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Research Note

Positive Social Interaction and Hearing Loss in Older Adults Living in Rural and Urban Communities

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Purpose: This study explored the extent to which hearing loss affected positive social interactions in older adults living in rural and urban communities.
Method: Pure-tone behavioral hearing assessments were administered to 80 adults 60 years of age or older. In addition, all participants completed 2 questionnaires, the Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991) and the Patient Health Questionnaire–Ninth Edition (Kroenke, Spitzer, & Williams, 2001).
Results: The preliminary findings suggested that adults with hearing loss living in rural towns had poorer positive social interactions compared with their urban counterparts with hearing loss. Also, adults with hearing loss living in rural towns had more symptoms of depression than adults with normal hearing who lived in these same geographical regions.
Conclusions: These preliminary findings could indicate that older adults with hearing loss living in rural communities will face more isolation than adults with hearing loss living in urban settings. Increasing our understanding of the extent of social isolation in adults with hearing loss living in rural and urban populations will be necessary.

The effects of social isolation on physical and mental well-being can be dramatic (Berkman & Syme, 1979). The evidence has suggested that the quantity and quality of individuals' social relationships are associated with physical and mental health across the life span (Berkman & Glass, 2000; Cohen, 2004; George, 1989). The absence of social relationships can negatively affect the outcomes associated with both physical and mental health conditions (Berkman, 1995; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Smith, Jackson, Kobayashi, & Steptoe, 2017). Hearing loss has consequences for emotional well-being, can lead to fewer social interactions, and can result in reduced quality of life (Ciorba, Bianchini, Pelucchi, & Pastore, 2012; Moser, Luxenberger, & Freidl, 2017).

A number of studies have demonstrated that for adults with hearing loss, social isolation occurs in specific groups of people. Some studies have found that older women, those with greater degrees of hearing loss, those with chronic diseases, and those who do not use hearing aids experience social isolation (Mick, Kawachi, & Lin, 2014; Mick & Pichora-Fuller, 2016; Palmer, Newsom, & Rook, 2016; Pronk, Deeg, & Kramer, 2013; Pronk et al., 2011; Weinstein, Sirow, & Moser, 2016). Also, feelings of loneliness in men but not in women have been reported (Pronk et al., 2011). Other studies have reported that older women between the ages of 60 and 69 years, and not men or older adults, have feelings of social isolation (Mick et al., 2014). Finally, those living with a partner in the household, and those with medium and high levels of education have reported more feelings of social isolation (Pronk et al., 2011; 2013). Most definitely, further work will be necessary to help explain these conflicting outcomes.

Social isolation can result in loneliness, which, in turn, can lead to depression. Studies have found a strong association between loneliness and depression (Aylaz, Akturk, Erci, Ozturk, & Aslan, 2012; Cacioppo, Hughes, Waite, Hawkley, & Thisted, 2006; Springer et al., 2003; Wan Mohd Azam et al., 2013). Evidence also has suggested that social support is a mediating factor for loneliness and depression in the general population (Cacioppo et al., 2006; Wan Mohd Azam et al., 2013). Poor social networks can be associated with increased feelings of loneliness. Considering that loneliness is a significant risk factor for depression and, additionally, the lack of social support networks can

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mediate loneliness, it will be important to understand how hearing loss might factor into these associations, especially for at-risk populations including older adults and those who cannot easily access hearing health care.

Recently, a theoretical framework, the International Classification of Functioning, Disability and Health model, has been used to help audiologists better manage those with hearing loss by considering the social and environmental contexts of these adults in addition to the use of diagnostic and intervention procedures (Davis et al., 2016; Gagne, Jennings, & Southall, 2009). According to this framework, hearing loss as a health condition will affect body structures (e.g., deterioration of outer and inner hair cells), related activities associated with having a hearing loss (i.e., reduced speech perception skills), and individuals' participation in society (e.g., involvement in social activities, accessing hearing health care; Davis et al., 2016). Use of this framework has the potential to improve the clinical management of adults with hearing loss by considering more than just typical intervention approaches (i.e., amplification and rehabilitation). It will allow professionals to understand how their clients function within their social and environmental networks and potentially help them to improve or maintain social interactions, thereby avoiding loneliness. By using this model, we can increase our understanding of how positive social interactions (PSIs) affect adults with limited access to hearing health care. That is, if adults with hearing loss cannot access hearing health care resources, thereby preventing them from receiving interventions for their hearing loss, would they be less willing to engage in social interactions? By understanding how access to health care might affect social engagement, professionals will be better equipped to help their patients.

