The Benefits of Hearing Aids and Closed Captioning for Television Viewing by Older Adults with Hearing Loss

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Objective: Although watching television is a common leisure activity of older adults, the ability to understand televised speech may be compromised by age-related hearing loss. Two potential assistive devices for improving television viewing are hearing aids (HAs) and closed captioning (CC), but their use and benefit by older adults with hearing loss are unknown. The primary purpose of this initial investigation was to determine if older hearing-impaired adults show improvements in understanding televised speech with the use of these two assistive devices (HAs and CC) compared with conditions without these devices. A secondary purpose was to examine the frequency of HA and CC use among a sample of older HA wearers.

Design: The investigation entailed a randomized, repeated-measures design of 15 older adults (59 to 82 yr) with bilateral sensorineural hearing losses who wore HAs. Participants viewed three types of televised programs (news, drama, and game show) that were each edited into lists of speech segments and provided an identification response. Each participant was tested in four conditions: baseline (no HA or CC), HA only, CC only, and HA + CC. Also, pilot testing with young normal-hearing listeners was conducted to establish list equivalence and stimulus intelligibility with a control group. All testing was conducted in a quiet room to simulate a living room, using a 20 in flat screen television. Questionnaires were also administered to participants to determine the frequency of HA and CC use while watching television.

Results: A significant effect of viewing condition was observed for all programs. Participants exhibited significantly better speech recognition scores in conditions with CC than those without CC ($p < 0.01$). Use of personal HAs did not significantly improve recognition of televised speech compared with the unaided condition. The condition effect was similar across the three different programs. Most of the participants (73%) regularly wore their HAs while watching television; very few of them (13%) had ever used CC.

Conclusions: On average, use of CC while watching television dramatically improved speech understanding by a sample of older hearing-impaired adults compared with conditions without CC, including when HAs were worn.

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INTRODUCTION

Approximately 92% of people between 65 and 74 yr and 95% of people 75 yr and older watch television every day (Hanley 2002). Adults older than 65 yr watch more television than younger age groups, with an average of 3.5 to 5.25 hr of television per day (Hanley 2002; Mares & Woodard 2006). They rely on television for national and world news and for entertainment (Goodman 1990). There are many factors, however, that may limit television viewing by older people. One potential factor is hearing loss, which affects at least one third of adults older than 65 yr and one half of those older than 80 yr (Moscicki et al. 1985; Cruickshanks et al. 1998; Desai et al. 2001). Age-related hearing loss not only attenuates sound but also affects the clarity with which a spoken message is received. This limitation may be mitigated somewhat by the availability of speechreading cues, which are highly beneficial for speech understanding when combined with auditory information (Grant et al. 1998). Although recent reports suggest that older individuals do not lipread visual-only signals as well as younger adults (Tye-Murray et al. 2007), older people seem to derive significant benefit from the integration of auditory and visual cues (Walden et al. 1993).

Accurate perception of the televised message might also be compromised in older adults because of a decline in the ability to process auditory signals presented at a rapid rate (Gordon-Salant & Fitzgibbons 1993; Fitzgibbons et al. 2007). This age-related decline in processing rapid signals has been attributed to a cognitive decline in the speed of information processing (Salthouse 1996) as well as to a more central deficit in neural synchrony for coding of rapid signal onsets, as suggested by animal models of aging (Hellstrom & Schmiedt 1990; Boettcher et al. 1996). Age-related deficits for processing rapid speech, described above, have been observed in older listeners with normal hearing (Gordon-Salant & Fitzgibbons 1993). Older people with hearing loss have considerably more difficulty accurately perceiving rapid speech than either younger listeners with hearing loss or older listeners with normal hearing, because of the combined effects of hearing loss and decline in speed of signal processing (Gordon-Salant & Fitzgibbons 1993). It is also noteworthy that older listeners' difficulty in recognizing fast speech is exacerbated when limited semantic or syntactic contextual cues are available (Wingfield et al. 1985). Some television broadcasts present speech at a faster-than-normal rate by applying time compression technology either to commercials (MacLachlan & Siegel 1980) or to the televised program itself (Uglova & Shevchenko 2005), thereby compounding the older person's problem in receiving the message because of a hearing loss.

