



# Do Adults with Increased Fitness Levels Show Resistance to Age-Related Hearing Loss?

Tori Stone

M.Cl.Sc. Candidate – Audiology

School of Communication Sciences & Disorders, Faculty of Health Sciences, Western University

## Introduction

There are many benefits to maintaining a physically active lifestyle including disease prevention, improved mood and affect, weight management, increased lifespan, and an overall improvement in health. Physical activity has shown irrefutable evidence of chronic disease prevention such as cardiovascular disease, diabetes, cancer, hypertension, obesity, and depression. But what about hearing loss? Acquired hearing loss is a wide-spread chronic disease but the factors associated with prevention have not been adequately examined. The purpose of this systematic review is to investigate physical activity as a modifiable risk factor for age-related hearing loss.

## Question

**Do adults with increased fitness show resistance to age-related hearing loss?**

## Search Terms

### Hearing Loss

Hearing loss, hearing thresholds, age-related hearing loss, presbycusis, hearing impairment, hearing problems, sensorineural hearing loss

### Fitness

Fitness, physical activity, physical fitness, exercise, cardiovascular health, cardiorespiratory health

## Inclusion / Exclusion Criteria

### Inclusion Criteria:

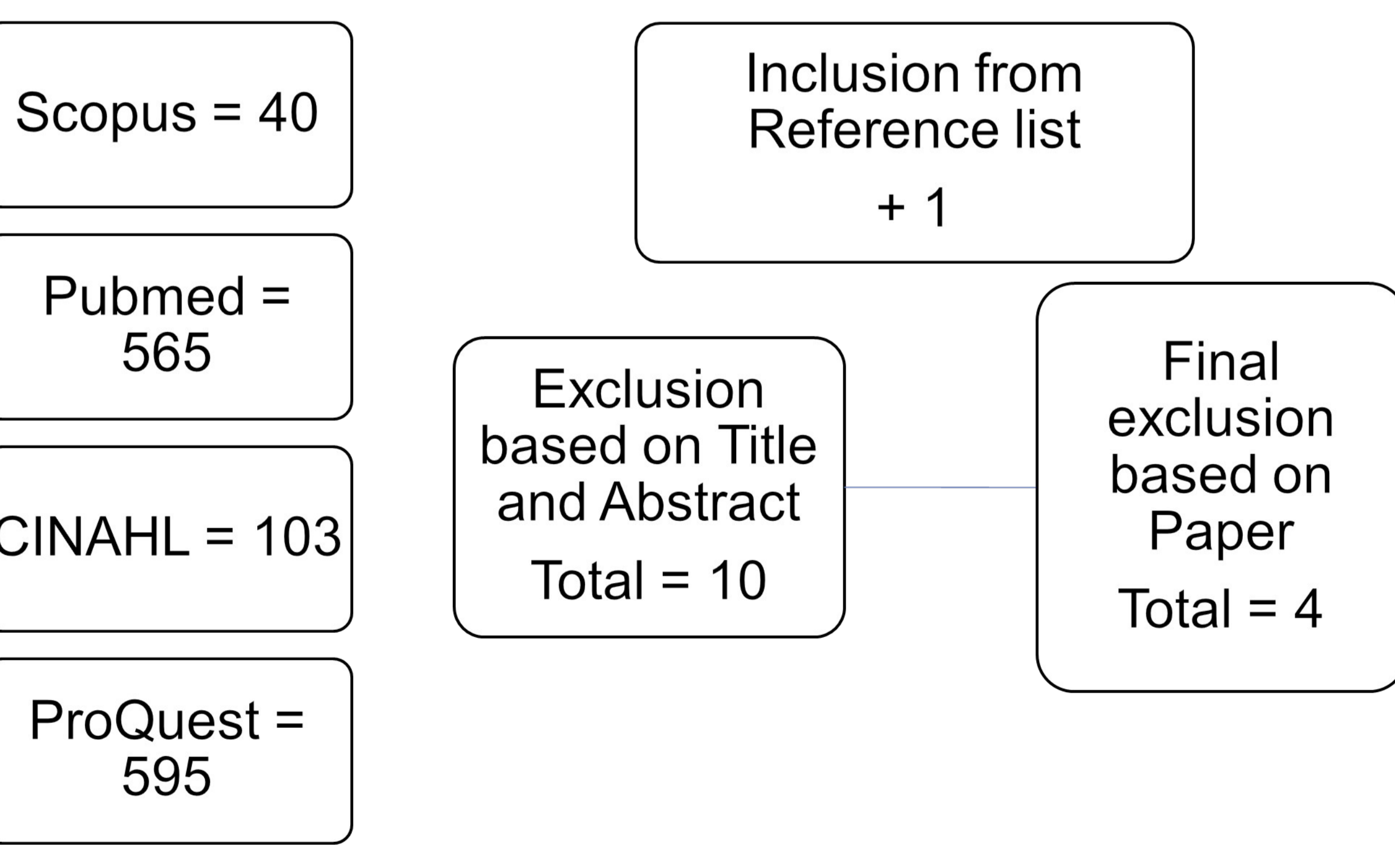
- Article examined physical activity and/or fitness level
- Subjects were human
- Subjects were adult
- Article accessible through Western University Library

### Exclusion Criteria:

- Article not available in English
- Duplicates
- Studies investigating Body Mass Index or waist circumference but not physical activity or fitness

## Literature Search

Scopus PubMed, CINAHL, and ProQuest were searched using the aforementioned search terms. One additional article was identified in the references. Articles were excluded based on Title, Abstract, and finally Full-Text using the above criteria. The flowchart below outlines the number of articles yielded in each stage. A total of 4 papers were included.



