Exploring Audiologic Contributors to Falls Risk: Preliminary Findings from Community-Dwelling Adults

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INTRODUCTION

Past studies have shown that the severity of hearing loss is associated with elevated rates of falls[1,2]. Similarly, perceived hearing handicap has been linked to increased falls risk[3,4]. Recent research also suggests including hearing loss as a modifiable risk factor in falls risk assessment tools and using amplification devices as a potential intervention[5].

Audiologists can play a crucial role in screening for falls risk and initiating risk modifications. Various falls risk screening test batteries have been proposed, including the use of specific questionnaire items and existing audiologic routines, such as administration of self-assessment measures of hearing and balance handicaps[3,6].

This study aimed to identify audiological variables that could serve as clinical markers of falls risk. Unlike previous studies that broadly linked audiological tests to fall rates, we focused on identifying associations between other widely-accepted falls risk factors and audiological findings from hearing aid needs assessments. This approach elucidates the underlying relationships between hearing loss and falls risk, potentially providing tailored recommendations for efficient and effective falls risk screenings and assessments. Additionally, it highlights unique insights audiologists can offer, not captured by the Centers for Disease Control and Prevention (CDC)'s Stopping Elderly Accidents, Deaths & Injuries (STEADI) initiative[7].

Incorporating these findings into clinical practice aligns with the goals of the CDC's clinical falls prevention algorithm, which emphasizes screening, assessing modifiable risk factors, and implementing interventions.

METHODS

Data Collection and Analysis

Falls risk screening and audiologic data were collected during qualification exams for several other hearing aid research studies conducted at Starkey and analyzed here to explore possible associations between audiological metrics and scores on the CDC's STEADI fall risk screening questionnaire (i.e., the Stay Independent brochure[8]). A stepwise linear regression identified audiological factors explaining variance in Stay Independent scores, while a multiple logistic regression assessed the predictive value of these variables for specific questionnaire responses linked to non-audiological fall risk factors.

Participants

Data from 378 community-dwelling adults (aged 19.9 to 90.7 years, mean age 69.6 years) were collected. For this analysis, 233 participants (mean age 68.4 years) were included in the final stepwise linear regression model, and 194 participants (mean age 67.7 years) were used in the multiple logistic regression analysis. Differences in sample sizes arose from missing data for some audiological assessment measures.

METHODS (cont.)

Assessments

- Pure-tone audiometry, unaided speech recognition tests in quiet and noise
- Tinnitus Handicap Inventory (THI)[9]
- Montreal Cognitive Assessment (MoCA)[10]
- Lifestyle inquiries and case histories
- Stay Independent brochure's 12-item questionnaire[8] (assesses a range of non-audiological risk factors associated with falls, including history of falls and injuries, balance and independence during mobility, fear of falling, physical limitations and sensory deficits, and preponderance for risky behaviors like night walking, and depression.)

RESULTS

Stepwise Linear Regression Analysis

Our final step-wise model included several significant factors influencing the STEADI (Stay Independent) scores:

