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Assessing Pediatric Nurses' Knowledge About Chemical Flame Retardants[1]

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Background: Chemical flame retardants are routinely applied to children's products and are harmful to their health. Pediatric nurses are in a key position to provide education to caregivers on methods to decrease their children's exposure to these harmful chemicals. However, a critical barrier is the absence of any program to educate nurses about chemical flame retardants. In order to overcome this barrier, we must first assess their knowledge. This article provides key highlights every pediatric nurse should know about chemical flame retardants and reports the results of a knowledge assessment study.
Purpose: The purpose of this study was to (1) assess pediatric nurses' knowledge of chemical flame retardants, (2) determine what topic areas of chemical flame retardants pediatric nurses lack knowledge in, and (3) determine the best method to educate nurses about chemical flame retardants.
Design and Methods: A single sample cross-sectional questionnaire design was used. A total sample of 417 advanced practice registered nurses and registered nurses completed an online survey about chemical flame retardants.
Results: Pediatric nurses' knowledge of chemical flame retardants was low (M = 13.4 out of 51). Articles, webinars, and e-mails were the primary preferred methods for education on the subject identified as a result of the survey.
Conclusions: Pediatric nurses have a large knowledge deficit related to chemical flame retardants. The data collected from this study will help structure future educational formats for pediatric nurses on chemical flame retardants to increase their knowledge.

Chemical flame retardants are marketed to the public as a mechanism of protection from fires, yet products containing flame retardants provide no more protection against fires than other safety barriers (Babrauskas, Blum, Daley, & Birnbaum, 2011). Moreover, research demonstrates that all chemicals in flame retardants are harmful to a person's health (Babrauskas et al., 2011; Gascon et al., 2011; Herbstman et al., 2010). Vulnerable populations, such as rapidly physically developing infants and children, are especially susceptible to the negative health impacts from exposure to flame retardants. The continued use of flame retardants is misleading to the public as one assumes that domestic products, especially children's products, are safe to use. Until federal law prohibits the use of these harmful chemicals, pediatric nurses, including registered nurses (RNs) and advanced practice registered nurses (APRNs), should provide education to parents and guardians on ways to decrease their child's exposure. In order to develop an education module that pediatric nurses can use, we must first assess pediatric nurses' knowledge of chemical flame retardants.

Background

Flame retardants are chemicals added to materials for the purpose of making those materials more resistant to fire, or

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Table 1 Chemical flame retardants.

Chemical name	Current state of use	Health effects linked to
Polybrominated diphenyl ethers (PBDEs)	2004: voluntarily withdrawn from production	Hyperactivity & learning disabilities in children
Firemaster 550	2001: released for use	Endocrine disruptor in rats
Tris(1-chloro-2-propyl) phosphate (TCPP)	Currently in use	Possible carcinogenicity, skin irritation, destruction of red blood cells (limited research)
Tris(1,3-dichloro-2-propyl) phosphate or chlorinated tris (TDCPP)	1977:banned from children's clothing; still used in other children's products	Cancer in animals
Tris(2-chloroethyl) phosphate (TCEP)	1992: carcinogen on the Proposition 65 list *	Fertility problems, thyroid and kidney cancers, and hyperactivity; neurotoxic

Note. Data developed from American Academy of Pediatrics, 2013; Blum & Ames, 1977; Gold, Blum, & Ames, 1978; Center for Environmental Health, 2013; National Resource Defense Council, 2010; Patisaul et al., 2012; State of California, 2015.

* Proposition 65 list: chemicals known to State of California to cause cancer or reproductive toxicity.

reducing the speed that a flame spreads. Currently there are five major known chemical flame retardants on the market today (Table 1). The majority of chemical flame retardants are lipophilic (adhering to fat cells) and have nonadherent properties to the products on which they are placed. Due to these properties, the chemicals are easily dispersed into the environment and can be inhaled, absorbed through the skin, and ingested. With children's frequent hand-to-mouth behavior, they have a higher rate of ingestion of the chemicals than adults. The chemicals can be found in dust, sewage sludge, and marine animals, ultimately impacting the food supply chain (Babrauskas et al., 2011).

The use of chemical flame retardants in the manufacturing of upholstered furniture began in 1975 when California adopted the Furniture Flammability Standard, Technical Bulletin 117 (TB117) (Babrauskas et al., 2011). This standard requires products containing polyurethane foam sold in California to resist a small open flame for 12 seconds, but does not require companies to add chemical flame retardants to meet the standard if it can be achieved using a different method. This standard came about when the tobacco industry was asked to make a safer cigarette to help decrease the risk of house fires because cigarettes had been cited as a major contributing factor to house fires (California Government, 2013; Callahan & Roe, 2012). Instead of the tobacco industry creating a safer product, the tobacco industry and the chemical industry promoted chemical flame retardants for upholstered furniture and distorted research findings of chemical flame retardants' effectiveness to ultimately play on the public's emotions on fire safety (Callahan & Roe, 2012). Babrauskas et al. (1988) conducted a study on chemical flame retardants and Babrauskas later testified that the chemical industry clearly distorted the research findings because the experiment was not based on real world conditions. The researchers used a large amount of chemical flame retardants which are not found in consumer products and compared this to non-treated flame retardant products. TB117 treated foam was not tested as a comparison. In addition, the products were not tested individually, but in a room with multiple combustibles (Babrauskas, n.d.; Babrauskas et al., 1988, 2011; Callahan & Roe, 2012). Even though the law only affected products sold to California consumers, companies only created one product line to meet this standard to be sold throughout the United States.

The addition of chemical flame retardants to consumer products started with products containing polyurethane foam, such as mattresses and couches, but rapidly progressed to the widespread use of these chemicals in multiple baby and children's products, such as infant mattresses, car seats, booster seats, changing pads, baby carriers, children's foam furniture, rocking chairs, nursing pillows, children's computer tablets, crib wedges, and portable mattresses (Clean and Healthy New York, 2011; Department of Ecology State of Washington, 2014; Ecology Center, 2011, 2013; Stapleton et al., 2011).

In 2013, California passed a new fire safety law, Technical Bulletin 117–2013 (TB 117–2013), that went into effect on January 1, 2014. This new fire safety standard allows companies to make fire retardant chemical-free products, but does not ban the use of flame retardant chemicals. Companies can use materials that are naturally fire retardant or barrier methods to adhere to the new standard.This new standard states that a product must not smolder for more than 45 minutes after a lit cigarette is placed on it (Center for Environmental Health [CEH], 2013). The new standard addresses the root cause of how fires start by evaluating the coverings versus the foam, creating a safer product that will be more fire resistant.

Research has found that chemical flame retardants are not effective at reducing fires (Babrauskas, 1983; Babrauskas et al., 2011; Schuhmann & Hartzell, 1989). These chemicals are applied to polyurethane foam, which is then covered by fabric or another covering. During fires, the covering is ignited first. By the time flames reach the foam, the fire is no longer a small open flame and the flame retardants are no longer effective (Babrauskas et al., 2011; CEH, 2013). According to Babrauskas, research was conducted by T. H. Talley in 1995 to determine if TB117-treated foam made a