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Hearing Impairment and Retirement

Mary E Fischer¹, Karen J Cruickshanks^{1,2}, Alex Pinto¹, Barbara E K Klein¹, Ronald Klein¹, and Dayna S Dalton¹

¹Department of Ophthalmology and Visual Sciences, University of Wisconsin, Madison, WI

²Department of Population Health Sciences, University of Wisconsin, Madison, WI

Abstract

BACKGROUND—Many factors influence the decision to retire including age, insurance and pension availability along with physical and mental health. Hearing impairment may be one such factor.

PURPOSE—The purpose of this study was to compare the 15 year retirement rate among subjects with and without hearing impairment.

RESEARCH DESIGN—Prospective, population-based study

STUDY SAMPLE—Subjects were participants in the Epidemiology of Hearing Loss Study (EHLS), a longitudinal investigation of age-related hearing loss. Participants who were working full- or part-time in 1993–1995 were included (n=1410, mean age=57.8 years).

DATA COLLECTION AND ANALYSIS—Data from four EHLS phases (1993–1995, 1998–2000, 2003–2005, and 2009–2010) were analyzed in 2010–2012. Hearing impairment was defined as a pure tone threshold average (at 0.5, 1, 2 and 4 kHz) greater than 25 dB HL in the worse ear. Employment status was determined at each of the four phases. Kaplan-Meier estimates of the cumulative incidence of retirement were calculated and Cox discrete-time modeling was used to determine the effect of hearing impairment on the rate of retirement.

RESULTS—The cumulative incidence of retirement was significantly ($p < 0.02$) higher in those with a hearing impairment (77%) compared to those without a hearing impairment (74%). After adjustment for age, gender, self-reported health, and history of chronic disease, there was no significant difference in the rate of retirement between those with and without a hearing impairment (Hazard Ratio (HR) = 0.9, 95% Confidence Interval (CI) = 0.7, 1.1). Similar results were observed when hearing aid users were excluded, when hearing impairment was based on the better ear thresholds, and when analyses were restricted to those less than 65 years of age and working full-time at baseline. Participants with a hearing impairment were less likely to state that the main reason for retirement was that the time seemed right.

CONCLUSIONS—Hearing impairment was found to be associated with a higher rate of retirement but the association was not independent of the effects of age, gender, and health.

Keywords

Hearing impairment; retirement; hearing loss; employment

INTRODUCTION

In recent years, the average age at retirement in the United States has begun to increase as a result of several factors including policy changes regarding the age at which individuals are eligible for full Social Security benefits, policy changes regarding the amount of earnings allowed before benefit reduction, the widespread removal of mandatory retirement ages, and the need for health insurance coverage through employment (Silverstein, 2008). The trend of later age at retirement coupled with an aging population as a consequence of the baby boom generation (birth years 1946 through 1964), is leading to an older U.S. workforce. It has been estimated that there will be more than 40 million U.S. workers aged 55 years or older by 2020 comprising 25% of the labor force (Toossi, 2012).

The incidence and prevalence of hearing loss increases with age (Cruickshanks et al, 1998; Cruickshanks et al, 2010), and as a result, the likelihood of having a hearing loss will increase over the span of an individual's employment career. In the Epidemiology of Hearing Loss Study (EHLS), the prevalence of hearing loss among those aged 48 through 59 was 20.6% and among those aged 60 through 69 was 43.8% (Cruickshanks et al, 1998). Data from the National Health Interview Study showed that 1 in 3 workers in the United States aged 65 years and older reported at least a little trouble hearing (Davila et al, 2009). As workers gradually transition into poorer hearing, communication in the workplace may become more difficult particularly in settings with background noise or large numbers of people or with the use of the telephone. If the communication difficulties go undetected or ignored, it may become more difficult to perform duties well, and a decline, either real or self-perceived, in performance may result. In addition, the work environment may seem more demanding and the work less rewarding. It has been reported that frustration, anxiety and fatigue occur more often among hearing impaired workers who used hearing aids than among workers without a hearing loss (Backenroth-Ohsako et al, 2003). These experiences and conditions may contribute subtly to a decision to retire or perhaps, to the involuntary loss of a job.

