

## **Fire Alarms and People with ASD: A Literature Summary**

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### About the Fire Protection Research Foundation

The [Fire Protection Research Foundation](#) plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.

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NFPA is a worldwide leader in fire, electrical, building, and life safety. The mission of the international nonprofit organization founded in 1896 is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. NFPA develops more than 300 codes and standards to minimize the possibility and effects of fire and other hazards. All NFPA codes and standards can be viewed at no cost at [www.nfpa.org/freeaccess](http://www.nfpa.org/freeaccess).

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## Executive Summary

This is a preliminary literature review looking for documentation of the impact of audible automatic fire alarm notification signals on persons diagnosed with Autism Spectrum Disorders (ASD). Topic areas to be included in this literature review include:

- General overview of Autism and ASD
- Recent findings in scientific papers on sound and light sensitivity for those with ASD

Fire drills are an important part of a life safety and evacuation plan that should be practiced repeatedly in order for everyone to effectively respond to a real fire. Our first exposure to fire drills is typically conducted in the school setting. Both NFPA 101, *Life Safety Code*, and NFPA 5000, *Building Construction and Safety Code*, require both audible and visual signals in accordance with NFPA 72, *National Fire Alarm and Signaling Code*, and ICC/ANSIA117.1, *American National Standard for Accessible and Usable Buildings and Facilities*, in new and existing school facilities. The loud noise and flashing strobe light generated by the fire alarm system is intended to alert students and faculty. It has proven to be a useful tool in fire evacuation. For a person with ASD however, the sounds and bright lights may be a source of extreme unpleasantness, discomfort, seizures and confusion.

No specific, scientific based literature looking at the response to fire alarms by people diagnosed with ASD was found. However, some general information is presented on sound and light sensitivities. In addition, some anecdotal information from first responders is included.

## Background

This report begins with a general overview of autism and autism spectrum disorder (ASD). Key information such as the possible causes, signs, and symptoms will be highlighted. Then, information on sound hypersensitivity and anecdotal examples from first responders are discussed.

### *Autism:*

Autism Spectrum Disorder (ASD) is a term used to describe a group of complex neurodevelopmental brain disorders<sup>10</sup>. ASD includes, but is not limited to: autistic disorder (classic autism), Rett Syndrome, childhood disintegrative disorder (CDD), pervasive developmental disorder-not otherwise specified (PDD-NOS) and Asperger Syndrome<sup>10</sup>. As recently as May 2013, the American Psychiatric Association has updated the diagnosis of ASD in the Diagnostic and Statistical Manual of Mental Disorders (DSM)<sup>1</sup>, which is used by physicians and other mental health professionals in the U.S. The recent revision in the DSM allows mental health professionals to more accurately diagnose individuals with ASD<sup>1</sup>.

The causes of ASD are still a mystery to medical professionals. To date there is still no known cause; however, research in the past 5 – 10 years suggests that there are both genetic and environmental factors in causing ASD<sup>10</sup>. According to the National Institute of Mental Health (NIMH), in identical twins, if one has ASD then the other twin has ASD in nearly 90% of cases<sup>10</sup>. Also, if one sibling has ASD the others are 35 times more likely to be diagnosed with the disorder than the average risk. Though scientists have some progress towards discovering the genes that may be directly involved in the development of ASD, there is still insufficient research and evidence to suggest any particular genes involved in the development of ASD<sup>10</sup>.

Environmental factors that may lead to the development of ASD may include, but are not limited to any of the following: air we breathe, food intake, the medicines we take, and the many other things our bodies come into contact with, such as exposure to toxins<sup>10</sup>. As with genetic factors, there is insufficient research and evidence to pinpoint any environmental

factor(s) causing the development of or triggering ASD. Scientists are currently studying how certain environmental factors may affect certain genes<sup>10</sup>.

### *Signs & Symptoms:*

Perhaps one of the more difficult tasks for physicians has been recognizing and diagnosing individuals with ASD, recent changes to the DSM's definition have allowed for improved diagnosis. Although the symptoms vary from one individual to another, they fall into three general categories: social impairment, communication difficulties, and behaviors that are repetitive or stereotyped<sup>10</sup>. The symptoms associated with autism usually occur before the age of 3 and can last throughout an individual's life, though the symptoms may be reduced with treatment. Those with social impairments usually "make little eye contact and fail to respond to other people"<sup>11</sup>. Communication issues are usually recognized as a child being "...slow to respond to both names and gestures in addition to speaking only using single words from failing to form complete sentences"<sup>10</sup>.

It is the extreme sensitivity to sound that impacts some people with autism that has presented problems related to fire alarms. This sensitivity also impacts the individual during wayfinding activities, which are characterized as "audible or graphic methods" (signs or maps) used to get to a desired location<sup>16</sup>.

### *Prevalence:*

Autism appears to be more common. In 2000, the number of children diagnosed with ASD was estimated to be 1 in every 150<sup>4</sup>. In 2008, the CDC estimated ASD in children represented a 3-fold increase from 40 years ago<sup>4</sup>. In a 2013 report by the National Center for Health Statistics (NCHS) indicates a significant increase in the diagnosis of ASD among U.S. school children. The NCHS report, "Changes in Prevalence of Parent-reported Autism Spectrum Disorder in School-aged U.S. Children: 2007 to 2011-2012", estimates that the current level of ASD diagnosis in U.S. school children is 1 in 50<sup>3</sup>. The report has several key findings. Most notably, the number of parent-reported ASD for children aged 6-17 has increased from 1.16% in 2007 to 2.00% in 2011-2012. Another key finding is that in 2011-2012, boys were four times more likely than girls to be

“on the spectrum” (3.23% in boys compared to 0.70% in girls)<sup>3</sup>. In fact, both boy and girls aged 6-17 saw dramatic increases in frequency of ASD diagnosis from 2007 to 2011-2012 (Figure 1).

