg/dL (5.59 µg/dL in Queensland), with a maximum of 32.7 µg/dL (Donovan, 1996). Findings from the 1995 study of blood lead levels in children from representative areas across all of Australia reflected the historical use of lead in petrol and its impacts on general exposure to lead in the community.

In this study, 45 children (11.3% of those in the study group) had blood lead levels greater than or equal to 10 µg/dL. Of these, two children had blood lead levels greater than 20 µg/dL. These two children were referred to a paediatrician for additional examination and discussion of measures to reduce blood lead levels. There is evidence to suggest a non-threshold relationship between increases in blood lead level in children and reductions in indicators of learning development such as IQ, meaning that efforts should be made to reduce lead exposure in children.

Statistically significant factors found to influence blood lead levels of children in the study group were age and Indigenous status. Both of these statistical relationships are consistent with those found in the 1995 Australian study (Donovan, 2006). Age is a common influence and relates to general play activity (e.g. play in soil and sand, and with pets) and associated hand-mouth activity associated with such play, as well as dietary factors associated with inadequate intake of calcium and iron. Those Indigenous children in the study had a much higher chance of having elevated blood lead levels. This points to the need for further examination of exposure factors such as playing in soil and with pets with associated hand-mouth activity, and predisposing dietary factors in these children.

Figure 2 (page 24) shows that for this sample, there are no distinct spatial patterns of blood lead levels within the Mount Isa township. This is consistent with the literature that indicates that individual behaviours and household factors are the most important influence on blood lead levels in children. A preliminary analysis of such risk factors reveals that important contributing factors to the elevated lead levels in this study group are chewing and mouthing behaviour, presence of bare soil in the house yard, ownership and playing with pets (in particular dogs).

For this group, the priority for Queensland Health has been to work with the families to identify and then modify any risk factors thought to relate to lead exposure and absorption in children. For some children who were identified earlier in the study, blood lead retesting has indicated that modifying risk factors (such as monitoring child hand-to-mouth behaviour and reducing access to bare soil in house surroundings) has reduced blood lead levels.

Though the magnitude of health effects of blood lead levels of < 10 µg/dL are not clear, there is increasing evidence that there is no threshold for developmental effects of lead exposure. In recognition of this, the Mount Isa community need to continue to work together to reduce lead exposure as much as possible. Queensland Health recognises the importance of this and is continuing to promote health messages through broader, population-based strategies of education and improved parental and child awareness of how to live safely with lead.

7.0 Queensland Health response

Queensland Health has been actively monitoring the results of the study to make sure that follow-up investigation and education was carried out for those households where it was considered necessary. Around four months into the study, an interim analysis was also undertaken to provide some information on trends. This interim analysis led to a number of actions such as increased community education, which included the development and circulation of fact sheets and posters and targeted stories in local community publications and newspapers (refer to Appendix 1).

For those households where children had elevated blood lead levels, individual follow-up activities have focused on:

- additional audits or collection of soil/paint/dust samples at other places where the child spends time
- assistance with modifying the home environment, and improving awareness regarding child hand-mouth behaviours and practices
- dietary investigation and advice
- additional blood testing to determine if exposure prevention strategies are reducing blood levels.

In order to maximise the efficiency and effectiveness of Queensland Health's health promotion strategies relating to lead, a research company will be commissioned in 2008 to undertake focus-group testing of Mount Isa parents to better determine current attitudes and beliefs about lead risks and protective factors.

Queensland Health continues to encourage community uptake of the free blood lead testing service at Queensland Medical Laboratory Pathology Services and will closely monitor results of any testing done. In addition, Queensland Health will continue to work with key partners through the Living with Lead Alliance to develop long-term strategies for lead management in Mount Isa.

8.0 Recommendations

1. Queensland Health will continue to monitor the results of routinely collected blood lead levels in Mount Isa, and actively manage elevated blood lead levels at 10 micrograms per decilitre and above.

2. Queensland Health will undertake a follow-up study of the blood lead levels of children in Mount Isa in 2012.

3. Queensland Health will continue to promote health messages through education and improved parental and child awareness of how to live safely with lead.

4. Queensland Health will continue to work with the Living with Lead Alliance. This work will include the development of more comprehensive mitigation strategies, including dust-control measures.

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