

Children Playing with Poison:

Arsenic Exposure from CCA-Treated Wood

Deborah L. Baptist and Nan S. Leslie



ABSTRACT

The world of children can involve exposure to many hazards, including toxic chemicals found in the environment. Arsenic is one of those chemicals. Sources of such exposure include food, soil, water, and air. However, touching chromated copper arsenate (CCA)-treated wooden structures or the soil surrounding them and then putting a finger in the mouth can raise a child's risk of arsenic poisoning. Nurse practitioners who provide routine care for children are in a position to assess their young patients for arsenic exposure and to initiate prevention strategies to protect children from exposure to this toxin. If the nurse practitioner suspects arsenic exposure or poisoning, she or he should contact the National Poison Control Directory or consult the web page for state-by-state poison control centers to determine a plan for treatment or referral.

Keywords: Arsenic, CCA-treated wood, children, chromated copper arsenate, exposure, prevention

The world of children involves play, exploration, and learning. It also involves exposure to many of life's hazards. Hazards come in numerous forms, including exposure to toxic chemicals found in the environment. One environmental health concern that has received considerable attention is children's exposure to arsenic. Potential sources of arsenic exposure for children include food, water, soil, and air.¹ However, arsenic can also be found in seemingly innocuous places, including wooden structures such as playground equipment, boat docks, patio decks, gazebos, walkways, fences, picnic tables, and so forth. The source of arsenic found in these structures is chromated copper arsenate (CCA), a wood preservative and pesticide that has been used for more than 60 years to protect wood from fungi, dry rot, mold, and termites.^{2,3} CCA-treated wood can be recognized by

its greenish to gray tint.² Children frequently play on and come into contact with wooden structures that have been treated with CCA and may be exposed to the chromium, copper, and arsenic residues that exist both on the surfaces of these structures and in the surrounding soil into which the metals have leached.⁴ Of these three components in CCA-treated wood, the toxic effects of arsenic pose the greatest risk to children.⁴

Of the two environmental forms, inorganic arsenic is considered more harmful than is organic arsenic.

Understanding the nature of arsenic exposure by CCA-treated structures is necessary if nurses wish to initiate prevention strategies to protect children. The purposes of this article are to explore potential dangers to young children who are exposed to arsenic residues in the environment from CCA-treated structures and to provide suggestions for solutions that could prevent such exposure.

Pathway to Exposure

Arsenic is an element that occurs naturally in the Earth's crust, appearing as a steel gray metal-like material. In the environment, arsenic often appears in combination with other elements and, based on these combinations, can be classified as organic arsenic or inorganic arsenic. Of the two environmental forms, inorganic arsenic is considered more harmful than is organic arsenic.⁵

Inorganic arsenic is found both naturally in the environment and in man-made products such as pesticides. Although the United States no longer produces arsenic, it continues to import and use arsenic produced in other countries. In the early 1990s the Environmental Protection Agency (EPA) banned the use of pesticides formulated with inorganic arsenic for use in agriculture. However, the use of arsenic as a pesticide and wood preservative in the form of CCA continued until December of 2003 when the EPA removed CCA-treated wood from the residential marketplace.⁶ Unfortunately, the ban on CCA-treated wood did not address the way to deal with wooden structures already in place in many residential settings and on playgrounds and other places frequented by children. According to the EPA, roughly 14% of public playgrounds have CCA-treated wooden structures, and

70% of single-family homes have decks and porches constructed from CCA-treated lumber.⁷ Furthermore, a study undertaken to determine the effects of time and weathering on the chemical structure of arsenic and chromium in CCA-treated wood and the transport of these elements into the environment showed that the arsenic-chromium cluster has long-lasting stability as indicated in its presence in samples of new wood, aged wood, and wood residue.³ The environmental implication of this long-term stability is that as the wood surface is

rejuvenated by erosion, the surface arsenic concentrations are maintained.³

The problem with arsenic residues from CCA is found in the pathways through which children can be exposed, including dermal contact with both CCA-treated wood and CCA residues that have leached into the soil. Compounding the problem of dermal contact is the propensity for young children to put their hands in their mouths after touching CCA-treated structures and to eat CCA contaminated soil.⁴

The possibility of a child being exposed to arsenic from CCA residue by the dermal or the oral route prompted Kwon et al⁷ to undertake a study in 2004 to examine the amount of arsenic on the hands of children who had contact with CCA-treated wood structures in playgrounds and with the sand beneath these structures. Results showed that the mean amount of water-soluble arsenic on the hands of children from the playgrounds with CCA-treated wood structures was significantly higher ($P < 0.001$) than the mean amount of water-soluble arsenic found on the hands of children from the playgrounds without CCA-treated wood. On the basis of these findings the investigators recommended that children wash their hands after playing on structures that have possibly been treated with CCA to decrease the potential for exposure to inorganic arsenic.

Based on safety concerns for children, raised by the general public and state regulatory agencies, EPA researchers undertook a probabilistic arsenic exposure assessment to evaluate the potential risk to children from CCA-treated wood.⁴ An in-depth analysis of several independent variables that could potentially influence the total

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