

Perceptions of lead exposure in First Nation hunters

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Introduction

Lead is a heavy metal which is classified as a probable carcinogen (group 2A) and has been shown to cause neurotoxicity as well as other deleterious effects on the cardiovascular, hematological, immunological, musculoskeletal, renal, and reproductive systems. First Nation hunters practice subsistence hunting primarily by using lead ammunition where major exposures to lead occur through ingestion of game meat. This research project reviews the current literature available on the health risks associated with eating game meat harvested with lead-based ammunition as well as the risk perceptions of First Nation hunters when using lead bullets while practicing subsistence hunting.

Materials and Methods

A literature search was carried out in the Ryerson University Library & Archives database looking for toxicological risk and risk perception of First Nation hunters when using lead-based ammunition. Combinations of 13 different keywords were used: "ammunition, blood-lead levels (BLL), bullet, consumption, Cree, exposure, First Nation, game, hunting, lead, meat, non-toxic, risk perception." After removal of non-relevant papers, the remaining articles were analyzed for their conclusions regarding the study topic.

Results, Discussion, and Conclusion

Game meat harvested with lead bullets showed elevated lead levels in tissues (Figure 2, Table 1). The lead levels were found to be most concentrated around the entry wound site. Limited data is available on the risk perception of First Nation hunters. However, in a closely related study on Quebecois hunters, 41% of hunters said consumption of game meat harvested with lead ammunition is safe and 30% said it is very safe. Further research and implementation of a non-toxic ammunition program is recommended.