In fact, there is a limited amount of evidence related to how social interactions are affected for older adults with hearing loss who live in communities with limited access to hearing health care. Some evidence exist suggesting that adults who live in communities with poor access to hearing health care have poorer quality of life compared with adults with hearing loss who live in communities with access to audiologic and other hearing health care services (Ingram et al., 2016; Nieman, Marrone, Szanton, Thorpe, & Lin, 2016). In fact, Savikko, Routasalo, Tilvis, Strandberg, and Pitkala (2005) found that a greater degree of self-reported loneliness occurred in older adults with hearing loss living in rural communities compared with older adults with hearing loss living in urban communities. However, much more data are required to understand the impact that hearing loss has on social interactions for older adults who live in rural communities. The purpose of this preliminary study, therefore, was to explore how social interactions might be affected for older adults living with hearing loss in rural versus urban communities. Additionally, we explored how social interactions or the lack thereof might increase depressive symptoms. We hypothesized that older adults living in rural communities with hearing loss would experience fewer PSIs and more depressive symptoms compared with the number of PSIs and symptoms of depression experienced by adults with hearing loss living in urban communities. We also explored the influence of income and education on the outcomes. Both of these factors have been shown to influence outcomes associated with feelings of social isolation and depression (Cacioppo et al., 2006; Pronk et al., 2013).

Method

Participants

The participants for this study were a subgroup of adults from a data set reported by Hay-McCutcheon et al. (2017). Specifically, data from 80 adults 60 years of age or older are reported in the current study. Thirty-seven adults had normal hearing, 43 adults had a bilateral mild or greater hearing loss, and 28 of these adults used hearing aids. Forty-nine of the adults lived in an urban area, and 31 lived in a rural town. An *urban area*, as defined by the U.S. Census Bureau is a city of 50,000 or more inhabitants, and a *rural town* has a population of 2,500 or fewer people (U.S. Census Bureau, 2015). The above information, along with other demographic and outcome data, is provided in Table 1.

Materials

The Medical Outcomes Study (MOS) Social Support Survey (Sherbourne & Stewart, 1991), a widely used measure of social support, was administered to participants in this study. The survey was originally developed for adults participating in the MOS, which was a 2-year evaluation of patients with chronic conditions (Stewart et al., 1989; Tarlov et al., 1989). The survey was designed using data from 2,987 patients and, since its development, has been used to assess perceptions of social support in adults suffering from drug abuse, HIV/AIDS, kidney disease, cancer, and diabetes, to name a few.

This scale measures five types of social support, including emotional support, informational support, tangible support, affectionate support, and PSI. Sherbourne and Stewart (1991) reported that the subscales can be used separately to measure and quantify specific types of social support. For purposes of this study, outcomes from the PSI subscale were used. We wanted to explore social isolation in the older population and, consequently, used the PSI scale of the MOS Social Support Survey for this purpose. The Committee on Accessible and Affordable Hearing Health Care for Adults (Committee on Accessible and Affordable Hearing Health Care for Adults, 2016) reported that we need to understand how age-related hearing loss can lead to social isolation, particularly for older adults who live in underserved communities. There are three items on the PSI subscale, and each was rated on a 5-point scale (i.e., *none of the time* to *all of the time*). These questions generally assessed the availability of others to help individuals relax or enjoy themselves. Higher ratings indicated better support. An alpha Cronbach's score of .94

Table 1. Participant demographic information and mean outcomes from the Medical Outcomes Study Social Support–Positive Social Interaction (MOS-PSI) and Patient Health Questionnaire–Ninth Edition (PHQ-9) questionnaires.

