

Impact of Hearing Loss and Access to Hearing Healthcare in Rural Adult Cochlear Implant Recipients

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ABSTRACT

Objective: A significant population of rural residents faces barriers to specialized healthcare. The purpose of this study is to examine socioeconomic characteristics and hearing healthcare access in rural adult cochlear implant (CI) recipients and compare the impact of hearing loss and timing of hearing loss management of rural and urban adult CI recipients.

Methods: Adult CI recipients from a tertiary medical center were identified and mailed a questionnaire assessing socioeconomic information, impact of hearing loss on education and employment and timing of onset, diagnosis and treatment of hearing loss. The benefits obtained from cochlear implantation were also evaluated.

Results: Of the 90 participants, 32 were from rural counties and 58 were from urban/suburban counties. Rural implant recipients experienced a significantly longer commute time to the cochlear implant center ($p < 0.001$), lower income ($p < 0.001$) and higher percentage of Medicaid coverage ($p = 0.004$). There was a trend toward delayed diagnosis and amplification in rural participants. The average time elapsed from onset of hearing loss to cochlear implantation was 28.3 years in urban adults compared to 33.5 years in rural adults ($p = 0.214$). Hearing loss negatively affected educational attainment and employment in urban and rural adults in a similar degree and both groups reported comparable benefit from cochlear implantation.

Conclusion: Rural CI recipients differ from urban residents in socioeconomic characteristics. Distance from cochlear implant centers may affect timely diagnosis and treatment of profound hearing loss. Further efforts to expand access to cochlear implant services may benefit rural adult patients.

INTRODUCTION

Hearing loss in the adult population of the United States is a significant public health issue. The U.S. Department of Health and Human Services, as indicated in Healthy People 2020, included timely hearing screening with appropriate treatment referral as a priority achievement¹. As the life expectancy in the U.S. continues to climb, the health burden of chronic disease would be expected to increase substantially, making prompt recognition and intervention essential.

Despite the high prevalence of adult hearing loss, treatment options are underutilized. According to the MarkeTrak VII online survey, less than 25% of adults with hearing loss own hearing aids². Delays to diagnosis and treatment exist because screening for hearing loss is not uniform and referrals for advanced testing are uncommon.

Cochlear implantation (CI) is an effective therapy for patients with advanced bilateral hearing loss who receive limited benefit from traditional amplification. Significant improvements have been reported in hearing-related outcomes and quality of life for CI patients³. Despite an abundance of data to support their efficacy and FDA approval in the United States for 30 years, it is estimated that fewer than 6% of Americans who could benefit from CI have one⁴. To date, little research exists documenting delays in receipt of hearing healthcare, specifically in the adult population of rural America.

The diagnostic and therapeutic process to obtain advanced aural rehabilitation, particularly cochlear implantation, is complicated and time consuming. Additionally, a significant financial burden is incurred due to travel, missed work and purchase of equipment such as hearing aids. There are no reports in the literature assessing adult hearing healthcare disparities. The purpose of this study is to examine the socioeconomic characteristics of rural adult CI recipients and compare the impact of hearing loss and timing of hearing loss management with urban adult CI recipients.

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METHODS

Institutional review board (protocol 14-0854-F1V) approval was obtained prior to initiation of the study. Inclusion criterion was adult (>18 years old) cochlear implant patients receiving active care at our institution from 1989 until present. Patients who received their cochlear implant before the age of 18 were excluded as the focus of this study was on adult cochlear implantation.

A 29-item questionnaire was developed to assess patient demographics, timing to the initiation of audiological care, barriers to care and effect of hearing loss on quality of life. The 7-item International Outcome Inventory for Hearing Aids (IOI) was utilized by adapting the questionnaire for cochlear implant patients and included to evaluate treatment efficacy.

Surveys were separated, based on patient-reported county of residence, to a urban/suburban group or a rural group based on the rural status of each county using the Beale codes of 2013 (US Department of Agriculture Rural-Urban Continuum Coding system)⁵. Beale codes 1 through 3 are considered urban/suburban, 4 through 6 are rural, and 7 through 9 are very rural. For the purposes of comparison in our study, we designated rural residents as those from a very rural county with a Beale code of 7 or higher.

Returned questionnaires were analyzed by coding each item separately into the secure Research Electronic Data Capture database (REDCap) (Vanderbilt University, Nashville, TN). Survey data was managed using an Excel spreadsheet (Microsoft, Redmond, WA, USA) and statistical analysis was performed with SAS software (SAS Institute Inc., Cary, NC, USA). A p -value < 0.05 was considered to be statistically significant.