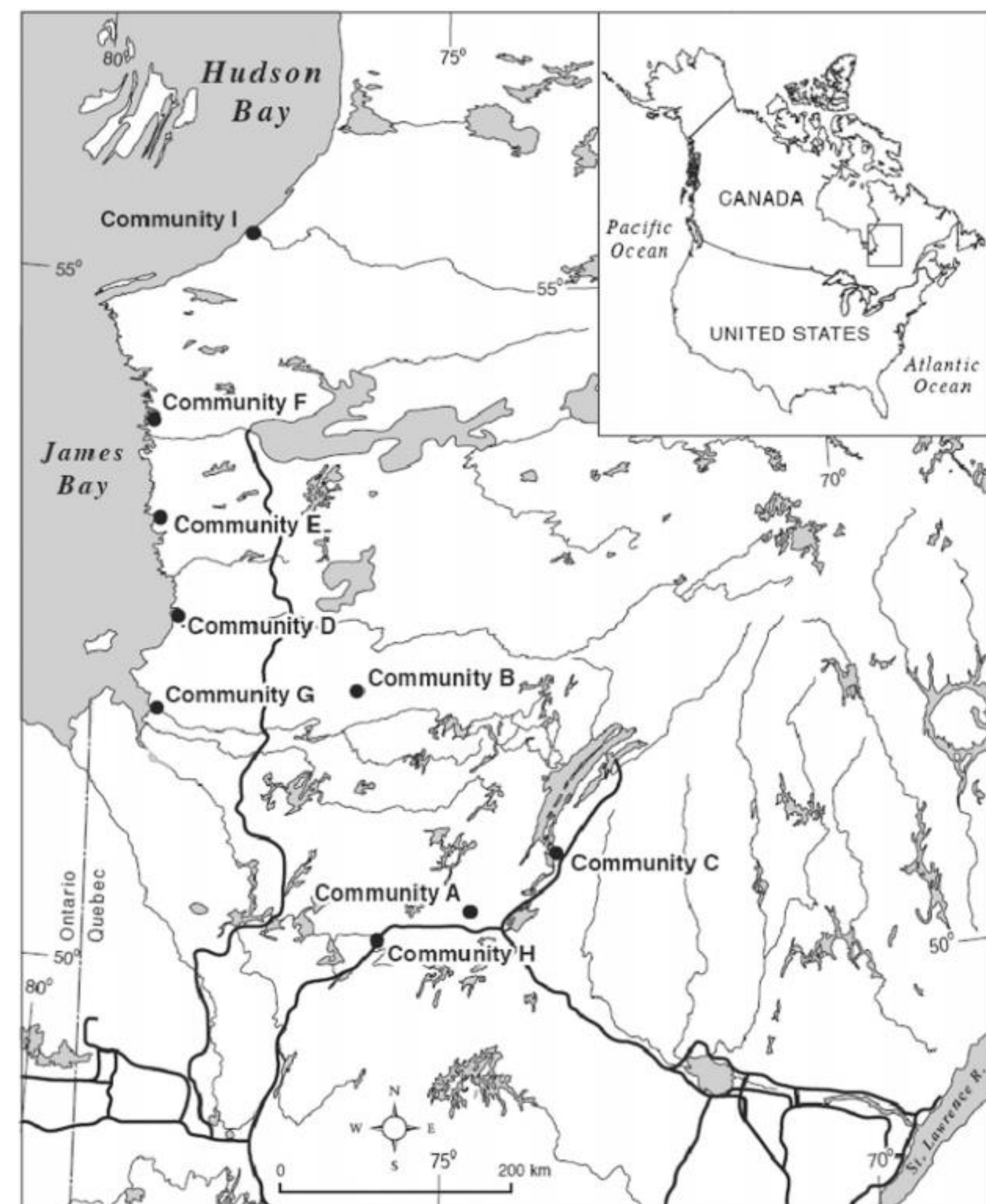


Figure 1. Communities of the Cree Territory of James Bay (retrieved from Liberda et al., 2014)