Variable	NH urban	NH rural	HL urban	HL rural
Number (*N*) = 80	24	13	25	18
Gender (*N*)	F = 14 M = 10	F = 6 M = 7	F = 12 M = 13	F = 8 M = 10
Mean age (*SD*)	68.3 (6.1)	66.2 (5.9)	71.6 (8.7)	72.9 (8.9)
Mean 5 F-PTA in better hearing ear (*SD*)	14.6 (3.7)	14.9 (7.4)	40.6 (13.3)	44.3 (12.0)
Hearing aid use (*N*)	0	0	17	11
Income (*N*)				
< $30,000	2	8	2	8
$30,000–$49,900	5	1	6	2
$50,000–$74,000	5	2	0	2
$75,000–$99,000	2	1	2	1
> $100,000	7	0	10	2
Did not report	3	1	5	3
Race (*N*)				
Black or African American	6	7	0	4
White	17	6	23	13
Other	0	0	1	1
Did not report	1	0	1	0
Education (*N*)				
Less than high school	0	0	0	2
High school or GED	0	6	5	5
Some college	5	3	2	5
Two-year college diploma	2	0	2	0
Four-year college degree	5	3	5	3
Graduate or professional degree	12	1	11	2
Outcome data				
Mean MOS-PSI (*SD*)	12.0 (2.7)	12.7 (2.7)	12.9 (3.0)	11.7 (3.2)
Median MOS-PSI	12.0	14.0	15.0	12.0
Mean PHQ-9 (*SD*)	2.7 (3.0)	2.5 (3.0)	4.0 (4.4)	4.5 (4.3)
Median PHQ-9	1.5	1.0	2.0	4.0

Note. NH = normal hearing; HL = hearing loss; F = female; M = male; GED = General Educational Development.

indicated high internal consistency reliability for the PSI scale (Sherbourne & Stewart, 1991).

We also wanted to assess the potential risk for depression in adults who perceive themselves to have few PSIs. Consequently, we selected a self-administered questionnaire that was a reliable measure of depression and could be completed within a few minutes. There are a number of scales that assess depression, including the Beck Depression Inventory (Beck, Ward, & Mendelson, 1961), the Center for Epidemiologic Studies Depression Scale (Radloff, 1977), and the Geriatric Depression Scale (Yesavage et al., 1982). For this study, though, all participants completed the public domain Patient Health Questionnaire–Ninth Edition (PHQ-9; Kroenke, Spitzer, & Williams, 2001), which is a popular self-assessment measure. This questionnaire incorporates depressive symptoms from the *Diagnostic and Statistical Manual–IV* (American Psychiatric Association) and consists of nine questions from the larger PHQ. The questions assess interest in doing things, sleeping habits, and feelings about oneself, to name a few, and they are scored on a scale from 0 (*not at all*) to 3 (*nearly every day*). The total score is calculated by summing the responses to each question and can range from 0 to 27. The depression severity ranges from *minimal* (scores of 0–4), *mild* (scores of 5–9), *moderate* (10–14), *moderately severe* (15–19), and *severe* (20–27). The internal reliability of the PHQ-9 was measured using Cronbach's alpha (i.e., .89; Kroenke et al., 2001).

Procedure

Participants were administered a hearing evaluation and then completed the questionnaires. Pure-tone behavioral hearing testing was conducted in a sound booth at the Speech and Hearing Center of The University of Alabama or in quiet rooms of public health departments in West Central Alabama. The level of the background noise in the rooms of the public health departments was monitored using a sound level meter (Larson-Davis 824 Meter). The noise levels were within the American National Standards Institute's 1999 standard for maximum permissible ambient noise levels for insert earphones for the octaves from 250 to 8000 Hz (American National Standards Institute, 1999). Insert earphones (ER-3A Etymotic Research) and a Maico 42 portable audiometer (Maico Diagnostics) were used to obtain binaural pure-tone behavioral thresholds at 250, 500, 1000, 2000, and 4000 Hz in the quiet rooms. An Otometrics Madsen Astera audiometer (Audiology Systems) and 3 M Auditory Systems EAR Tone 3A insert earphones were used to conduct behavioral threshold testing in the

sound booth. The average of all five behavioral thresholds (5 F-PTA) in the better hearing ear was used for analyses. *Hearing loss* was defined as a bilateral 5 F-PTA of 26 dB HL or greater according to the World Health Organization (2017). All participants completed the informed consent document, and procedures were carried out according to the Internal Review Board of The University of Alabama.

Data Analysis

Two multiple linear regressions were fit using R (R Core Team, 2017). Both included as fixed effects subject income with six levels, participant education with seven levels, residency status with two levels (urban/rural), and hearing sensitivity with two levels (hearing within normal limits, hearing loss). The dependent variable for the first regression was the MOS-PSI score, and the dependent variable for the second regression was the PHQ-9 score. We expected that the findings from these analyses would reveal that adults with hearing loss who lived in rural communities would have fewer PSIs compared with adults with normal hearing who lived in an urban city. Additionally, we predicted that fewer PSIs would result in more symptoms of depression. These findings will be important to understand how social and environmental contexts affect quality of life for adults with hearing loss living in communities with limited access to hearing health care.