Other factors that may act to reduce the older person's ability to understand the televised message are degradations in the listening/viewing environment and reduced inhibitory mechanisms in older people. Older listeners generally have more difficulty in understanding speech when it is presented in a background of noise (Dubno et al. 1984; Stuart & Phillips 1996) or in a reverberant environment (Nabelek & Robinson 1982), either of which may be present during television viewing. Part of the problem may be related to reduced audibility of speech information, as predicted by the Speech Intelligibility Index (ANSI 1997, R2007). Evidence also suggests that as people age, there is a reduction in the ability to inhibit irrelevant information (Hasher & Zacks 1988). This attribute may partially explain older listeners' difficulty understanding speech in noisy environments. It also suggests that for television viewing, interruptions in the program (such as with advertisements, changes in the scene) may distract older

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people, thereby diminishing their ability to follow the primary content of the program message.

A variety of assistive devices are available to improve understanding of television for older people with hearing impairment. The principal assistive listening device is a hearing aid (HA). Although HAs are beneficial for improving signal audibility and speech understanding in quiet, one-on-one communication, approximately 25% of older HA users do not report satisfaction with their HAs for television viewing (Kochkin 2005). Empirical assessment of older HA users' accuracy in understanding a televised message for actual television programs has not been reported to date. A second assistive technology that is potentially beneficial for understanding televised speech is closed captioning (CC). Captions are written text strings that appear on the television screen and completely or closely mimic the audio content of a television program. Since 1993, all televisions with a screen size exceeding 13 in have been equipped with CC decoders, as mandated by the Television Decoder Circuitry Act of 1990. As a result, essentially all televisions now incorporate CC decoders that can be activated by the user, and all of the major broadcasting networks have 100% of their televised programming available with closed captions. The extent to which older people with age-related hearing loss use and benefit from CC is virtually unknown. At least one older demographic survey reported that a relatively small proportion of people who used CC were older than 45 yr (Jensema 1987).

The purpose of the current study was to evaluate the benefit of HAs and CC for television viewing by a sample of older adults with hearing loss who use HAs. A secondary objective was to determine the frequency of use of HAs and closed captions for television viewing by this same sample. The principal hypothesis was that recognition scores for televised speech would be better with use of either HAs or CC compared with a baseline (BSLN) condition (no assistive devices) and that use of both assistive devices would produce better scores than those obtained with either one alone. It was also predicted that recognition scores would vary with programming type (game show, news, and drama), with game shows producing better scores than news or drama because of the availability of numerous nonverbal, visual cues that convey the intended message. A final hypothesis was that few older hearing-impaired individuals with HAs use CC for viewing television.

PARTICIPANTS AND METHODS

Participants and Recruitment

Participants were included in the study if they had a bilateral, sensorineural hearing loss, currently used binaural HAs, and had worn their HAs for at least 2 months to increase the likelihood that HA benefit and acclimatization had occurred (Cox et al. 1996). There were no restrictions on degree of hearing loss, because the goal of this initial study was to sample performance of a random clinical population of older adults who wore HAs. Participants were also required to be older adults, age 60 yr and older. This age group was chosen because reports have shown that hearing loss begins to affect both men and women at the higher frequencies around the age of 60 yr (Pearson et al. 1995). Additionally, participants were required to be native speakers of American English, to be high school graduates (or higher levels of education), and to have vision corrected to 20/20 by contact lenses or glasses.

A total of 22 adults who wore binaural HAs were recruited from Audiology or HA Centers in the Birmingham, AL, and Atlanta, GA, areas. Although all 22 participants were tested for the study, recognition data from only 15 are reported here. The data from 6 adults were excluded because these individuals had a significant conductive component in their hearing loss, and the data of an additional participant were excluded because this individual was considerably younger than the others. The final sample of 15 older adults were aged 59 to 82 yr (mean age = 74.53 yr, SD = 7.33; 9 men and 6 women). As noted above, each participant was a native speaker of English who had a bilateral, sensorineural hearing loss and was a current user of binaural HAs. Vision problems were reported by the participants to be corrected to 20/20 by contact lenses or glasses. To ensure adequacy of vision abilities for seeing the closed captions, participants were required to view, read, and write four practice sentences presented on the television with 75% accuracy, following procedures recommended by Jensema (1998). Hearing sensitivity of the final study group ($N = 15$) ranged from mild to profound. Individual four-frequency (0.5, 1, 2, and 4 kHz) pure-tone averages in each ear and aided monosyllabic speech recognition scores (Northwestern University Test No.6, Tillman & Carhart 1966) are listed in Table 1. The average thresholds across frequency showed a moderate to severe, gradually sloping sensorineural hearing loss typical of presbycusis. The HAs worn by this group varied in style, power, and manufacturer to reflect the range of HAs worn by a clinical population. All participants had owned their HAs for at least 2 months before the study onset; duration of individual listener HA use is reported in Table 1.

