The association of multisensory dysfunction and fall risk in hospitalized older adults

Principle Investigator:

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Abstract:

Falls occurring in a health care setting are a significant adverse outcome. Serious injury or death is following an inpatient fall is classified as a "never event" – should never happen – by the National Quality Forum and the Centers for Medicare and Medicaid Services. In addition to the very real human cost in terms of worse patient outcomes, many insurers do no reimburse hospitals for costs associated with falls. Despite the best efforts of the health care system, inpatient falls remain a significant problem, with overall rates of 3.3. to 12.5 falls per 1000 patient-days. Screening questionnaires and inventories are commonly deployed to identify those at risk for falls. However, they are imperfect with highly variable positive and negative predictive values. Additionally, the costs of over-labeling patients as fall risks are not insignificant. For example, commonly strategies are often financially prohibitive such as assigning the patient a staff member who monitors them constantly or alert staff after-the-fact and erode patient autonomy such as bed alarms.

Sensory impairments are significantly associated with increased fall risk. Screening for these deficits can be done in a point-of-care fashion and is an underleveraged strategy for better understanding, and ameliorating, fall risk. For example, in hospitalized patients, self-reported hearing loss increases fall risk by 74%. Significant olfactory dysfunction is independently associated with increased fall risk and increases the odds of balance dysfunction 4-fold (OR=4.1, 95% CI 1.5-13.7). The presence of both olfactory and vestibular dysfunction predicts worse standing balance and 50% increased fall incidence. The limited studies that have investigated MSD show a dose-response relationship between number of concurrent sensory dysfunctions and falls. Most studies demonstrating this risk have investigated community dwelling older adults. Despite its strong associations with cognition – also an important mediator of fall risk – only a minority of studies include olfaction. Additionally, sensory dysfunction has historically been studied in isolation. As a result, there is a significant gap in the literature regarding the relationship between MSD and fall risk in inpatient populations. **Multisensory dysfunction (MSD)** – including dysfunction of the olfactory, hearing, and vestibulo-occular systems – represents **an ideal clinical biomarker of fall risk**.

The proposed research will (1) determine the prevalence and magnitude of MSD in UH CMC inpatients who have been labeled as a "fall risk" by standard of care screening metrics and (2) develop predictive models using MSD and clinical data to predict falls. We hypothesize that MSD is highly prevalent in this population (>80%). We also hypothesize that predictive models incorporating MSD data will exceed the performance characteristics of the Morse Fall Scale (sensitivity ~ 60%, specificity ~ 70%, positive predictive value ~ 2%, and negative predictive value ~ 99% with cutoff value score $\geq$ 45 representing fall risk). Sensory data will be obtained via AROMA (olfaction), Shoebox Audiometry (hearing), and RightEye (vestibulo-occular function). Mini mental status exam, FRAIL (frailty questionnaire), and bedside visual acuity testing will also occur.

The proposed research is critical to the development of effective screening and risk mitigation strategies for patients whose fall risk is mediated by MSD. Beyond optimizing fall prevention resources, identifying the scope of MSD in this patient population also introduces novel opportunities of intervention. For example, patients with newly identified hearing loss can be triaged to hearing support services and expedited receipt of hearing aids. Those with vestibulopathy or vestibulo-ocuclar hypofunction can receive targeted physical therapies and visual training. Olfactory dysfunction can similarly be treated with olfactory retraining. Rehabilitating sensory function has been shown to improve sensory, cognitive, and fall outcomes. Additionally, MSD rehabilitation can be deployed at bedside and in home-based programs, making is readily scalable at a public health level.

The involved student will be responsible for patient-facing data collection, basic data analysis, and scientific writing. Through their participation, they will become experienced in the administration and interpretation of sensory tests. While this project is clinically oriented, we anticipate basic science collaborations with our colleagues in Neuroscience at Case Western Reserve University. Though not required, the student is welcome to participate in the study design and execution of these associated experiments in mouse models of MSD.

Student Fellow Training/Mentoring Plan

The student will participate in biweekly (every other week) formal lab meetings. They will also receive individualized mentorship from the project primary investigator and quality improvement faculty. Attendance at Health Services Research Seminars will be strongly encouraged. Students and their mentor(s) will complete a formal written Individual Development Plan to ensure the research experience is structured to fulfill expectations of all parties. Studies will have access to asynchronous learning via Udemy (free through the library) to gain additional skills in scientific writing and data analysis.