

VISION 20/20 PILOT OF ALARMS FOR PROFOUND HEARING LOSS

A pilot study showing the effectiveness of tactile waking devices on the hearing impaired



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Introduction

People with Profound Hearing Loss: What do we know? What's missing?

“During the development of the 2010 edition of NFPA 72, the technical committees incorporated recent research on waking effectiveness for persons with hearing loss ...A great deal of discussion...centered on the fact that **the new requirements do 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**”.

Robert P. Schifiliti, P.E., Chair



People with Profound Hearing Loss: What is the problem? What is the research question?

What method(s) work best to awaken people who have profound hearing loss in the event of a fire in their home?

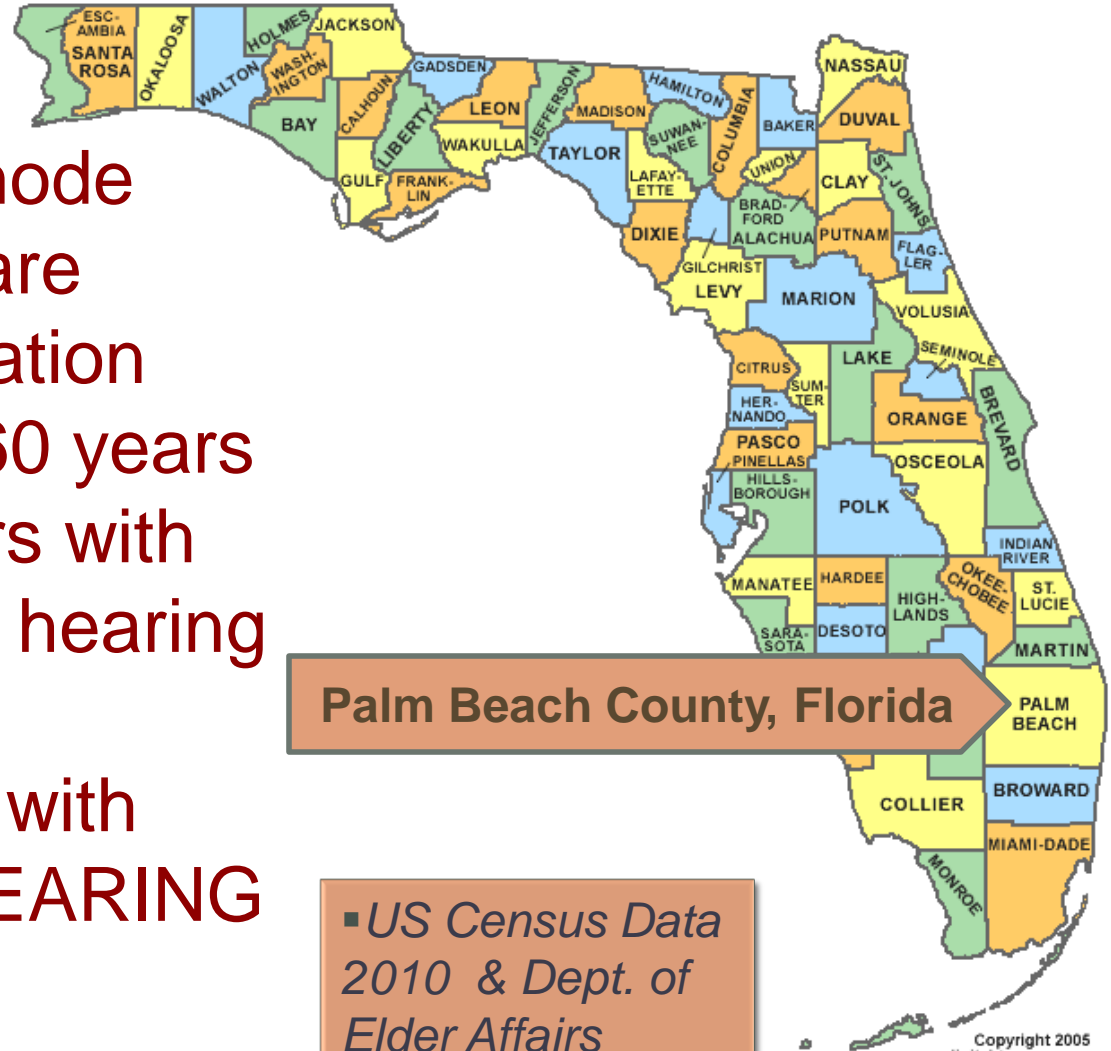
We needed to do the research.

