

Human Health Risks from Lead Ammunition

Human exposure to lead in the United States has dramatically decreased as lead has been phased out or reduced in gasoline, plumbing, paint and toys. Public health agencies regulate lead in industrial activities and consumer products, and have to varying degrees begun to address lead exposure at shooting ranges. Little attention has been focused on hunting or fishing activities that may cause harmful lead exposure.

Lead has long been the primary metal used for ammunition because of its mass and malleability, but lead is an extraordinarily toxic element. The chemical properties of lead and its harmful effects on humans have been known for nearly 2000 years ([Lessler 1988](#); [Needleman 1999](#); [Hernberg 2000](#); [Tong et al. 2000](#); [Nriagu 2009](#)).

Recent research shows that lead is toxic at very low levels once thought harmless, and at levels well below the Center for Disease Control benchmark (blood lead level of 10 micrograms per deciliter) for intervention in children and what guns groups and the ammunition industry incorrectly refer to as a “safety limit” ([Wu et al. 2003](#); [Denham et al. 2005](#); [Lanphear et al. 2005](#); [NTP 2012](#)).

When lead is ingested it attacks organs and many different body systems. Lead poisoning can damage the brain, central nervous system and reproductive system, and cause kidney disease, cancer, high blood pressure, anemia, impotence, birth defects, miscarriage, nerve disorders, memory and concentration problems, and a host of other health disorders. In large enough doses, lead can cause brain damage leading to seizures, coma and death. Even very low levels of lead exposure can decrease IQ and cause learning disabilities and behavioral problems in children or increase the probability of dying from a heart attack or stroke in adults ([ICPS 1989](#); [Needleman et al. 1990](#); [Goyer 1996](#); [Borja-Aburto et al. 1999](#); [USDHHS 2007](#); [Lustberg and Silbergeld 2002](#); [Needleman et al. 2002](#); [Canfield et al. 2003](#); [Needleman 2004](#); [Khan 2005](#); [Lanphear et al. 2005](#); [Braun et al. 2006](#); [Ekong et al. 2006](#); [Menke et al. 2006](#); [Schnaas et al. 2006](#); [Cecil et al. 2008](#); [Hauser et al. 2008](#); [Wright et al. 2008](#)).

Lead is especially dangerous to fetuses and young children, for whom poisoning is even more pronounced because lead is absorbed faster and disrupts development, causing slow growth, development defects, and damage to the brain and nervous system ([Schnaas et al. 2006](#)). Some studies link elevated bone or blood lead levels with aggression, delinquent behavior, attention deficit hyperactivity disorder and criminal behavior ([Nevin 2000](#); [Needleman et al. 2002](#); [Needleman 2004](#); [Braun et al. 2006](#); [Wright et al. 2008](#)). The consensus among medical researchers is that there is no safe level of lead exposure in young children ([CDC 2005](#)).

Hunters who use lead bullets or shot, and their families, are at risk of lead poisoning in several ways: ingesting lead shot pellets or lead bullet fragments or residues in game meat, ingesting lead residue from handling lead bullets, or inhaling airborne lead during ammunition reloading or at shooting ranges (Carey 1977; [Scheuhammer and Norris 1995](#); [Tsuji et al. 1997](#), 1999; [Scheuhammer et al. 1998](#); [Johansen et al. 2001](#), 2004, 2005; [Bierregaard et al. 2004](#); [KDHE 2004](#); [Khan 2005](#); [Mateo et al. 2007](#)).

Elevated blood lead levels and resulting health effects and disease have been well documented for people who frequent or work at indoor and outdoor firing ranges ([Fischbein et al. 1979](#); [Novotny et al. 1987](#); [Chisholm 1988](#); [Valway et al. 1989](#); [Peddicord and LaKind 2000](#); [Gulson et al. 2002](#)).

Hunters who reload rifle and pistol ammunition or cast their own lead bullets are at particular risk of harmful lead exposure.

Unsurprisingly, many studies show harmful levels of lead exposure and elevated blood lead levels in subsistence hunters who regularly eat game meat harvested with lead ammunition (Carey 1977; [Tsuji and Nieboer 1997](#); [Tsuji et al. 1997](#); [Scheuhammer et al. 1998](#); [Tsuji et al. 1999](#); [Nieboer 2001](#); [Johansen et al. 2001](#); [Johansen et al. 2004](#); [Bierregaard et al. 2004](#); [Johansen et al. 2005](#); [Mateo et al. 2007](#); [Tranel and Kimmel 2009](#); [Verbrugge et al. 2009](#); [Kosnett 2009](#)) and significantly higher lead exposure in people from hunting communities ([Dewailley et al. 2001](#); [Levesque et al. 2003](#); [Titus et al. 2009](#)).

An increasing number of studies are directly measuring high lead concentrations in game meat - from visible lead particles and fragments to very fine dust and residues only visible by radiograph - in waterfowl, squirrels, deer, pigs, game birds and elk killed by lead shotgun pellets or lead bullets ([Frank 1986](#); Harmata and Restani 1995; [Knopper et al. 2006](#); [Hunt et al. 2009](#); [Cornicelli and Grund 2009](#); [Bedrosian and Craighead 2009](#); [Pain et al. 2010](#)). The meat of game birds killed with lead shot can have high lead levels even after lead pellets are removed and the birds are cooked ([Pain et al. 2010](#)). Lead bullets tend to shatter into fragments upon impact with bone, leaving shards and imperceptible dust-sized particles of lead. This lead can infect game meat up to a foot and a half away from a bullet wound when fired from a high-powered rifle, and even lead shot can leave particles, dust and residues in game meat. Copper bullets leave no lead and rarely fragment.

The Center for Disease Control found that those consuming wild game in North Dakota have 50% more lead in their bloodstream than non-game-eaters ([Iqbal et al. 2009](#)). Several scientific studies have shown that venison packets donated by hunters to feed the hungry, processed from deer shot with lead ammunition, are contaminated with toxic lead ([Cornicelli and Grund 2009](#); [Hunt et al. 2009](#); [Cornatzer et al. et al. 2009](#)). Taking game to a processor is not a solution: research shows that in a majority of cases, one or more consumers of a hunter-killed, commercially-processed deer will consume toxic lead derived from bullets ([Hunt et al. 2009](#)). The Minnesota Department of Agriculture found lead bullet fragments in 26% to 60% of ground venison packages from commercial processors ([MDA 2008](#)). Based on these studies, state health and wildlife agencies (see for example [North Dakota](#), [Minnesota](#) and [Wisconsin](#)) recommend that women and children do not eat any game harvested with lead ammunition. Food banks and shelters have had to pull lead-tainted venison meat from their shelves. More than 2.5 million pounds of game meat (approximately 10 million meals), most of it shot with lead ammunition, is donated annually in the United States and four Canadian provinces ([Avery and Watson 2009](#)).