



RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

Review of Alarm Technologies for Deaf and Hard of Hearing Population

It is estimated that almost 1 out of 100 Americans over the age of twelve experience hearing loss classified as severe (>60 through 80 dBA) or profound (>80 dBA) hearing loss, and more than 14 out of 100 Americans over the age of twelve experience hearing loss to some degree. An important shortcoming of commonly used audible alarms is their inability to warn people who are deaf, and to some extent those who are hard of hearing.

Audible and visible alarms are required in sleeping rooms, such as hotel rooms which may be occupied by people who are deaf or hearing impaired. However, evidence suggests that strobe lights are ineffective in alerting such people when asleep. A previous Research Foundation study also shows that older adults also may fail to respond to both audible and visible alarms. This effect is further enhanced when people are asleep.

It is recognized that people who are deaf or hard of hearing often have to compensate by using alternative devices such as bed shakers, pillow shakers, or portable devices that alert them of alarm activation in an emergency. Despite the critical role these devices play in life safety for people with hearing loss, their suitability, reliability, potential applications and uses in current and future buildings needed further study.

Project Goal & Approach

The primary objective of this Fire Protection Research Foundation project was to develop resources on and provide a review of the currently available alternative alarm and detection technologies and their respective characteristics, use cases, regulations and certification and approval processes for the deaf and hearing-impaired community.

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Summary Observations

Through a scientific literature review, 13 alarm technologies were found to be used to wake people who are deaf and hard of hearing while sleeping. The technologies were categorized into four primary stimulus types: 1) audible, 2) olfactory, 3) tactile and 4) visual. A description of the technology, its availability, use, effectiveness and undesirable consequences are identified for all technologies. The 19 applicable codes and standards that apply to these technologies have been identified and reviewed. Beyond the literature review, a survey was circulated among the deaf and hard of hearing population and affiliated caretakers or service providers to obtain user perspectives on the technologies identified through the literature.

Based on the scientific literature review, it is deemed necessary to re-evaluate the recommendation of strobes as an alternative alarm technology for awakening people who are deaf or hard of hearing. The literature concludes that low-frequency audible alarms are effective for people who are hard of hearing and for older age groups, and that bed/pillow shakers could be effective for people who are hard of hearing or deaf. However, more research is needed regarding the effectiveness of bed/pillow shakers in relation to older age groups. While some technologies have been identified in the literature as potentially effective (e.g., low-frequency audible alarms, bed/pillow shakers), the survey conducted indicates that people who are deaf or hard of hearing do not necessarily commonly use them. The survey also indicates that support persons and fire safety experts may recommend technologies that have been proven ineffective in the scientific literature. It is therefore argued that information campaigns are needed towards these target groups. It is also argued that efforts are aimed towards developing a usable standard for alarm technologies incorporating tactile signals. New technologies, such as wearable devices, should be further investigated to establish their effectiveness in waking up people who are deaf or hard of hearing.