Purpose of the Study



Where was the study? Why there?

- 1,971 sq. miles
 - Larger than Rhode Island & Delaware
- 1.3+ Million population
 - 363,618 over 60 years
 - 155,540 seniors with some degree of hearing loss
 - 16,000 people with PROFOUND HEARING loss



Who did we need to do the study?

- **Palm Beach County Fire Rescue** (Principal Investigator, secured grant and partners)
- **Area Agency on Aging** (Fiscal Agent/ Home Visits)
- **Deaf Service Center** (Measurement-Audiology)
- **Florida and the Palm Beach County Association of the Deaf** (Promoters & recruiters)
- **Hearing Association of America** (Promoters & recruiters)
- **Delray Medical Center** (Sleep Suite/Pilot Demo)
- **Florida Atlantic University** (Research & Report)



What had previous researchers found?

Summary Chart of Literature Review Of Findings Re Successful Devices

STUDY	SUBJECTS	SOUND/ AUDIBLE	STROBE LIGHT	BED SHAKING MOVEMENT	SUMMARY NOTES
Akerstedt (2002) for Combustion Science Engineering (CSE)	Deaf college students			Vibrating watch, page, pillow, bed shaker 71% REM awake by watch & pager	
Ashley (2007)	N=120 (40 deaf, 40 hearing abled,40 hard of hearing)	Standard audible detector only effective in awakening people w/no hearing loss 520Hz square wave auditory signal was most effective-92% awoke participants	Did not sufficiently awaken ANY population 27% awoke participants	Vibratory Tactile Device: most successful wakening for all hearing abilities and age (hearing able, hard of hearing, & deaf) Intermittent shaking devices most effective for deaf 80-84% awoke	Tested hearing able, hard of hearing, & deaf Devices used during Stage 2 sleep(Delta & REM) Deaf responded 90% to pillow shaker & 84% to mattress shaker

Chart continues and summary is provided of studies results completed to date

What definitions of terms drove the study?

- **Profoundly Deaf:** “totally deaf; unable to hear anything” Retrieved from <http://www.thefreedictionary.com/profoundly+deaf>
- **BAHA:** “used to help people with chronic ear infections, congenital external auditory canal atresia and single sided deafness who cannot benefit from conventional hearing aids. The system is surgically implanted and allows sound to be conducted through the bone rather than via the middle ear - a process known as direct bone conduction.” Retrieved from <http://www.umm.edu/otolaryngology/baha.htm>
- **Cochlear Implant :** “A cochlear implant is a small electronic device that helps people hear. It can be used for people who are deaf or very hard of hearing. ” Retrieved from <http://www.umm.edu/ency/article/007203.htm#ixzz1vnXxfjC>
- **Hearing Aid:** “A small electronic apparatus that amplifies sound and is worn in or behind the ear to compensate for impaired hearing” Retrieved from <http://medical-dictionary.thefreedictionary.com/hearing+aid>

Definitions cont.

- **Strobe Light:** A strobe light or stroboscopic lamp, commonly called a strobe, is a device used to produce regular flashes of [light](http://en.wikipedia.org/wiki/Strobe_light). Retrieved from http://en.wikipedia.org/wiki/Strobe_light
- **Intermittent Bed Shaker:** “A bed shaker which goes under the mattress and vibrates the bed in an intermittent pattern awakening the sleeper to an emergency” Retrieved from <http://www.safeawake.com/Adults%20with%20Varying%20Hearing%20Levels.html>
- **Voice Alarm:** “Dedicated manual or automatic equipment for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.” Retrieved from <http://defineterm.com/?s=voice+alarm>

Definitions cont.

