

VIEWPOINT

Are Fire Policies Fair When They Mandate the Use of Chemical Flame Retardants Without Mandating Their Safety Testing?

Eric M. Hecht, MD, MSPH

Department of Public Health Sciences, University of Miami Miller School of Medicine, Miami, Florida.

Julien Thomas, MS

Department of Public Health Sciences, University of Miami Miller School of Medicine, Miami, Florida.

David C. Landy, MD, MPH, PhD

Department of Orthopedic Surgery, University of Chicago Medical Center, Chicago, Illinois.

Fire and health policies in the United States appear to be unbalanced. On the one hand, US regulations require the inclusion of chemical flame retardants (CFRs) in many household and clothing items with the goal of saving families from death and injury due to fires. On the other hand, there is no accompanying requirement to establish the safety of the chemicals used to achieve this goal, despite a wealth of data suggesting toxicity.¹⁻⁴ This public health paradox poses the greatest risk to children, who are more vulnerable to toxins than adults and are often exposed to CFRs during critical periods of development.²

A repeated scenario over the last several decades has been the market introduction of a CFR that has not undergone adequate toxicological testing, followed by its removal once toxicity concerns become apparent. In many cases, the products were on the market for decades. The original case study occurred in 1977, when the Consumer Product Safety Commission, a federal agency, effectively banned the sale of children's clothing containing the CFR 2,3-dibromopropyl phosphate (brominated tris), following the release of animal studies that found the chemical to be mutagenic and absorbed from fabrics. Prior to the ban, brominated tris had not been adequately tested for toxicity. Brominated tris was modified and replaced with chlorinated tris, which also was not adequately tested for toxicity but was then also found to be mutagenic, absorbed through skin, and, 1 year after its introduction, banned from use in children's clothing. Similarly, following the removal of polychlorinated biphenyls from the US market in 1977, a chemically related class of compounds known as the polybrominated diphenyl ethers (PBDEs) entered the marketplace and became the most commonly used household-based CFRs for several decades. In 2004, the production of several PBDEs were phased out following concerns that arose from animal tests and from human epidemiological studies suggesting associations with endocrine disruption, neurodevelopmental disorders, and cancer.^{3,4} Almost 10 years after the phaseout of these PBDEs, decabromodiphenyl ether, a chemical in the PBDE group, was brought to market only to be banned by several states in 2013.^{1,5} While not all CFRs raise toxicity concerns, it is possible that this scenario will eventually play out again because halogenated chemicals and other potentially hazardous substances, which have not undergone adequate toxicological testing, are still being used as CFRs today.¹

Chemical flame retardants are found embedded in household furniture, electronics, and insulation. In the United States, approximately 1 billion pounds

(~450 000 000 kg) of CFRs are sold each year, and several pounds of these substances can be found in the typical home.¹ This extraordinary level of CFR usage is attributable to flammability regulations. For example, the Consumer Product Safety Commission has regulations that require household products like mattresses to withstand an open flame before sale.¹ In California, furniture and children's products are required to withstand intense heat.¹ An unintended consequence of California's law has been its evolution into a "national standard" as national furniture manufacturers make their products to comply with California law.¹ Children's exposure to CFRs occurs when CFRs leach out of furniture and become part of household dust, and then children inadvertently put their hands in their mouths after playing on the floor. Public health surveillance studies on children from the United States find detectable serum levels of CFRs that are 10 times higher than those in children from other countries.¹

One of the most worrisome toxicological issues regarding CFRs and children's exposure to them is neurotoxicity. Many CFRs are lipophilic and traverse the blood-brain barrier.⁴ In studies of neonatal mice exposed to CFRs,^{3,4} researchers have seen neurobehavioral effects on motor activity, habituating reflexes, and cholinergic transmission. Epidemiological studies of children have associated higher levels of CFRs in the blood with cognitive, motor, and behavioral abnormalities.⁴ Maternal serum levels of CFRs during pregnancy have been associated with reduced IQ, an increased number of attention disorders, and hyperactivity in children.⁴ Two longitudinal studies^{6,7} have recently demonstrated associations between CFR serum levels and adverse neurodevelopmental outcomes. In 2010, Herbstman et al⁶ found a positive association between higher serum cord blood CFR levels and lower mental development test scores among children at 12, 48, and 72 months. In 2014, Chen et al⁷ found that increased serum levels of CFRs in pregnant women were associated with lower IQ scores and hyperactivity in their children. The limitations of these studies include significant losses of participants to follow-up, multiple hypothesis testing, and modest effect sizes. Nevertheless, if the detected associations are real, the population effect could be large because the exposure is common.

Inadequate regulations designed to ensure chemical safety are part of the problem. The Toxic Substances Control Act of 1976 is still the only barrier between the manufacturing and the marketing of a CFR. Although the Toxic Substances Control Act requires manufacturers to submit a premanufacture notice to the

Corresponding

Author: Eric M. Hecht, MD, MSPH, Department of Public Health Sciences, University of Miami Miller School of Medicine, 1120 NW 14th St, Clinical Research Bldg, Ste 902, Miami, FL 33136 (ehecht@miami.edu).

Environmental Protection Agency for all new chemicals (older chemicals are exempt) before they can be commercially distributed, the only required data regarding health effects is that which is already known and/or reasonably ascertained. No formal toxicity testing by the manufacturer is required as part of the premanufacture notice. It is only if the Environmental Protection Agency determines that a chemical may pose "an unreasonable risk" that safety testing might then be required. These regulations, however, might not provide adequate assurance that CFRs are not harmful.²

Strategies to rebalance fire prevention and chemical safety should begin with the idea that CFR use might be less compelling today than during the times when smoking and fireplaces were more common, and when smoke detectors, better electrical product safety standards, and fire-safe cigarettes, candles, and fabrics were not available. These changes alone have reduced the risk of death and injury due to fires. An additional starting point in assessing the need to balance fire and CFR policies is the consideration that mandatory flammability regulations involve the loss of consumer decision making regarding the purchase of a CFR-containing product and, as such, create a higher-than-usual ethical requirement for CFRs to be safe. This ethical requirement also suggests that product labeling and a publicly available registry of CFRs could

increase transparency and enhance informed decision making. A balanced approach should also include an assessment as to how effective CFRs are in actual fire-related circumstances and a reevaluation of CFR toxicity testing. Industry testing might include mutagenicity, neuroendocrine toxicity, and bioavailability studies that could potentially identify hazardous chemicals, even if these screenings have limitations regarding their potential to predict clinical disease. Finally, good public health practice includes communicating with the public, and public health officials may wish to inform families that millions of pieces of furniture in US homes currently contain banned CFR toxicants.

Some progress has already been made. California Technical Bulletin 117 was recently modified so that flammability requirements are less stringent, and newly made furniture that complies with modified Technical Bulletin 117 is also now labeled as such.⁵ Still, the label does not inform the consumer if CFRs are used in the product. This year, congressional committees are considering new ways to amend and modify the Substances Control Act. It is likely that toxicological testing of new (and old) chemicals will be discussed as these new proposals are formulated. Clarification of these issues could go a long way toward creating policies that both favor children and create safer homes. Industry should support these efforts.

ARTICLE INFORMATION

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