**Thesis Project Portfolio**

# The WorkSafe Monitor: A Comprehensive Wearable Personal Safety Monitor for Manufacturing and Construction Workers

(Technical Report)

# An Analysis of Treatment Options and Overcoming Stigma Associated with Age-Related Hearing Loss

(STS Research Paper)

An Undergraduate Thesis

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## Table of Contents

## Sociotechnical Synthesis

Presbycusis, also known as age-related hearing loss, is a condition described as the gradual loss of hearing in individuals as they age. This condition is very prevalent; however, there is a disconnect between commonality and societal acceptance when it comes to hearing loss. Many individuals, fearing the classification of being seen as disabled or needing assistance, will refuse to admit that they require assistive technology or lifestyle changes. This avoidance can result in negative consequences, including social isolation and decreased quality of life. Therefore, it is important to explore and advocate for possible medical interventions and communication strategies so these individuals can continue to feel involved in society.

My STS research paper mainly employs a literature review to examine different methods of symptom alleviation, prevention techniques, and inclusive infrastructure. Given that there is no perfect treatment for presbycusis to restore hearing to its pre-symptomatic state, the focus is on exploring how various technologies and inclusive strategies can be integrated into society to support individuals with presbycusis and mitigate the risk of societal isolation. Moreover, the paper builds off of the Social Construction of Technology (SCOT) framework to analyze how the best assistive devices and treatments are the ones that have been favored by society as a result of perceptions surrounding disabilities. Cultural lag is also a main focus of the paper, as many communication-inclusive strategies have not been as successful as expected due to slow moving social change. Overall, this research paper underscores the importance of adopting a multifaceted approach to support individuals with presbycusis and their integration into society. By addressing assistive technologies, prevention strategies, inclusive infrastructure, and societal norms, society can work towards reducing the stigma associated with hearing loss and creating more accessible and inclusive environments for all individuals.

My technical paper describes the project that was completed in the Spring of 2024 by my Capstone group, the WorkSafe Monitor. The WorkSafe Monitor is a wearable device intended to be used by employees on construction sites. This device monitors different health and safety attributes so the worker can receive real time alerts if they enter a dangerous environment, as well as sending real time data to a server so the employer can track the employees' environment. Ideally, the manager would use this information to refine and specify safety training for their employees. The device actively monitors four factors: hazardous gas, particulate matter, sound levels, and fall detection. If a dangerous level of hazardous gas is present, the buzzer equipped on the device will buzz on the user's chest so that they know to evacuate the area as quickly as possible. All four of the featured data can be evaluated on an external website, as well as previous data from the workday. If a user is exposed to high sound levels, the website will send an alert to the manager. Furthermore, if the employee falls or almost falls, the wearable device will detect this incident and notify the manager. Recording the conditions that influence worker-safety in a negative way assists in developing a training schedule specifically targeted to the most common safety issues present at the work site. The WorkSafe Monitor consists of a printed circuit board, three external sensors, a battery, an NI myRio microcontroller, and a 3-D printed external casing for the protection of the device. The device is also equipped with straps so that the WorkSafe Monitor can be strapped onto the user's chest to interfere as minimally as possible with their workflow. The WorkSafe Monitor is cost efficient, costing less than $200 to build, and a lightweight solution to worker safety in the construction industry. This project was completed under the supervision of the Electrical and Computer Engineering department.

Health and safety, specifically related to hearing loss, tie my STS research paper and my Technical Report together. My capstone project is specific to preserving the health and wellbeing

of employees working on construction sites, including the detection of loud sounds. Sensing sounds over a specific decibel level and alerting the manager so that preventive practices can be put in place will lead to better hearing health of the employee as they age. This brings us to the topic of my STS research paper, stigma and societal perceptions surrounding age-related hearing loss and approaches to treatment and symptom alleviation. Deploying hearing preventive measures, such as the WorkSafe Monitor, can assist in reducing age-related hearing decline.

I would like to extend my gratitude to Professor Barnes and Dr. Watson for their invaluable guidance and assistance throughout the semester in constructing our Capstone project. Additionally, I am thankful to Dr. Fitzgerald for his feedback during the development of my research paper, and to Dr. Wayland for his support during the writing of my prospectus.