Given the estimates of the future age distribution of the U.S. workforce and the rates of hearing loss, it is clear that the number of individuals in the workforce with a hearing loss is substantial and will grow in size, even in occupations typically performed in quiet environments, leading to important workplace and economic implications (Tye-Murray et al, 2009). The purpose of this study was to evaluate one of the implications, namely whether a hearing impairment contributes to an earlier retirement and consequent loss of productivity and economic rewards. Data were available to assess the effect of hearing loss on retirement independent of any age, gender, and health effects over a 15 year follow-up period. In addition, the impact of the severity of hearing impairment on retirement was investigated.

MATERIALS AND METHODS

Subjects

Study subjects were participants in the EHLS, a prospective, population-based investigation of age-related hearing loss, based in Beaver Dam, Wisconsin. Members of the Beaver Dam Eye Study (BDES), which was initiated in 1987–88, were eligible to participate in the baseline EHLS (EHLS-1), concurrently conducted with the first follow-up phase of the BDES in 1993–1995. Of the 4,541 living eligible subjects, 3,753 (82.6%) participated in EHLS-1. Follow-up studies were conducted 5 years (EHLS-2), 10 years (EHLS-3), and 15 years (EHLS-4) after baseline. Data from the baseline and the follow-up examinations are used in this report. Additional details of the BDES and the EHLS have been reported (Klein et al, 1991; Klein et al, 1996; Cruickshanks et al, 1998). Institutional Review Board approval by the Health Sciences Institutional Review Board of the University of Wisconsin and informed consent were obtained.

Individuals were excluded from these analyses if they were not working full- or part-time at baseline (n=2133), did not participate in one or more follow-up visits, either at 5, 10 or 15 years (n=166), and did not have complete audiometric data (n=44). Employment status was ascertained at each of the follow-up phases.

Measurements

Employment Status—Employment status at baseline was reported in response to the question, “Are you currently (past year) working full-time or part-time, a homemaker, retired, unemployed or disabled?” At the follow-up examinations the phrase “including seasonal work” was included in the question.

Employment status five years prior to EHLS-1 was collected in the BDES-1 using a similar question. Retirement was considered to have taken place if a response of “Retired” was given to the employment status questions. In EHLS-3 and EHLS-4, retired study subjects were asked to select the main reason for retirement from a list of eight possible choices.

Hearing Impairment—Pure-tone air-conduction thresholds were measured following the guidelines of the American Speech Language and Hearing Association (ASHA) and equipment calibration met American National Standards Institute (ANSI) standards (American Speech-Language-Hearing Association, 1978; American National Standards Institute, 1989; American National Standards Institute, 1992). Hearing impairment was defined as a baseline pure-tone average (PTA) at 500, 1000, 2000, and 4000 Hz of greater than 25 decibel (dB) HL (Hearing Level) in the worse ear. The severity of hearing loss was categorized into three levels: mild (> 25 and 40 dB HL), moderate (> 40 and 60 dB HL), and marked (> 60 dB HL). Details of the audiometric procedure have been published (Cruickshanks et al, 1998; Wiley et al, 1998).

Covariates—Demographic factors included in the study were age, gender, and income (0–9K, 10–19K, 20–29K, 30–44K, 45–59K, and 60K+). Health-related items included smoking history, obesity (body mass index (BMI) ≥ 30.0 kg/m²), self-reported general health (excellent, good, fair, and poor), and history of chronic disease. A chronic disease history

was considered present if the subject reported any one of the following conditions: cancer, diabetes, cardiovascular disease (angina, myocardial infarction, stroke, coronary bypass or angioplasty), arthritis, and late-stage age-related macular degeneration. For the self-reported health, the categories of fair and poor were combined because of small numbers.

Statistical Analyses

Differences in baseline characteristics between those with and without a hearing impairment were tested for significance using the t-test or chi-square test. Kaplan-Meier estimates of the cumulative incidence of retirement were calculated and the log-rank test was used for comparisons.

The effect of hearing impairment on the rate of retirement was determined through Cox discrete-time modeling. Models were fit adjusting for each of the covariates along with age and gender. For categorical covariates, a reference category was chosen and indicator variables were created. A multivariable model was developed in a stepwise manner with all covariates being considered. Hazard ratios and 95% confidence intervals were computed using the parameter estimates and their standard errors. All analyses were performed using SAS software, version 9.1 (SAS Institute, Inc., Cary, NC) in 2010–2012.