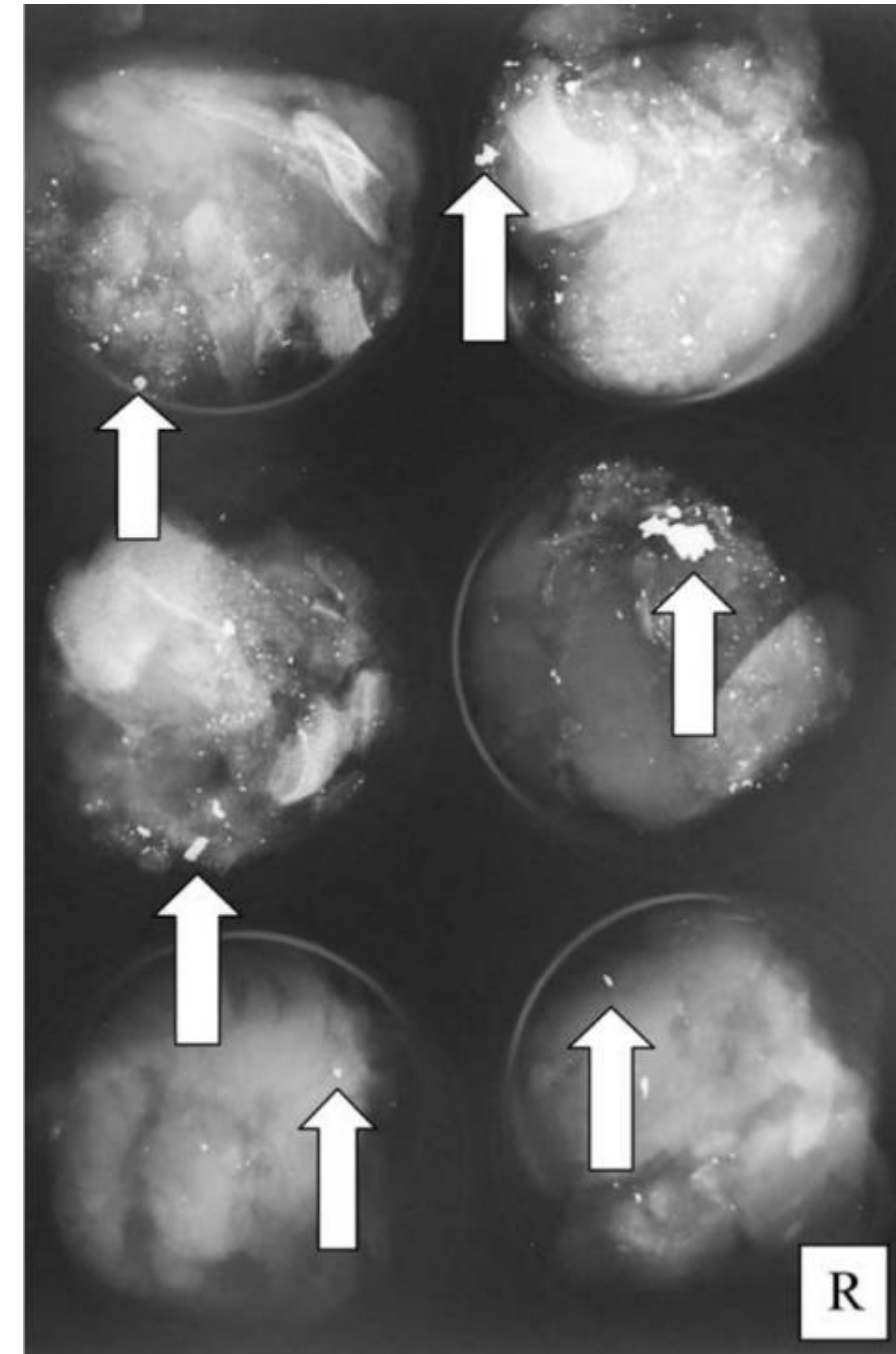


Figure 2. Radiograph illustrating lead bullet fragmentation in caribou striated muscle (retrieved from Tsuji et al., 2009)

Game	Lead concentration (mg kg ⁻¹)						Maximum level
	Mean	GM	P25	P50	P75	P95	
White-tailed deer	0.283	0.015	0.001	0.004	0.200	0.880	4.20
Moose	0.170	0.005	0.001	0.003	0.010	1.40	2.00

Note: GM, geometric mean; P25 = 25th percentile; P50 = 50th percentile; P75 = 75th percentile; P95 = 95th percentile

Table 1. Distribution of lead concentration in white-tail deer and moose meats killed by lead ammunition (retrieved from Fachehoun et al., 2015)

		Once a month	Once a week	Three times a week
White-tailed deer	Individual exposure dose (µg kg ⁻¹ bw day ⁻¹)			
	Mean	0.024	0.107	0.319
	P50	0.001	0.004	0.011
	P75	0.005	0.021	0.062
	P95	0.061	0.263	0.790
	PoCE – adults (%)	0.4	1.6	4
Moose	PoCE – children (%)	0.7	2.9	7.7
	Individual exposure dose (µg kg ⁻¹ bw day ⁻¹)			
	Mean	0.007	0.031	0.092
	P50	0.0003	0.001	0.004
	P75	0.002	0.008	0.023
	P95	0.020	0.086	0.258
PoCE – adults (%)	0.1	0.5	1.5	
PoCE – children (%)	0.2	0.9	3.3	

P50: 50th percentile; P75: 75th percentile; P95: 95th percentile

Table 2. Individual daily lead exposure doses and probabilities of critical exposure (PoCE) (adapted from Fachehoun et al., 2015)



Figure 3. Lead from ammunition will enter the food chain and expose humans and animals to health risks. (retrieved from Arnemo et al. 2016)

