

## Chapter 28

# Empirical Study Using Alternative Early Warning Systems to Address Fire in the Homes of Deaf or Hard- of-Hearing Individuals

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### ABSTRACT

*Home fires do not only destroy property, but they also place human life at significant risk. Fires at night, during sleeping hours, can pose even more of a risk for a residential dweller due to the sheer fact that the resident is not in a fully awake and conscious state. In terms of the profoundly deaf community, these individuals may be more at risk, since hearing is not optimal, and traditional emergency devices may not prove worthy (Ashley, 2007). This chapter measures and quantifies two commercially available emergency alerting devices, available to the profoundly deaf community in three modalities: (1) sounds – a 520 HZ square wave and voice annunciation; (2) light – a 177 high intensity candela strobe; and (3) movement – an intermittent bed shaker. Providing a salient alert system increases the likelihood of an individual who is profoundly deaf to awaken regardless of the level of sleep, including REM sleep. What was measured were: (1) whether the subject awakens during REM sleep with each modality of the alerting devices aforementioned and (2) the quickness of the reaction time of the awakening process to determine the most successful of the three modalities tested.*

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## **INTRODUCTION**

### **Background Information**

The Institution of Fire Engineers (IFE) receives \$949,000 grant from Department of Homeland Security for Vision 20/20 Community Risk Reduction. Palm Beach County Fire Rescue in West Palm Beach, Florida was one of five communities in the nation to receive funding from the grant. Palm Beach County received \$160,000 to accomplish three projects:

**Project 1:** Install smoke alarms and to provide slips & falls education through a home visitor program.

**Project 2:** Install early warning devices for people with profound hearing loss.

**Project 3:** Conduct a research study to identify the best type of early warning device(s) to awaken people with profound hearing loss.

This paper addresses the primary work conducted through Project 3. A portion of the grant funds received was to test scientifically different methods for awakening, alerting and informing persons with profound or total hearing loss.

### **Significance of the Study and Site Selection**

It was noted in that during the development of the 2010 edition of the NFPA72, National Fire Alarm and Signaling Code, that the technical committees focused on “new requirements (for fire alerting devices) did not address those who are severely hearing impaired or profoundly deaf. The committees would like to have scientific data on methods for awakening, alerting and informing persons with profound or total hearing loss” (R. P. Schifiliti, personal communication, March 09, 2009).

Across the nation and the world, fires while sleeping are responsible for a high incidence of death among all populations. For the profoundly

deaf individual who may be at more risk in night fires, special early warning emergency devices may be more essential.

Research was required to determine which devices were more appropriate for a growing population of people with profound hearing loss. Since Palm Beach County had an extremely large senior population with reported hearing issues (16,000 individuals in season), it was deemed to be an appropriate site for such a research study that could not only save lives in Palm Beach County, Florida, but potentially could also save lives throughout the United States and possibly the world. Generalizability of the findings in this study was important to policymakers in fire agencies, community agencies that serve seniors and the profoundly deaf, community educators, and researchers.

### **Literature Review**

Numerous sleep studies have been conducted for various populations testing different alerting devices. For example, studies have addressed college students (Akerstedt, 2002); the deaf compared to hearing able and hard of hearing (Ashley, 2007); profoundly hearing, fully hearing able, profoundly deaf hearing, hard of hearing and full hearing able (Dubois, Ashley, Klaussen, & Roby, 2005). The parameters of the studies were not limited to the 50 and above age group or those individuals diagnosed as profoundly deaf.

Regardless of the testing procedures used, or the devices tested (sound/audible, strobe light, or bed shaking device (intermittent or otherwise), there is common agreement that the deaf and the hard of hearing, as well as the able elderly population, need to have access to audible alarm alternatives (Roby, 2005). There are over thirty-five million Americans who suffer from hearing loss that can be assisted by having the right devices in their place of residence.

Fully deaf is defined as those without hearing, 90dB (decibel rating) or less over the range of 500 Hz to 8000 Hz. Hard of hearing is defined as those

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