- **REM Sleep:** “Usually, REM sleep occurs 90 minutes after sleep onset. The first period of REM typically lasts 10 minutes, with each recurring REM stage lengthening, and the final one may last up to an hour. During this stage the eyes move rapidly in different directions. Intense dreaming occurs during REM sleep as a result of heightened brain activity, but paralysis occurs simultaneously in the major voluntary muscle groups. REM is a mixture of encephalic (brain) states of excitement and muscular immobility.” Retrieved from <http://www.webmd.com/sleep-disorders/excessive-sleepiness-10/sleep-101>
- **Reaction Time** (measured in seconds): “The time elapsing between the beginning of the application of a stimulus and the beginning of an organism's reaction to it.” Retrieved from <http://www.merriam-webster.com/medical/reaction%20time>
- **Waking Time:** “Marked by full consciousness, awareness, and alertness.” Retrieved from <http://www.thefreedictionary.com/waking>

How was the study staged & conducted?

Initial Approval of Study

- Western Institute Review Board (WIRB) Certificate of Approval for this study

Subjects

- 50 people, **age 50 years or older with profound hearing loss 90 dB +** were recruited www.youtube.com/watch?v=bEEhaWyc-aM
<http://www.youtube.com/watch?v=UxYBAFdxJvg>

Screening Process

- Application with Palm Beach County Fire Rescue
- Verification of Hearing Loss with Deaf Service Center's audiologist report
- Verification of criteria for study with Delray Medical Center

Test Site

- Sleep over at Delray Medical Center Sleep Center
- Tested with various devices while in REM sleep
- Data reviewed & forwarded for analysis

Final Verification of Data

- Florida Atlantic University verifies research, conducts literature studies, writes up the report and prepares presentation materials

What processes were used for approval of research? The WIRB process

- Verification of certificate of researchers' knowledge of human subject research
- Development of:
 - MOU's between agencies
 - Alarm application & qualification form
 - Screening procedures for each agency
 - Adult consent forms
 - Flyers for recruitment
 - Podcasts for recruitment
 - News releases

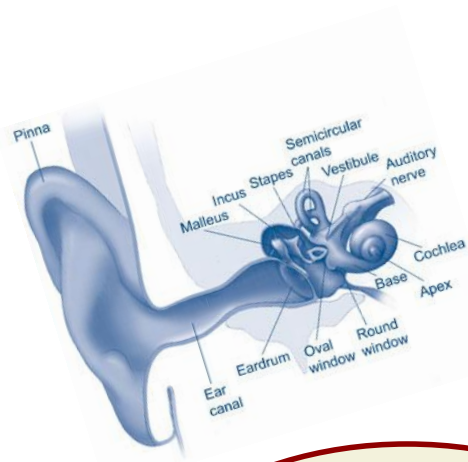


- Development of:
 - Participant questionnaires
 - Step-by-step research protocol
 - Spreadsheets for coding of clients
 - Suggested statistical analysis for data sets

Sample of Procedural Map

PROCEDURAL MAP FOR PROJECT		
Collect demographic information from the call-in participants.		
STAGE 1: PRE-SCREENING—Initial Contact at Palm Beach County Fire Rescue		
Service Center in West Palm Beach and to Delray Medical Center in Delray Beach? <ul style="list-style-type: none"> ○ Please note you will need to stay overnight at the Delray Medical Center in the Sleep Lab if selected for this pilot demonstration. ○ Are you willing to stay overnight? 	<ul style="list-style-type: none"> • You as driver? • Someone else as driver? 	
	Yes	No
There are a series of MEDICAL questions that you must answer at this time. Are you ready for the questions?	Yes	No
<ul style="list-style-type: none"> • Have you been diagnosed with any sleep disorder? 	Yes	No
<ul style="list-style-type: none"> • If you are selected or this pilot, do you have reliable transportation to get you to the Deaf 	Yes	No

What was tested in the sleep lab?



Is it **light**?



Is it **sound**?

T3

Or **520 HZ**

Or **Voice**

Is It **movement**?



What method(s) work best to awaken people who have profound hearing lost in the event of a fire in their home?




What devices were used?

All devices were operated remotely from the sleep technician's lab. Patient was viewed from remote room. Patient had electrodes to measure input.

