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## Appendix O - Comparison to National and Community Surveys

### Comparison of blood lead levels with national surveys of blood lead levels and community surveys of blood lead levels

No national baseline study has been undertaken that assesses the geometric mean (GM) blood lead level (BLL) in children under six years of age in Canada. As a result, in order to compare BLLs, this study includes findings assembled from a few studies that can provide an indication of how the levels found in Flin Flon Area children compare with levels found in other communities. None of these should be considered a “perfect” comparison - the Flin Flon Area population will likely have some characteristics that are unique, and not necessarily shared with these comparison areas of study (e.g., environment, diet, housing conditions). Instead, these comparisons should be considered as providing a *context* within which the present study’s BLL results can be interpreted.

To provide this context for interpretation, comparisons were made with national level studies in Canada and the United States, as well as with smaller studies of BLLs in atypically exposed communities in Canada. Where applicable, potential challenges with these comparisons are outlined for the reader’s consideration.

#### National surveys of blood lead levels

An age appropriate comparison can be made with the United States’ NHANES (2009-10) in which one age group studied is children between one and five years old. The challenge with this comparison is that cultural, regulatory, and environmental differences likely impact on comparability. Additional, comparisons can be made with the Canada Health Measures Survey (2013b.). Although the CHMS is designed to be representative of 96% of the Canadian population, it does not include areas with a population less than 10,000 people. Furthermore, the only data collection sites in Prairie provinces for this round of the CHMS were Winnipeg, MB, Calgary, AB, and Edmonton, AB. With these cautions in mind, the comparison demonstrates that, as illustrated in Table 1-1, the GM BLL for the comparable age group of one to five year olds from the NHANES was slightly lower (1.17 µg/dL) when compared with the geometric mean found among Flin Flon Area children (1.41 µg/dL overall), and slightly lower than the geometric mean found among children in West Flin Flon (2.11 µg/dL).

**Table 1-1: Blood lead concentrations as reported by a Canadian and a U.S. National Population Biomonitoring Studies**

Age	Data Source	Geometric Mean ( $\mu\text{g/dL}$ )	Reference
0-6 years	Flin Flon Area Overall	1.41 (95% CI: 1.07-1.76)	Current Study
0-5 years	Flin Flon Area Overall	1.41 (95% CI: 1.05-1.77)	Current Study
0-6 years	West Flin Flon	2.11 (95% CI: 1.42-2.80)	Current Study
0-5 years	West Flin Flon	2.23 (95% CI: 1.52-2.94)	Current Study
3-5 years	CHMS	0.93 (95% CI: 0.86-1.0)	CHMS 2013
1-5 years	U.S. NHANES (2009-10)	1.17 (95% CI: 1.08-1.26)	U.S. CDC 2011

### Community surveys of blood lead levels

In addition to the studied reported above, there have been a number of recent smaller studies that have been conducted with younger children in communities that would be considered atypically exposed (see Table 1-2). When the Flin Flon Area children's levels are compared with these studies, the geometric means obtained in the Flin Flon Area are considerably lower than geometric mean ranges found in these other communities.

Among recent community studies where exposure to soil has been a primary concern, the geometric means found in the present study are lower than those found among children in Trail, BC (5.0  $\mu\text{g/dL}$ ), and similar to levels found among children living in an area in proximity to a lead smelter in Belledune, NB (3.54  $\mu\text{g/dL}$ ). In these cases, the studies were conducted in areas in proximity to smelters. Cautions in making these comparisons are that the soil levels and original BLLs found in Trail, BC are magnitudes higher than what has been measured in the Flin Flon Area. A caution with making the comparisons with the Belledune study that focused on children living beside a smelter is that it included only a small number of samples ( $n=10$ ), and that Belledune is a coastal, rural area whose residents likely have significant differences in diet and activity, when compared with Flin Flon Area residents.

When compared with other atypically exposed communities where the exposure concern has not necessarily been soil, but rather water or food, the results obtained for children in the Flin Flon Area are again consistently lower than other study results. Results in Flin Flon Area children are lower than those found in similar aged children in North Hamilton (2.3  $\mu\text{g/dL}$ ). Cautions in making this comparison are that the main exposure concern was water, and North Hamilton is a large, urban area with likely different environmental and population characteristics when compared to the Flin Flon Area. Other studies which have focused primarily on exposure to local food have found higher GM BLLs (5.3  $\mu\text{g/dL}$ ) in five year old children in Nunavik, Quebec. The main challenges in making comparisons to this study is that it was undertaken in a northern, Aboriginal community which is likely to significantly differ in many ways from the Flin Flon Area.

In terms of comparison to a population without a source point of exposure, recent results from a study of a sub-set of Montreal residents (Levallois 2012) compared closely with the results of the current Flin Flon Study. The Montreal study of children ages 12 to 71 months of age found a GM BLL of 1.35  $\mu\text{g/dL}$  (95% CI: 1.27 - 1.43). Other similarities with included a higher BLL measured in boys, when compared to girls and a higher BLL among children in the 2 year old

age category when compared to other age categories. It should be noted that this study involved 1-5 year olds.

**Table 1-2: Blood Lead Concentrations for Atypically Exposed Communities**

Age	Community	Date of Measurement	Exposure Concerns	N	Geometric Mean ( $\mu\text{g/dL}$ )	Reference
Children 0-6 years old	Flin Flon Area Overall	2012	Soil	118	1.41 (95% CI: 1.07-1.76)	Current Study
Children 0-5 years old	Flin Flon Area Overall	2012	Soil	100	1.41 (95% CI: 1.05-1.77)	Current Study
Children 0-6 years old	West Flin Flon	2012	Soil	18	2.11 (95% CI: 1.42-2.80)	Current Study
Children 0-5 years old	West Flin Flon	2012	Soil	16	2.23 (95% CI: 1.52-2.94)	Current Study
Children 0.5-5 years old	Trail, BC	2011	Soil	106 <sup>1</sup>	5.0	Trail Health and Environment Committee 2011
Children 0-6 years old	North Hamilton, ON	2008	Water	616	2.3 (95% CI: 2.1-2.4)	EOHP Inc. 2009
Children 3-6 years old	Belledune, NB (proximity to smelter)	2004	Soil	10	3.54	Gov. NB 2005 (a)
Children 5 years old	Nunavik, QC	2000-2003	Local Food	110	5.3	Fraser <i>et al.</i> , 2006
Children 1-5 years old	Montreal, QC	2009-2010	Water, Dust, Paint	306	1.35 (95% CI: 1.27-1.43)	Levallois <i>et al.</i> , 2012

## Conclusion

The overall conclusion of this comparison is that Flin Flon Area children have comparable GM BLLs to those found among children in a national level US CDC (2011), and comparable to a study of a typically exposed children in Montreal (Levallois *et al.*, 2013). The study also found that Flin Flon Area children have slightly higher GM BLLs to those found among children in a recent CHMS (2013b). In addition, the study found that the GM BLL among Flin Flon Area children is considerably lower when compared to children in communities with identified source points of exposure (i.e., Trail, Hamilton, Belledune, Nunavik).

<sup>1</sup> The age range for the Trail, BC study was 6 months to 60 months of age, however the n was only provided for children under 36 months of age.