RESULTS

There were 1562 participants (mean age = 58.1 years) working full- or part-time at baseline. Of these, approximately 30% demonstrated a hearing impairment. The analytic study population included the 1410 participants (ages 48–85 years, mean = 57.8) who were working full- or part-time at baseline and who participated in at least one follow-up phase. Approximately 28% ($n = 396$) of these subjects were found to have a baseline hearing impairment (by audiometric testing) with nearly 3 out of 4 (73.0%) having a mild loss. The mean PTA_{0.5–4 kHz, worse ear} at baseline and at the 15-year follow-up was 20.9 dB HL and 31.8 dB HL, respectively.

Those with impairment were significantly older and more likely to be male (Table 1). They were also more likely to have histories of smoking and chronic disease and were less likely to perceive their health as excellent.

The 15-year cumulative incidence of retirement was 74.8%. The incidence was significantly ($p < 0.02$) higher in the subjects with a baseline hearing impairment (77.1%) compared to the subjects without an impairment (73.8%). Severity of the hearing loss was not significantly related to the incidence of retirement at the 5-year follow-up but at 10 years, subjects with a mild impairment displayed a marginally significant ($p = 0.07$) higher incidence of retirement (64%) compared to all subjects with a moderate or marked loss (51%) (Figure 1). However, with 15 years of follow-up, the difference between the rate among those in the mild hearing loss group (78%) and those in the moderate or marked loss group (76%) was no longer significant ($p = 0.22$).

After adjustment for age, gender, self-reported health, and history of chronic disease, there was no significant difference in the rate of retirement among the subjects with a hearing

impairment compared to subjects without an impairment (Hazard Ratio (HR) = 0.87, 95% Confidence Interval (CI) = 0.71, 1.06, $p = 0.18$) (Table 2). When participants wearing hearing aids at baseline were excluded, the 15-year unadjusted retirement rate among the hearing impaired was 76.1% and it continued to be marginally significantly ($p < 0.06$) greater than in the non-impaired participants. But after multivariable adjustment, the retirement rate in the hearing impaired was not significantly higher than in the non-hearing impaired (HR = 0.86, 95% CI = 0.70, 1.06, $p = 0.15$).

With respect to gender, the 15-year rate of retirement in males was 73.5% and the rate was significantly ($p = 0.03$) higher in the hearing impaired (76.0%) than in the non-hearing impaired (71.8%). In females, the overall retirement rate was 75.9% and those with a hearing impairment displayed a higher rate of retirement (80.3%) than those without an impairment (75.2%) although the difference was not significant ($p = 0.14$). After covariate adjustment, there was no significant difference in retirement rates based on hearing impairment in the males (HR = 0.95, 95% CI = 0.74, 1.21, $p = 0.67$) but among the females, hearing impairment was associated with a marginally significant ($p = 0.08$) lower rate of retirement (HR = 0.74, 95% CI = 0.53, 1.04). Additional modeling found that when income was added to the multivariable model, the retirement rates in the impaired and non-impaired were not significantly different (HR = 0.77, 95% CI = 0.54, 1.10, $p = 0.15$).

Results were not appreciably altered by excluding subjects who had transitioned from full-time to part-time employment in the 5 years prior to baseline or by restricting the analyses to participants who were less than 65 years of age and working full-time at baseline. In addition, similar results for the overall association between hearing impairment and the rate of retirement were observed when hearing impairment was based on the better ear thresholds. The incidence of retirement was significantly ($p < 0.01$) higher in those with a hearing impairment in the better ear (80.0%) compared to those without an impairment (73.8%). After adjustment for age, sex, self-reported health, and chronic disease history, there was no significant difference in the rate of retirement for the participants with a hearing impairment in the better ear compared to the participants without a hearing impairment (HR = 0.88, 95% CI = 0.69, 1.13).

The main reason for retirement differed somewhat by hearing impairment status (Table 3). Subjects without a hearing impairment were more likely to state that the time seemed right (78.8%) and less likely to state that retirement was mandatory (2.5%) compared to subjects with a hearing impairment (time seemed right: 74.4%; mandatory: 6.5%). No subjects with a hearing loss selected hearing problems as their main reason to retire.

DISCUSSION

Hearing impairment was found to have a significant relationship with the rate of retirement when there was no adjustment made for other retirement-related factors, including age, gender, history of chronic disease and self-reported health. After these factors were included in the modeling, the association between hearing impairment and retirement was no longer significant. It is important to note that the inclusion of covariates such as age and gender may have resulted in over-adjustment. For example, age was strongly related to retirement

and hearing impairment. If hearing impairment plays a role in the age-retirement relationship, adjusting for age results in masking the hearing effect on retirement.