Results

Demographic data along with the mean and median outcomes for the MOS-SPI and the PHQ-9 questionnaires are provided in Table 1. The MOS-PSI data suggest that adults with normal hearing who lived in rural areas had comparable PSIs (i.e., 12.7) with adults with normal hearing living in an urban setting (i.e., 12.0). For adults with hearing loss, those who lived in a rural setting had fewer PSIs (i.e., 11.7) than those who lived in an urban area (i.e., 12.9). For the PHQ-9 results, adults with hearing loss reported more symptoms of depression (i.e., 4.0 for urban adults and 4.5 for rural adults) compared with adults who had hearing within normal limits (i.e., 2.7 for urban adults and 2.5 for rural adults). Cohen's *d* effect size calculations for the MOS-PSI and the PHQ-9 data are provided in Table 2. For the majority of comparisons, the Cohen's *d* values suggested small to moderate effect sizes. Of note, the effect size of .39 when comparing the outcomes on the MOS-PSI for adults with hearing loss living in a rural town or an urban community suggests that adults living in rural towns had poorer outcomes than adults living in an urban city. Also, a moderate effect size of .49 was found when comparing the outcomes on the PHQ-9 for adults with hearing loss living in a rural area with the findings from adults with normal hearing who lived in an urban city. Finally, an effect size of .54 for the comparison of the outcomes on the PHQ-9 for adults living in rural towns with and without hearing loss suggests that adults with hearing loss might experience more depressive symptoms than adults with normal hearing living in these rural communities. Finally, Pearson two-tailed correlations were performed using the outcomes from the MOS-PSI and the PHQ-9 for adults living in rural and urban areas. The Pearson correlation ($r = -.41$, $p < .001$) revealed that those with fewer PSIs reported more symptoms of depression.

Table 2. Comparing the Medical Outcomes Study Social Support–Positive Social Interaction (MOS-PSI) and Patient Health Questionnaire–Ninth Edition (PHQ-9) outcomes for adults living in urban and rural areas (Cohen's *d*).

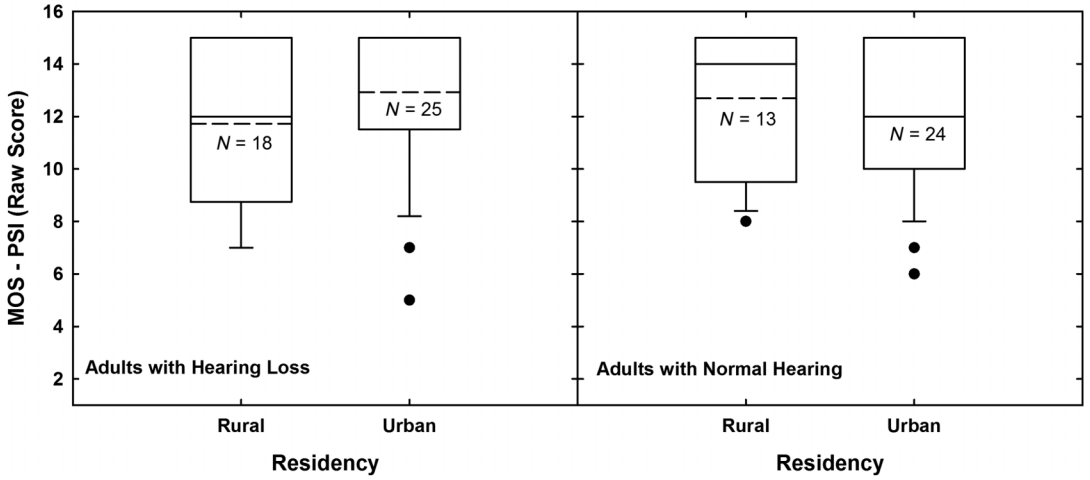
Cohen's *d*	NH urban	HL rural	NH rural
MOS-PSI			
HL urban	0.32	0.39	0.07
NH urban	–	0.10	0.26
HL rural	–	–	0.34
PHQ-9			
HL urban	0.35	0.11	0.40
NH urban	–	0.49	0.07
HL rural	–	–	0.54

Note. NH = normal hearing; HL = hearing loss.