Stimuli

Stimuli included 124 sentences or parts of sentences from three different television programs: *ABC World News Tonight* (news), *Jeopardy* (game show), and the *West Wing* (drama). The programs were originally recorded in fall 2005 and winter 2006. Four lists of 10 sentences each were recorded for each of the three shows ($N = 12$ lists), yielding 120 scoreable sentences. Four additional practice sentences were recorded for screening purposes.

Sentences contained at least four content words (i.e., nouns, verbs, adjectives, adverbs, prepositions) that could be used for scoring. Each sentence was spoken by one person at a time. However, several different speakers were included in each set of sentence stimuli in a given sentence list.

Selected sentences were edited from the original video using Adobe Premier Pro (v 1.5) video editing software. Thirty seconds of silence and blank (black) screens were inserted between each sentence to provide time for listeners to record their response on an answer form. Closed captions were added to the sentences using Adobe Premier Pro's title effects. A different randomization of the sentence lists was created for each participant, so that the order of presentation of each of the 12 lists (4 lists × 3 programs) was completely randomized over the participants. After digital editing, a master DVD was burned containing all sentence lists.

Pilot testing with 11 young adult listeners with normal hearing was conducted to verify that the final sentence lists for each program type yielded equivalent scores when sentences

TABLE 1. Age, hearing characteristics, and length of hearing aid use for the 15 participants

Participant number	Age (yr)	PTA—R (dB HL)	PTA—L (dB HL)	Aided NU-6 (% correct)	Length of HA use (yr)
1	78	101	93	6	1
2	82	40	49	74	5
3	82	56	60	78	9 mo
4	80	35	75	62	7
5	71	65	75	22	3
7	71	95	95	16	4
8	74	34	33	96	2
9	81	61	66	10	4 mo
10	74	53	54	76	2
11	67	40	44	78	2.5
14	63	43	55	62	2 mo
17	73	39	41	74	2
19	81	49	49	48	3
20	82	55	59	58	RE-2; LE-5
21	59	20	30	84	8 mo

PTA, pure-tone average (500, 1000, 2000, and 4000 Hz); R, right; L, left; NU-6, Northwestern University Test 6; HA, hearing aid.

were presented without CC (audio signal level was 60 dB A) and with CC (sound off). The young adult listeners also had normal vision (with or without correction), as indicated by self-report. There were 50 scoreable words for each final sentence list. Pilot data for the audio-only and the CC-only conditions are shown in Figures 1 and 2, respectively. Analyses of variance were conducted separately for each viewing condition on arc-sine transformations of the scores for each of the four lists. Results showed no significant differences between lists ($p > 0.05$) for both viewing conditions, confirming list equivalence. The figures demonstrate that average scores across the four sentence lists and three program types in this pilot study ranged from 86 to 98% correct (mean = 92% correct) without CC and from 95 to 100% correct (mean = 98% correct) with CC.

Procedure

Preliminary testing • The participants filled out a consent form and questionnaire that included information about television use, CC use, and television preferences. Each participant next had a complete audiometric evaluation to verify the presence of a sensorineural hearing loss. Speech recognition performance was assessed also for monosyllabic word stimuli (Northwestern University Test No. 6, Tillman & Carhart 1966) presented at 50 dB HL in the sound field, while the participants wore their HAs adjusted to normal use settings. The average aided score for the participants on a standard monosyllabic word test was 56%, with a range of 6 to 96%.

The functioning of the participants' HAs was verified electroacoustically using a Frye Electronics FP 35 HA analyzer. A listening check of each HA was also conducted to ensure proper functioning. All of these procedures took place at the University of Alabama at Birmingham's (UAB) Spain Rehabilitation Center.

Experimental testing • All testing was performed in a quiet room at the UAB Spain Rehabilitation Center. During testing, participants were seated in a comfortable chair 80 in from a Sylvania 20 in flat-screen color television (Model 6420FF) and viewed segments from three types of television programming in four viewing conditions. A DVD player was used to present the video segments and practice segments. The speech signal was presented through the speakers of the television at an average conversational level (60 dBA), which was calibrated daily (Extech sound level meter, Model 407740). Background noise was also measured and never exceeded 40 dBA (typical of quiet rooms) for any participant.