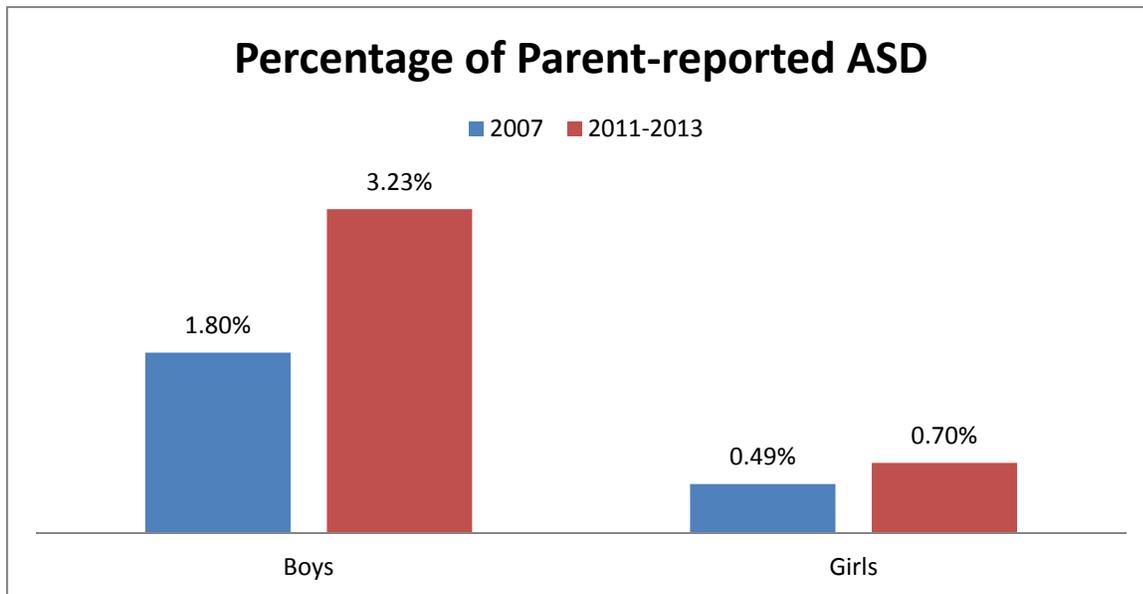


Figure 1: Comparisons in ASD diagnosis in Boys and Girls Aged 6-17<sup>3</sup>

The report credits the improvements in methods for diagnosing ASD as one of the main reasons for this increase, much of which may be the “result of diagnoses of children with previously unrecognized ASD”<sup>3</sup>.

### *Hypersensitivity:*

There is some literature states that some individuals with ASD experience abnormalities in auditory, visual, and touch sensory processing<sup>7</sup>. For the purposes of this report, auditory and visual sensory processing are more closely related to situations involving fire alarms. Visual abnormalities are considered to “...manifest as an apparent discomfort from lights, particularly bright lights”<sup>7</sup>. There are no current findings on any differences in the physiological makeup of those diagnosed with autism that would account for the sound sensitivity<sup>14</sup>. Yet researchers report that hyperacusis, the unusual intolerance of ordinary environmental sounds, is one of the commonly reported issues in those diagnosed with ASD<sup>11</sup>. However, there are conflicting findings in some studies that have not found a difference in sound sensitivity in children diagnosed with an ASD compared to those that do not have ASD<sup>6</sup>.

One study published in 2013 did involve a quantitative investigation of the acoustic reflexes in young children.<sup>18</sup> The experiment included 83 subjects: 29 in the control group with a range of 7 to 17 years of age and 54 in the group of autistic subjects ranging in age from 4 to 23. The acoustic reflex was measured for each subject at 500, 1,000, and 2,000 Hz. The specific findings were that that group of autistic patients had lower thresholds (i.e. hypersensitivity), which suggests that they were more sensitive than the control group to the tone stimuli used in the test.<sup>18</sup>

Researchers continue to explore methods for alleviating the pain caused by sounds, with desensitization training being one possible method of treatment. Two individuals that have significant experience with this type of training, Jay Lucker and Alex Roman, state that desensitization training is meant to “...desensitize the emotional and non-classical auditory systems so that they no longer react negatively to loud and annoying sounds, the things that make the sounds, and the situations in which such sounds may occur”<sup>8</sup>. Their research concludes that desensitizing children diagnosed with ASD can alleviate the “negative emotional reactions” to loud sounds<sup>8</sup>.

### *First Responder Findings:*

The latest report by the NCHS is of interest to emergency responders, whom may have to respond to situations that involve those diagnosed with ASD. There are some training programs and other educational resources available for emergency responders on autism. One such training and educational program is available for the fire service and emergency responders through the Autism & Law Enforcement Education Center (ALEC) of the Arc of South Norfolk Family Autism Center. It’s “Fire/Rescue Autism” program is designed to enhance autism awareness for the fire service and emergency responders.

There are currently, fifteen states that have successfully implemented the ALEC program, which provides the training necessary in identifying and assisting individuals diagnosed with ASD<sup>15</sup>. The ALEC program has trained over 21,000 first responders and is continuing in its pursuit for expanding their scope of services to more regions<sup>15</sup>.

## Summary Observations:#

No specific information about the interaction of people diagnosed with ASD with fire alarm systems was found. As research continues in the attempting to locate specific genes and environmental factors that may lead to answers, there also exists a need to research the impact of fire alarms on those with autism and to develop methods that may help accommodate those who find loud noises very discomforting and disrupting. With the latest NCHS report announcing the increase in those being diagnosed with ASD there will be an increase in dependence on first responders and others for assistance in emergencies.

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