The outcomes from the MOS-PSI scale for adults living in urban and rural areas are displayed in the box plots of Figure 1. For each box plot in Figure 1, and in Figure 2 that follows, the horizontal edges represent the 25th and 75th percentiles, the solid line within the box represents the median, and the dotted line represents the mean. The whiskers represent the 10th and 90th percentiles, and the solid circles show the suspected outliers. Data from adults with hearing loss are shown in the left panel, and the right panel shows the findings from adults who had hearing within normal limits. Twenty-four adults with normal hearing lived in an urban setting, and 13 adults with normal hearing lived in a rural town. For the adults with hearing loss, 25 of them lived in an urban setting and 18 lived in rural areas. Multiple regression analyses, as shown in Table 3, revealed that only income was a mitigating factor for the outcomes. Adults who made less than $30,000 reported fewer instances of PSI compared with adults who made over $100,000. Hearing sensitivity, education, or residency were not significant factors in the analysis model. An effect size calculation revealed a medium effect size for income (i.e., Cohen's $f^2 = .16$). Cohen's f^2 values of .02 are considered small effect sizes, values of .15 are considered medium effect sizes, and those .35 or greater are considered large effect sizes (Cohen, 1988).

The box plots in Figure 2 show the outcomes for the PHQ-9 depression questionnaire. The findings for adults with normal hearing are provided in the right panel, and the results for adults with hearing loss are provided in the left panel. Again, higher scores indicate more depressive symptoms. The majority of the scores for adults with and without hearing loss fell between 0 and 4, indicating minimal depression. However, in general, adults with hearing loss tended to have higher scores than adults who had hearing within normal limits. Multiple regression analyses

Figure 1. Raw scores obtained from the positive social interaction scale of the Medical Outcomes Social Support Survey (MOS-PSI) for adults with normal hearing (right panel) and for adults with hearing loss (left panel) are shown in this box plot. The total number of participants is displayed for each box. Outcomes for rural and urban residents are displayed separately in each panel. For each box plot, the horizontal edges represent the 25th and 75th percentiles, the solid line within the box represents the median, and the dotted line represents the mean. The whiskers represent the 10th and 90th percentiles, and the solid circles show the suspected outliers.



revealed that hearing sensitivity was a significant factor helping to explain the outcomes and that residency was trending toward significance (see Table 3). Those with hearing loss reported more depressive symptoms than those who had hearing within normal limits.

Discussion

The trends observed from our data might suggest that older adults with hearing loss living in rural communities, where access to hearing health care could be poor, experience fewer PSIs than their urban counterparts (see Figure 1 and Table 2). That is, rural adults 60 years of age or older with hearing loss who lived in rural communities had poorer outcomes on the MOS Support Survey compared with adults with hearing loss who lived in urban areas (Cohen's $d = 0.39$). We also found that adults with hearing loss who lived in a rural community had poorer outcomes on the PHQ-9 compared with adults who lived in a rural town who had hearing within normal limits (i.e., Cohen's $d = 0.54$). Overall, hearing

Figure 2. Raw scores obtained from the Patient Health Questionnaire–Ninth Edition (PHQ-9) are shown. Data from adults with normal hearing are displayed in the right panel, and the left panel shows data from adults with hearing loss. Within each box, data from urban and rural residents are displayed separately. The horizontal edges within each box represent the 25th and 75th percentiles. The solid line within the box represents the median, and the dotted line represents the mean. The whiskers represent the 10th and 90th percentiles, and the solid circles show the suspected outliers. The total number of adults who completed the questionnaire is provided for each box.