RESULTS

Characteristic	Urban	Rural	Urban vs Rural p-value
Population Size	58	32	
Mean age (years)	63.8	58.5	0.107
Mean commute time to UK (min)	60	126	< 0.001
Male sex (%)	45%	47%	0.852
Race			
White	97%	100%	0.288
African American	2%	0%	1.000
Native American	2%	0%	1.000
Education (%)			0.057
No degree	7%	22%	0.049
High school or equivalent	28%	38%	0.331
Post-secondary education	22%	13%	0.399
College graduate	28%	9%	0.059
Graduate degree	16%	19%	0.771
Income (%)			< 0.001
Less than \$10,000	8%	28%	0.011
\$10,000-20,000	12%	22%	0.209
\$20,000-30,000	21%	22%	0.741
\$30,000-60,000	25%	22%	0.953
More than \$60,000	35%	6%	0.007
Insurance (%)*			
Medicaid	14%	41%	0.004
Medicare	57%	50%	0.529
Private	50%	22%	0.009
Other	21%	25%	0.638
Cochlear Implant Use (%)			0.271
Unilateral	75%	88%	
Bilateral	25%	13%	

*Percentages do not add to 100% due to multiple selections permitted.
f - Fisher's Exact test used due to an anticipated frequency < 5 in one of the categories

Table 1: Comparison of demographics in urban and rural adult cochlear implant recipients

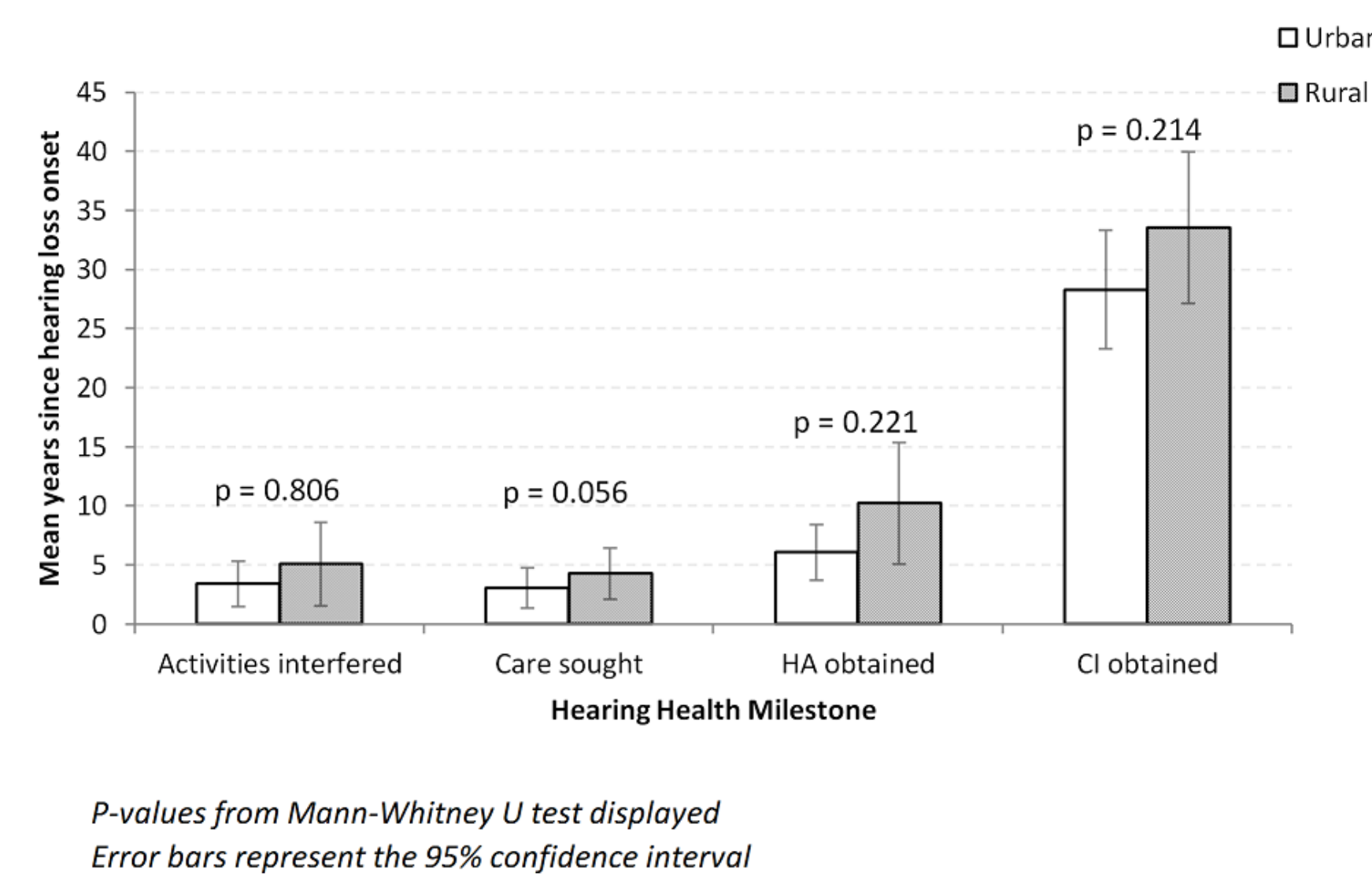


Figure 1: Assessment of average time interval (years) from onset of hearing loss to interference with daily activities (first column), to seeking medical/audiological care (second column), to obtaining hearing aids (third column), to cochlear implantation (fourth column) for urban and rural study participants.