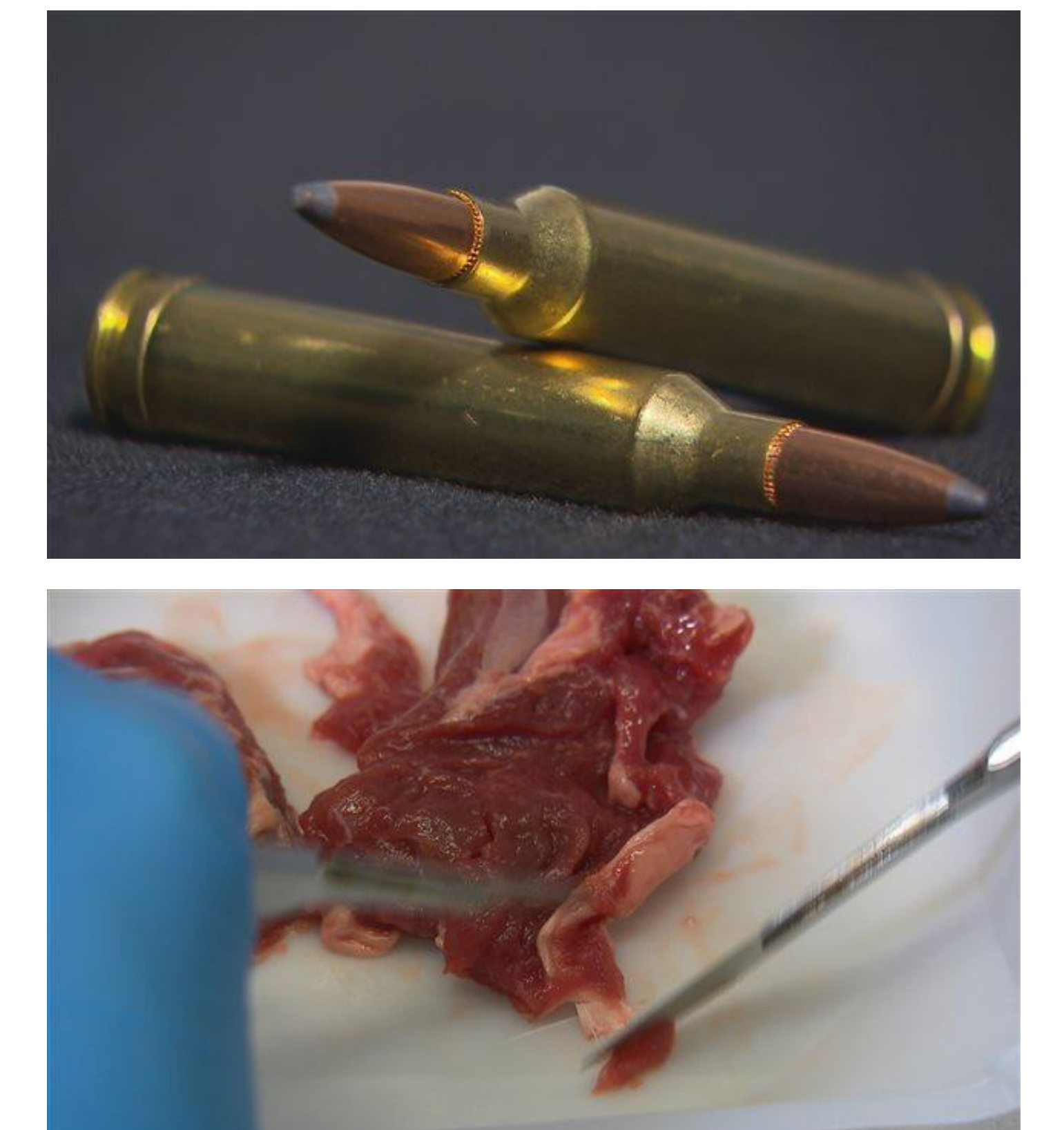
Human Exposure Discussion

There are nutritional benefits as well as cultural importance to eating game meat for the First Nations. However, actions should be taken to limit lead intake, especially for the vulnerable population. This can be achieved by discarding all meat 10cm around the bullet path and entry wound site. In addition, children and women of childbearing ages should not be allowed to eat game meat harvested by lead ammunition.

Next steps

The push towards the use of non-toxic alternatives is highly recommended. Suggestions to aid this include:

- Raising hunters' awareness on the health effects of lead ingestion
- Identifying and dissolving barriers for switching to non-toxic alternatives
- Showing hunters the relative advantage of using lead-free bullets (e.g. copper penetrates better)
- Being sensitive to the cultural context (e.g. lead bullets are harming the environment)
- Offer training to allow hunters to adapt to using a new type of bullet



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References

- Liberda et al. *Environ. Res.* **2014**, *134*, 286-294.
- Tsuji et al. *Bull. Environ. Contam. Toxicol.* **2009**, *82*, 435-439.
- Fachehoun et al. *Food Addit. Contam. A.* **2015**, *32*, 1501-1511
- Arnemo et al. *EcoHealth.* **2016**, *13*, 618-622