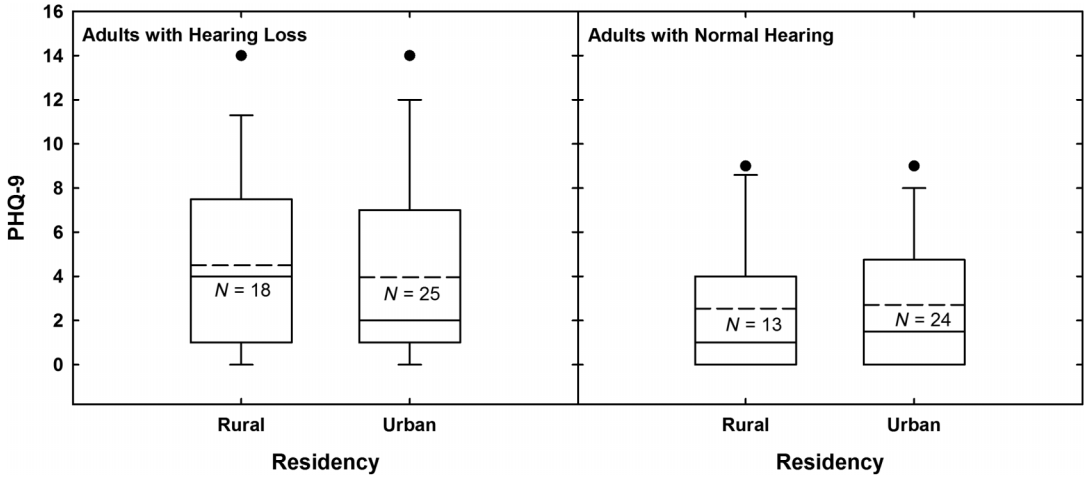


Table 3. Multiple regression findings for the Medical Outcomes Study Social Support–Positive Social Interaction (MOS-PSI) and the Patient Health Questionnaire–Ninth Edition (PHQ-9) results using income, education, hearing status, and residency as factors.

Multiple regression analysis				
MOS-PSI model, $F(14, 65) = 1.27$, $p = .25$				
	t	***df***	***p* value**	**Cohen's f^2**
Income	2.15	5	.04	.16 (medium)
PHQ-9 model, $F(14, 65) = 1.78$, $p = .06$				
Hearing	–2.11	1	.04	.04 (small)
Residency	1.76	1	.08	< .01

sensitivity was a significant factor for the outcomes on the PHQ-9, revealed through the multiple regression analyses. Finally, the correlation analysis suggested that fewer instances of PSI resulted in more symptoms of depression.

These preliminary findings could indicate that older adults with hearing loss living in rural communities will face more isolation compared with adults with hearing loss living in urban settings. Furthermore, for adults 60 years of age or older who live in rural towns, a hearing loss and feelings of isolation could lead to more depressive symptoms than adults who have hearing within normal limits and live in a rural town. Individuals with few PSIs or contacts are considered to be socially isolated or lonely (Nicholson, 2012). This social isolation and loneliness are risk factors for physical and emotional ailments and, ultimately, mortality (Berkman, 1995; Holt-Lunstad et al., 2015; Smith et al., 2017). Addressing the social support needs of adults living in all communities, therefore, is important, but we must also consider that older adults living in rural areas with hearing loss may require additional attention to improve their social connections and help to prevent physical and emotional decline. The International Classification of Functioning, Disability and Health model would suggest that effective diagnostic/intervention management of those with hearing loss should also consider social/environmental contexts of the patient. It might be appropriate for audiologists to assess the degree to which their older patients interact positively with others in their communities, either rural or urban. For those patients with limited PSIs, audiologists could provide their patients with options for social gatherings in their community and, if needed, options for means of transportation to these events. Audiologists could also seek guidance from other professionals, which could include social workers or other professional therapists, who might provide specific treatment options for these adults. This clinical model would allow hearing health care professionals to provide effective care to their patients, thereby allowing them to successfully manage their hearing loss. This treatment plan could include a multidisciplinary approach to help them adjust to their hearing loss, as suggested above, or to provide specialized care to adults living in areas with poor access to hearing health care through the use of community health workers, telehealth techniques, or support groups.

Study Limitations and Future Directions

To improve our understanding of the issues that older people in rural settings experience, it will be necessary to conduct further studies. The primary limitation of this study is the relatively small sample size, and consequently, a larger population of older adults with and without hearing loss living in communities with and without access to hearing health care will be required to understand how hearing loss affects PSIs and depression in these regions. A larger sample size would also allow us to understand how varying degrees of hearing loss affect social isolation and depression. In addition to an increased sample size, more detailed measures of social isolation will be needed. Possibly, reporting activities of daily living would provide a more comprehensive picture of social interactions. Considering that older adults living in rural communities may be more socially isolated than adults living in urban communities (Baernholdt, Yan, Hinton, Rose, & Mattos, 2012), it will be necessary to understand how social interactions of older adults living in rural communities change with the onset and progression of hearing loss. Perhaps, adults who live in rural towns and develop a hearing loss will require specific interventions, which could include the participation in group rehabilitation or more clinical sessions with their audiologist or hearing health care professional. Understanding the extent of social isolation will ultimately help to tailor and design rehabilitation programs for older adults with hearing loss living in a variety of communities across the country.

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