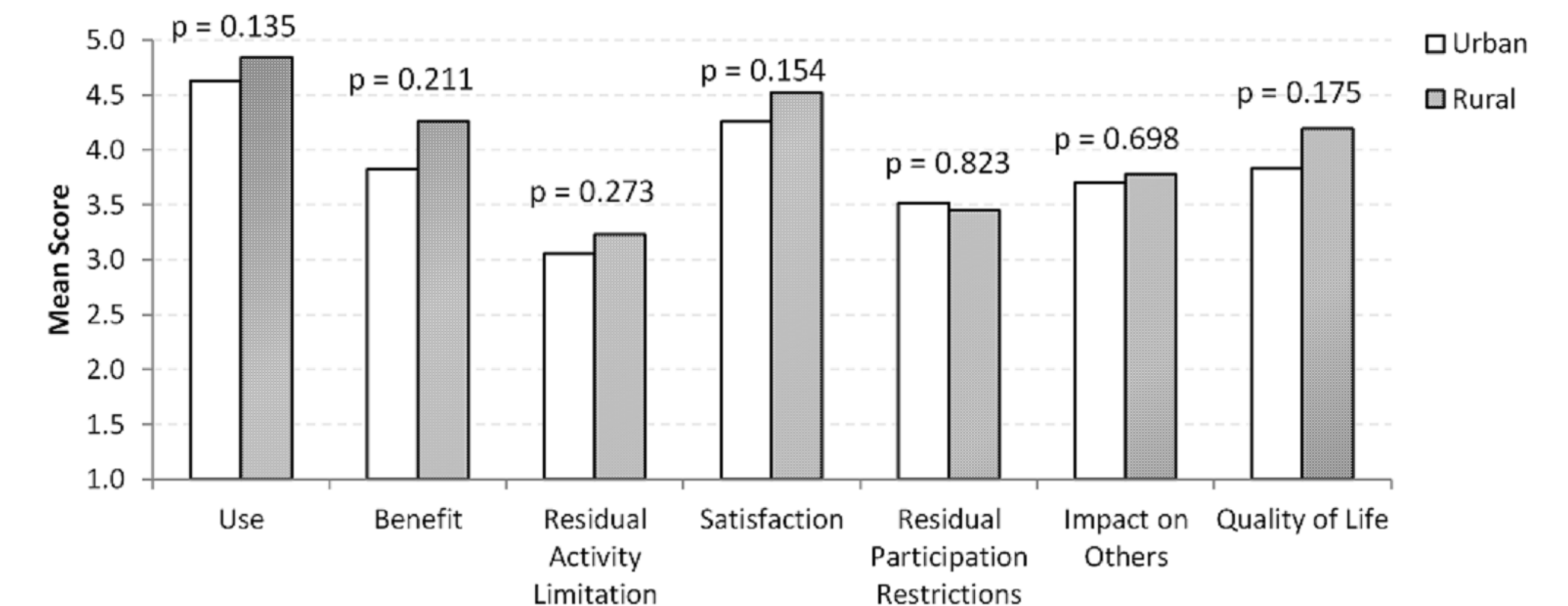


Figure 2: Comparison of outcomes for urban and rural cochlear implant participants via the IOI instrument.

Self-Reported Impact on Job & Education (% Agree or Strongly Agree)	Total Sample	Urban	Rural	Urban vs Rural p-value
Difficulty performing job	78%	83%	68%	0.164
Prevent Hiring	49%	50%	47%	0.851
Causing Loss of Job	30%	23%	44%	0.133
Prevent Promotion	56%	66%	37%	0.041
Cause Discrimination in Workplace	40%	43%	33%	0.481
Desire to complete higher education	58%	58%	58%	1.000
Prevented from completing education in past	44%	48%	38%	0.426

f - Fisher's Exact test used due to an anticipated frequency < 5 in one of the categories

Table 2: Comparison of education and job-related effects in rural and urban cochlear implant patients.

CONCLUSIONS

- Rural populations expectedly demonstrate socioeconomic characteristics that make prolonged travel to tertiary care referral centers difficult, including increased commute time and lower levels of household income. This is especially impactful in cochlear implantation, as rigorous post-implant audiological follow up is essential in attaining successful outcomes.
- Trends indicate a rural delay in receiving audiological care following self identification of hearing loss, but no time points, including time to CI ($P = 0.214$), reached statistical significance.
- Considering all participants, there was an average time gap of approximately 30 years between the time of onset of hearing loss and cochlear implantation.
- Both populations show a large percentage of respondents who attribute job and educational difficulties to their hearing impairment.
- Data indicated at least a moderate benefit in all 7 categories for each group, demonstrating the acceptability, utility and improved quality of life achieved with cochlear implantation
- Future studies investigating remote audiological diagnostic testing and cochlear implant programming could serve to expand the reach of specialized providers from tertiary care medical centers. Additional education should also be provided for community primary care physicians and local health departments to inquire about hearing loss in adult patients and initiate appropriate referrals.

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