## Results

An extensive search of the literature yielded 4 appropriate and relevant papers examining the relationship between physical fitness and age-related hearing loss. The quality of each article was evaluated using the CCAT quality assessment tool. Key elements of each article were extracted with guidance from a data extraction tool. The following pieces of information have been highlighted in the extraction table below: Research Objective, Sample Size, Description of Methods, Findings, Conclusion, and Quality Score as a percentage.

Research Objective	Sample Size	Description of Methods	Findings	Conclusion	Quality Score
Investigate the association between CV health and HL – specifically pure tone hearing and DPOAEs	101 participants aged 10-78	Thresholds at 1-4kHz, and DPOAEs. VO2 peak measured by exercise on a Monark Bicycle.	The old age group with low CV fitness level had significantly worse thresholds hearing at 2000 and 4000 Hz. DPOAEs were stabilized in the old high-fit group.	There is a potentially positive impact of CV health on hearing sensitivity (thresholds and DPOAEs) over time.	92.5%
Examined the associations between BMI, WC, and PA, and self-reported HL in women	68,421 women	Participants responded to the Nurses' Health Study II survey from 1989 to 2009. Self-report technique.	Higher BMI and larger WC are associated with increased risk of hearing loss. Higher PA is associated with reduced risk of HL in women. Walking 2 hours/week could prevent HL.	Maintaining healthy weight and staying physically active may help reduce the risk of HL.	72.5%
Identify predictors of hearing thresholds and hearing deterioration – determine target groups for hearing screening.	1,721 Dutch participants aged 24-81	Participants responded to the Maastricht Aging Study. Measured hearing thresholds.	Level of physical activity was not related to higher rates of hearing loss. Large WC was associated with poorer baseline thresholds and faster deterioration, although small. *Higher age, male gender, manual occupation were also associated with poorer thresholds	Modifiable factors related to health, fitness, and body composition could predict hearing thresholds and hearing deterioration.	67.5%
Examine the link between cardiovascular fitness and hearing sensitivity	1,082 participants aged 20-50	Participants responded to the NHANES survey. VO2max was obtained from treadmill-based test. Measured hearing thresholds.	Women with higher predicted cardiorespiratory fitness were 6% more likely to have good hearing.	Findings suggest a potentially auditory-protective effect of cardiorespiratory fitness.	70%

PA = Physical Activity    BMI = Body Mass Index    CV = Cardiovascular    HL = Hearing Loss  
WC = Waist Circumference    DPOAEs = Distortion Product Otoacoustic Emissions

## Conclusions

The systematic review yielded four papers. Three out of the four papers identified a correlational effect of physical activity with improved hearing thresholds in adults. One did not find a significant correlation between physical activity and hearing but did find one between waist circumference and hearing however the quality of this paper was poor due to a reliance on self-report measures. These findings suggest a potential auditory-protective effect of good physical health however more research is needed to determine the quantifiable affect and the associated factors. The amount of physical activity per week or the level of fitness required to have a protective affect need to be determined. Level of physical fitness is modifiable and the association between fitness and hearing ability could be a future direction for health promotion programs.

The authors suggested that the preventative mechanism associated with physical activity comes from the increased cardiovascular health and circulation which allows for a rich blood and oxygen supply to the cochlea. These mechanisms were not examined directly in any of the above studies. More research is needed in this area with animal models to determine the relationship between physical activity and prevention of age-related hearing loss

A limitation of this systematic review is that not all papers may have been captured through the literature search and therefore the findings may not reflect all relevant research. There is always a concern that not all appropriate search terms were used or that Western Libraries did not have access to the paper.

The current body of literature on this topic is insufficient and more large-scale research needs to be done on the affects of fitness and health on hearing conservation. When looking at hearing loss risk factors, it is extremely difficult to separate the effects of diet, exercise, lifestyle and personal predisposition. A longitudinal cohort study that examines the association between many health-related risk factors and hearing loss is warranted. Additionally, effects of physical activity on known chronic diseases correlated with hearing loss (ex. cardiovascular health) was not examined. The correlation of said factors may demonstrate a greater effect of physical activity on overall health and in turn lead to hearing protection.

Overall, more research is needed in this area, however current research suggests there is great potential for clinical relevance and health promotion.

## References

- Curhan, S., Eavey, R., Wang, M., Stampfer, M., & Curhan, G. (2013). Body mass index, waist circumference, physical activity, and risk of hearing loss in women. *The American Journal of Medicine*, 126, 1142.e.1-1142.e.8.
- Hutchinson, K., Alessio, H., & Baiduc, R. (2010). Association between cardiovascular health and hearing function: Pure-tone and distortion product otoacoustic emission measures. *American Journal of Audiology*, 19, 26-35.
- Linsen, A., van Bostel, M., Joore, M., & Antoonis, L. (2014). Predictors of hearing acuity: Cross-sectional and longitudinal analysis. *Journals of Gerontology: MEDICAL SCIENCES*, 69(6), 759-765.
- Loprinzi, P., Cardinal, B., & Gilham, B. (2012). Association between cardiorespiratory fitness and hearing sensitivity. *American Journal of Audiology*, 21, 33-40.