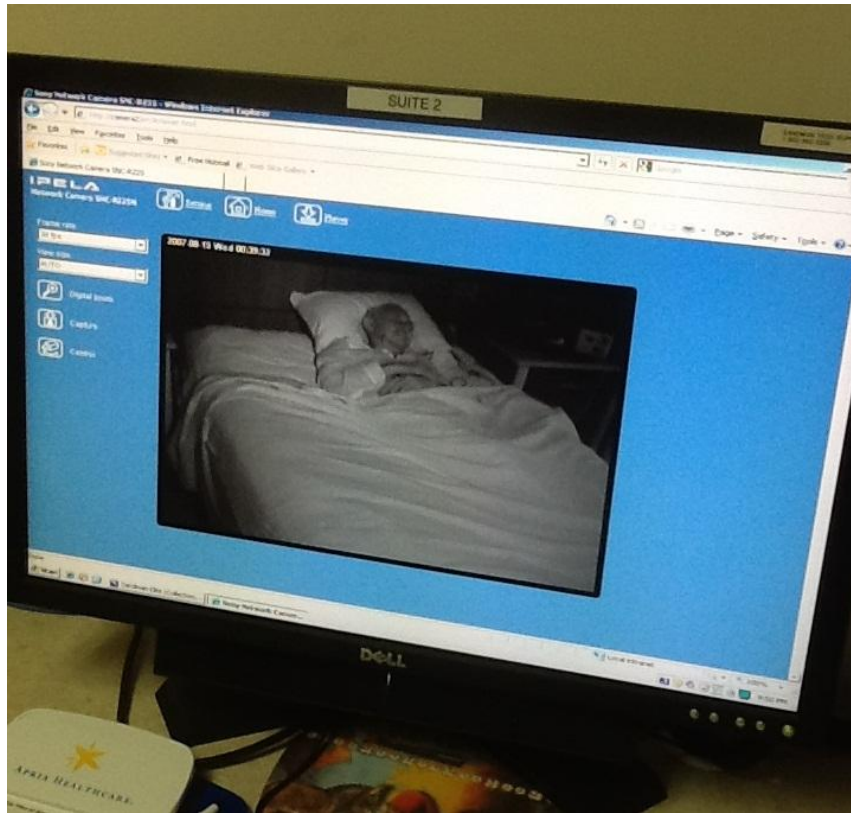
Photoelectric smoke alarm

- ADA compliant 177 cd Strobe- Wall and Ceiling mount in the 7109/7139 Series: 710/713 CS/LS- Gentex corporation

Modified Bedside Fire Alarm and Clock

- Lifetone Technology which is a notification appliance that has three modalities:
 - Sound-520 Hz tone and voice annunciation in English and Spanish “**Fire- Get Out**”
 - Light- a flashing yellow display screen with **FIRE** in black block letters and 
 - Movement/motion – an intermittent bed shaker that can be placed under the pillow or mattress

Prana beds & caring technicians



Sleep Lab Photos





The study was a quasi-experimental design



Using Version 19 of SPSS

What methodology & statistical analysis will be used to verify results?

Statistical Applications Used for Independent and Dependent Variables Will Include:

Chi-Square

Factorial ANOVA

Cramer's V and Phi

Pearson's Correlation

Multiple Regression

How will the findings be reported?



- **Indicators of whether the study was successfully carried out**
 - e.g., amount of sample attrition
- **Estimates of the intervention's effect on all outcomes measured**
- **Any estimates of its effect on subgroups within the study sample**

- **Any descriptive data on how the intervention was actually delivered in the study**
 - **Extent to which participants completed the sleep lab,**
 - **Gender,**
 - **Age,**
 - **Most effective hearing devices**

How will the recommendations and conclusions be disseminated?



- **The analyze data will be reported regarding:**
 - Various intervention's effectiveness
 - Generalizability to others who receive or could receive the intervention
 - Study limitations
 - Significance to policymakers in fire agencies or communities, community educators, and researchers

How Will the Results Be Shared?

- Reports to Vision 20/20
- Presentations at national conferences
- News and press articles
- Communication to the deaf community through their networks and organizations
- Articles in national & international publications