There have been few previous investigations of hearing loss and its' impact on retirement decisions. Data from the first wave of the national Health and Retirement Study (HRS), conducted in 1992 among individuals 51–61 years of age, suggested that a self-report of poor hearing or vision was related to an earlier (approximately 1 year) expected retirement age (Dwyer and Mitchell, 1999). It has also been reported that in this same cohort, while 18% of individuals with a hearing loss considered themselves completely retired, only 12% of those without a hearing loss were completely retired (National Academy on an Aging Society, 1999).

Hearing is an important component of the face-to-face communicative and interactive processes that take place in the work setting. As hearing declines, oral communication may become more difficult and social functioning is affected (Dalton et al, 2003; Fischer et al, 2009). In a focus group interview investigation of office workers with a hearing loss (average age = 61 years), communication problems with co-workers, employers and clients were frequently mentioned when discussing job performance (Tye-Murray et al, 2009). So although a hearing problem may contribute to difficulty in the work place, this study did not observe that hearing impairment was associated with an increased rate of retirement over 15 years. In addition, having a hearing problem was not reported as a main reason for retirement in this study.

Any hearing-related problems in the work environment likely evolved as a slow process over many years as did the hearing loss. During this time workers may have gradually learned how to adapt to the hearing loss by making accommodations in their work environment. Workers may be making modest adjustments to their work environment and activities perhaps without even being aware of doing so. Employer-initiated accommodations are not widespread. The types of accommodations available include individualized equipment such as hearing aids, telephone amplifiers, and FM or infrared sound systems, as well as workplace programs such as a reduction in background noise (Fok et al, 2009). But previously reported data from the National Health Interview Survey, have suggested that workers with severe hearing impairment, defined as “having difficulty hearing normal conversation even while wearing a hearing aid”, were approximately half as likely to report receiving accommodations compared to workers with other conditions meeting the inclusion for the Disability Follow-Back Survey (Zwerling et al, 2003). There are likely to be many and quite varied reasons for the lack of accommodations with responsibility attributable to not only the employer but also to the employee with hearing loss. In a qualitative study of the stigma surrounding hearing loss, results suggested that there is a reluctance to disclose a hearing loss (Wallhagen, 2009) and without this disclosure, accommodations will not be considered.

There are a myriad of factors which influence retirement planning and the average age at retirement in the United States. Prior to the mid-1980's, there had been a long-standing trend toward an earlier age at retirement (Quinn, 2002). Factors such as public and private retirement plans, pension plan benefits, savings, stock market experiences, and Social

Security contributed to the opportunity to retire at younger ages. But in the 1990's and 2000's this trend began to shift to a later retirement age due to changes in retirement plans and benefits. The selection of participants for this study was based on employment in 1993–1995, and determination of retirement status was made in 1998–2000, 2003–2005, and 2009–2010, years during which average retirement age was stable or shifting upward. It was not possible to directly determine the effect that the economic factors had on the hearing impairment-retirement relationship. But it is noteworthy that among females, there was a suggestion that participants with a hearing impairment were less likely to retire when income was not considered. After income was included in the modeling, the difference in retirement rates between those with and without hearing impairment was reduced. This may indicate that the female participants with a hearing impairment were less able to afford retirement.

With respect to possible limitations of this study, retirement in many cases is a process, with gradual withdrawal from the work force through a reduction in hours worked or through the acceptance of a bridge job (Cahill et al, 2006). A difference in the proportion of subjects who are already reducing hours between the hearing impairment and no hearing impairment groups may have affected the results since individuals who have decreased their work hours may be more likely to retire within the next 10 or 15 years. Although it was found that the extent of transitioning from full- to part-time in the 5 years prior to baseline was greater in those with a hearing impairment (20.4%) compared to those without a hearing impairment (9.5%), age was a likely contributor to this difference and the removal of these subjects from the analyses did not substantially change the results.

If the trend to a later age at retirement continues, we can expect to have a work force with a greater proportion of older members and possibly a greater proportion with a moderate or severe hearing loss. We did not observe a significant difference in retirement rates at 15 years of follow-up between subjects with a baseline mild hearing loss and subjects with a baseline moderate or marked hearing loss but our power to detect a difference may have been inadequate. It is possible that with a larger number of subjects with severe hearing loss, a relationship between hearing impairment and retirement, independent of age and other covariates, may be found.