- **Age:** There was a significant effect of age with STEADI scores increasing by 1 point for every 14 years of age ($\beta = 0.07$, $p < 0.001$).
- **History of Vertigo**: Participants with a history of vertigo had, on average, significantly higher STEADI scores compared to those without such a history ($\beta = 0.83$, $p = 0.03$).
- **Frequency of Outdoor Activity:** Participants who reported engaging in outdoor activities "Often" ($\beta = -1.83$, $p = 0.03$) or "Very often" ($\beta = -1.85$, $p = 0.03$) had STEADI scores that were significantly lower than those who engaged less frequently.
- **Tinnitus Handicap Inventory (THI) Score:** Degree of perceived tinnitus handicap significantly influenced STEADI scores ($\beta = -0.03$, $p = 0.002$), whereas falls risk increased with perceived severity:
  - Very Mild (THI score 0–16): Increase of 0 to 0.48 points
  - Mild (THI score 18–36): Increase of 0.54 to 1.08 points
  - Moderate (THI score 38–56): Increase of 1.14 to 1.68 points
  - Severe (THI score 58–76): Increase of 1.74 to 2.28 points
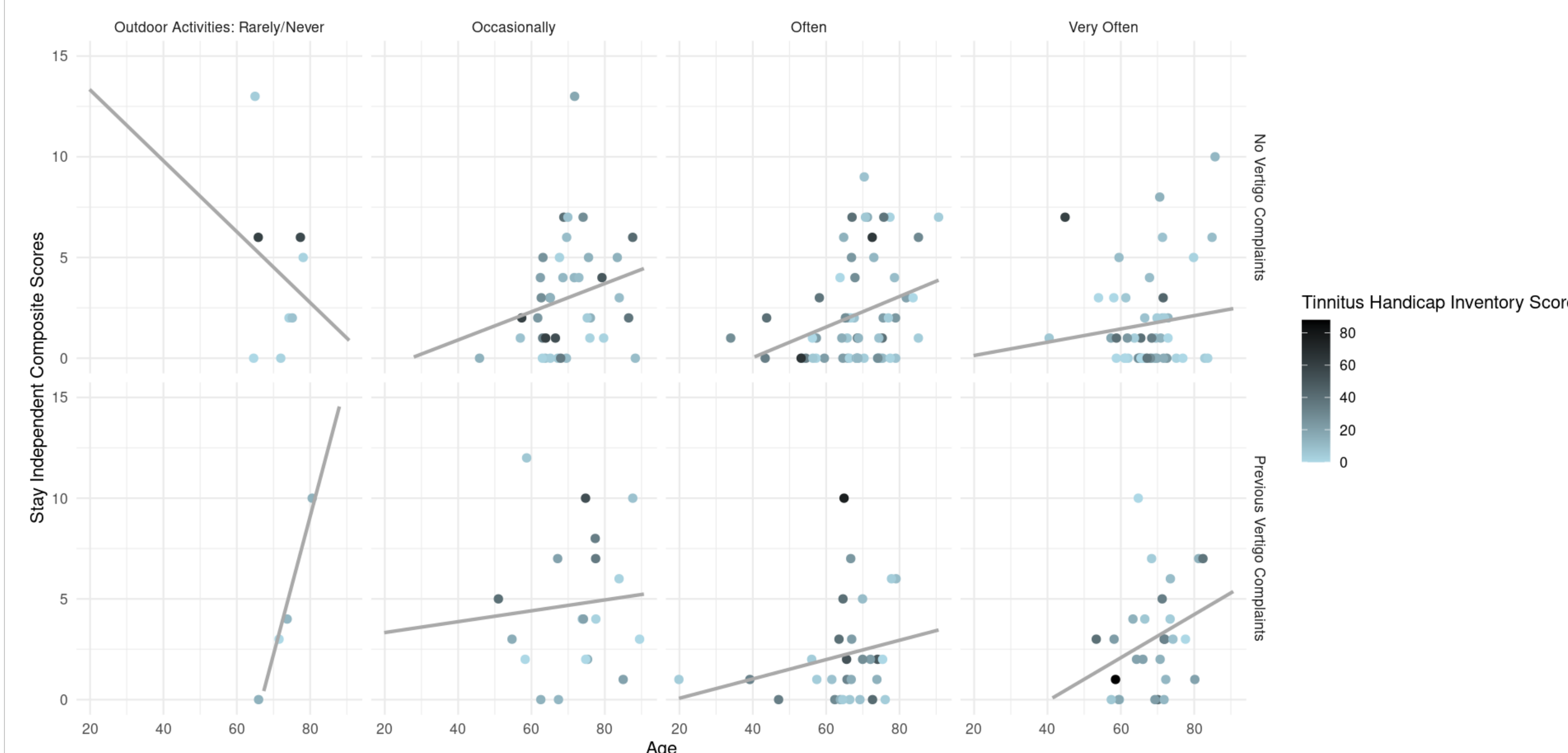 - Catastrophic (THI score 78–100): Increase of 2.34 to 3.0 points

Figure 1. Scatter plots illustrating the relationship between total STEADI Stay Independent scores and age, with data points colored by THI scores. TOP ROW: Participants reporting no vertigo complaints. BOTTOM ROW: Participants with vertigo complaints. COLUMNS: Frequency of outdoor activities from Rarely/Never (LEFT), Occasionally, Often, to Very Often (RIGHT).

RESULTS (cont.)

Multiple Logistic Regression Analysis

Our multiple logistic regression analysis found significant predictors of responses:

Stay Independent Question	Sample (n)	Factor	z-value	p-value
"I have fallen in the past year."	193	Age	2.78	0.005
		Historical vertigo	2.05	0.041
"I use or have been advised to use a cane or walker to get around safely."	193	None	-	-
"Sometimes I feel unsteady when I'm walking."	194	Age	2.76	0.006
		Historical vertigo	2.14	0.032
"I steady myself by holding onto furniture when walking at home."	193	Outdoor Activities (Occasionally)	-1.99	0.047
		Outdoor Activities (Often)	-2.24	0.025
		Outdoor Activities (Very Often)	-2.06	0.039
"I am worried about falling."	192	Age	2.65	0.008
"I need to push with my hands to stand up from a chair."	191	Age	3.38	<0.001
		THI Score	2.11	0.035
		Outdoor Activities (Very Often)	-2.19	0.029
"I have some trouble stepping up onto a curb."	193	Better ear QuickSiN SNR	2.41	0.016
		Better ear WRS Score	2.42	0.015
		Outdoor Activities (Often)	-2.39	0.017
		Outdoor Activities (Very Often)	-2.62	0.009
"I often have to rush to the toilet."	191	Better ear QuickSiN SNR	-2.68	0.007
		Age	2.85	0.004
		Historical vertigo	1.65	0.099
"I have lost some feeling in my feet."	194	None	-	-
"I take medicine that sometimes makes me feel light-headed or more tired than usual."	193	Age	2.82	0.005
		Outdoor Activities (Often)	-2.20	0.028
"I take medicine to help me sleep or improve my mood."	192	THI Score	2.27	0.023
		Outdoor Activities (Occasionally)	-2.27	0.023
"I often feel sad or depressed."	192	Age	2.22	0.026
		THI Score	4.45	<0.001

Table 1. Summary of significant predictors of responses to the CDC's Stay Independent brochure's questions.

SUMMARY

Frequent outdoor activity and unaided speech-in-noise ability were associated with a lower risk of falls, while age, vertigo, and tinnitus increased the risk, as reflected in Stay Independent responses. However, no causal relationships can be concluded.

Our final model explained just 12% of the variation in composite Stay Independent scores, suggesting that the CDC's questionnaire may not fully capture the influence of hearing difficulties on falls risk. However, the Stay Independent tool still provides audiologists with valuable awareness of a patient's non-audiological risk factors.

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