The strengths of this study include the longitudinal design which allowed the investigation of the 15-year history of employment experienced after the determination of a hearing impairment. This study included objective measurements of hearing thresholds instead of a reliance on self-report and a number of covariates related to retirement were available for inclusion in the models. Finally, the large cohort was population-based and follow-up rates were greater than 80%.

CONCLUSIONS

Hearing impairment was found to be associated with a higher rate of retirement over 15 years of follow-up but this association was not independent of age, gender, and health. However, the effect of hearing impairment on personal finances and work opportunities and on the wider labor force market deserves continued attention. As the U.S. workforce ages

(Silverstein, 2008; Toossi, 2012), there will be an increasing need for awareness of the impact of hearing impairment in the work place among its' older members. The experience and knowledge accumulated by the long-term employee leads to productivity and efficiency gains, particularly when the employer provides a work environment that is conducive for success.

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ABBREVIATIONS

BDES	Beaver Dam Eye Study
BMI	body mass index
CI	confidence interval
dB	decibel
EHLs	Epidemiology of Hearing Loss Study
HL	hearing level
HR	hazard ratio
PTA	pure-tone average

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Figure 1. Probability of Retirement by Severity of Hearing Impairment. Black bars indicate 5 years of follow-up; dark gray bars indicate 10 years of follow-up; light gray bars indicate 15 years of follow-up.

Table 1Study Subject Characteristics at Baseline by Hearing Impairment Status^a

Characteristic	Baseline Hearing Loss			p-value
	All	Yes	No	
N	1410	396	1014	
Mean Age (Standard Deviation)	57.8 (6.5)	61.1 (7.4)	56.5 (5.6)	< 0.0001
Gender				< 0.0001
Male	49.1	71.5	40.3	
Female	50.9	28.5	59.7	
Obese (BMI ≥ 30.0 kg/m ²)	43.1	46.4	41.8	0.12
Smoking				0.01
Never	43.8	37.6	46.3	
Past	38.5	43.4	36.5	
Current	17.7	19.0	17.2	
History of Chronic Disease	41.8	46.3	40.1	0.03
Self-reported Health				< 0.001
Excellent	29.9	23.0	32.6	
Good	61.2	64.8	59.8	
Fair/Poor	8.9	12.2	7.6	
Hearing Impairment – Worse Ear				
None (< 25 dB HL)	71.9	0.0	100.0	
Mild (≥ 25 & < 40 dB HL)	20.5	73.0	0.0	
Moderate (≥ 40 & < 60 dB HL)	5.0	17.7	0.0	
Marked (≥ 60 dB HL)	2.6	9.3	0.0	

^a Column percentages, i.e. the percentage of participants included in the column who have the characteristic, are presented.

Table 2

Association of Hearing Impairment and Retirement, Proportional Hazards Modeling All Participants and Excluding Hearing Aid Users, Overall and by Sex

	Overall		Males			Females		
	HR ^a	95% CI ^b	p-value	HR	95% CI	p-value	HR	95% CI
All Participants								
Unadjusted	1.23	1.04,1.47	0.02	1.28	1.02,1.61	0.03	1.25	0.93, 1.69
Adjusted ^c	0.87	0.71, 1.06	0.18	0.95	0.74, 1.21	0.67	0.74	0.53, 1.04
Excluding Hearing Aid Users								
Unadjusted	1.19	0.995, 1.43	0.056	1.21	0.95, 1.53	0.12	1.29	0.95, 1.77
Adjusted ^c	0.86	0.70, 1.06	0.15	0.91	0.71, 1.17	0.46	0.77	0.54, 1.09

^a HR: Hazard Ratio

^b CI: Confidence Interval

^c Adjusted for age, gender, self-reported health, and chronic disease history

Table 3**Main Reason for Retirement by Hearing Impairment**

Main Reason	Hearing Impairment	
	Yes (n=262) N (%)	No (n=655) N (%)
Vision Problems	1 (0.4)	3 (0.5)
Hearing Problems	0 (0.0)	1 (0.2)
Health Problems	30 (11.4)	76 (11.6)
Time Seemed Right	195 (74.4)	516 (78.8)
Mandatory, Wanted To	9 (3.4)	7 (1.1)
Mandatory, Didn't Want To	8 (3.1)	9 (1.4)
Laid Off	7 (2.7)	18 (2.7)
Other	12 (4.6)	25 (3.8)