After the initial screening procedure (described above), the test stimuli were presented in one of four conditions, and participants wrote each sentence they perceived. The interstimulus interval was 30 sec, during which a blank (black) screen was visible on the television. The four conditions were as follows: (1) BSLN, stimuli were presented without CC and the participants did not wear their HAs; (2) HA, participants wore their own HAs adjusted to everyday settings; (3) CC, CC was turned on but participants were unaided; and (4) HA + CC, CC was turned on and the participants wore their own HAs. The order of the viewing conditions was randomized across listeners, as was the assignment of sentence list to condition. Thus, each listener received a unique assignment of sentence list to condition across each of the three shows. Examination of the lists used for each condition confirmed that the distribution was equal across the participants. The entire procedure was completed in one session of 2.5 to 3 hr. Participants were given frequent breaks as necessary to minimize fatigue.

This project was approved by the Institutional Boards for Human Subjects Research at the University of Maryland, College Park, and the UAB.

RESULTS

Word recognition scores obtained from the 15 participants measured for three types of programs and four listening/viewing conditions are shown in Figure 3. The primary hypothesis was that elderly listeners who use HAs would demonstrate different speech recognition scores for televised programming across the different listening/viewing conditions. Before data analysis, word recognition scores were arc-sine transformed. Results of a repeated-measures analysis of vari-

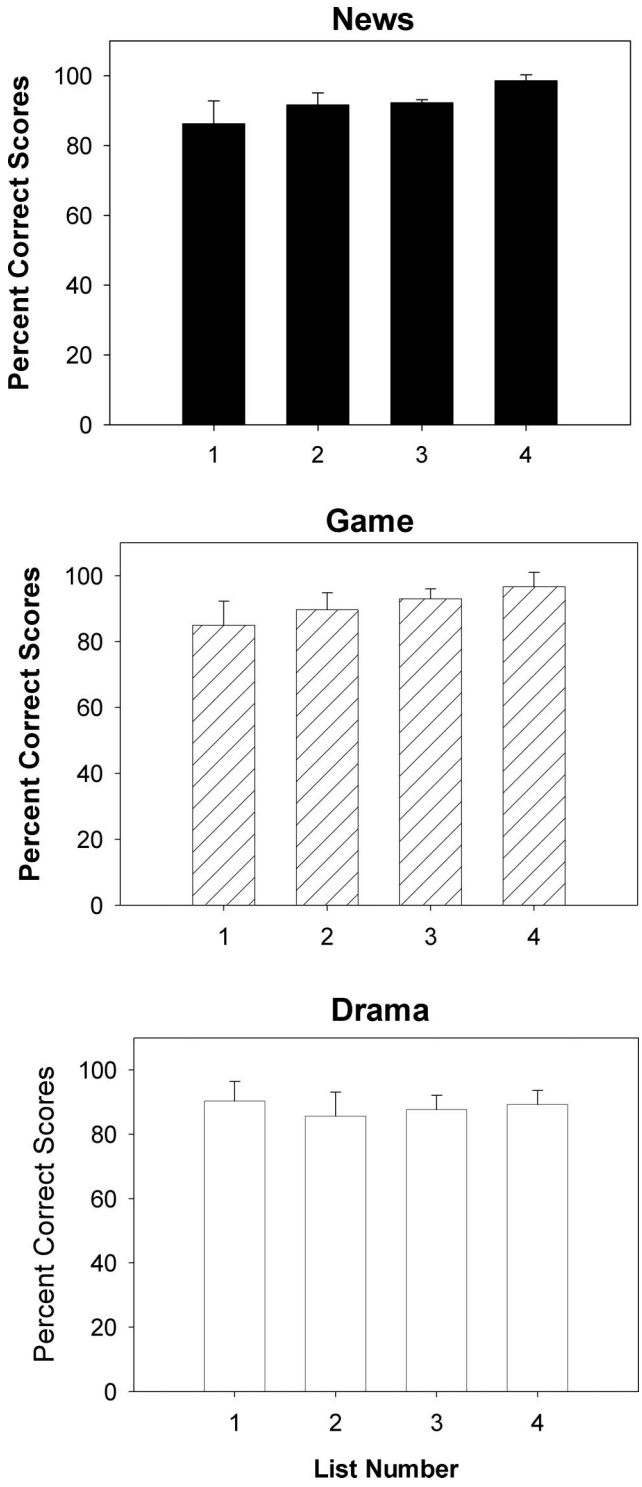

Fig. 1. Percent correct scores of young, normal-hearing listeners ($N = 11$) for four lists of televised speech stimuli, shown separately for each of three program types, in the viewing condition without closed captioning. Error bars represent 1 SD.

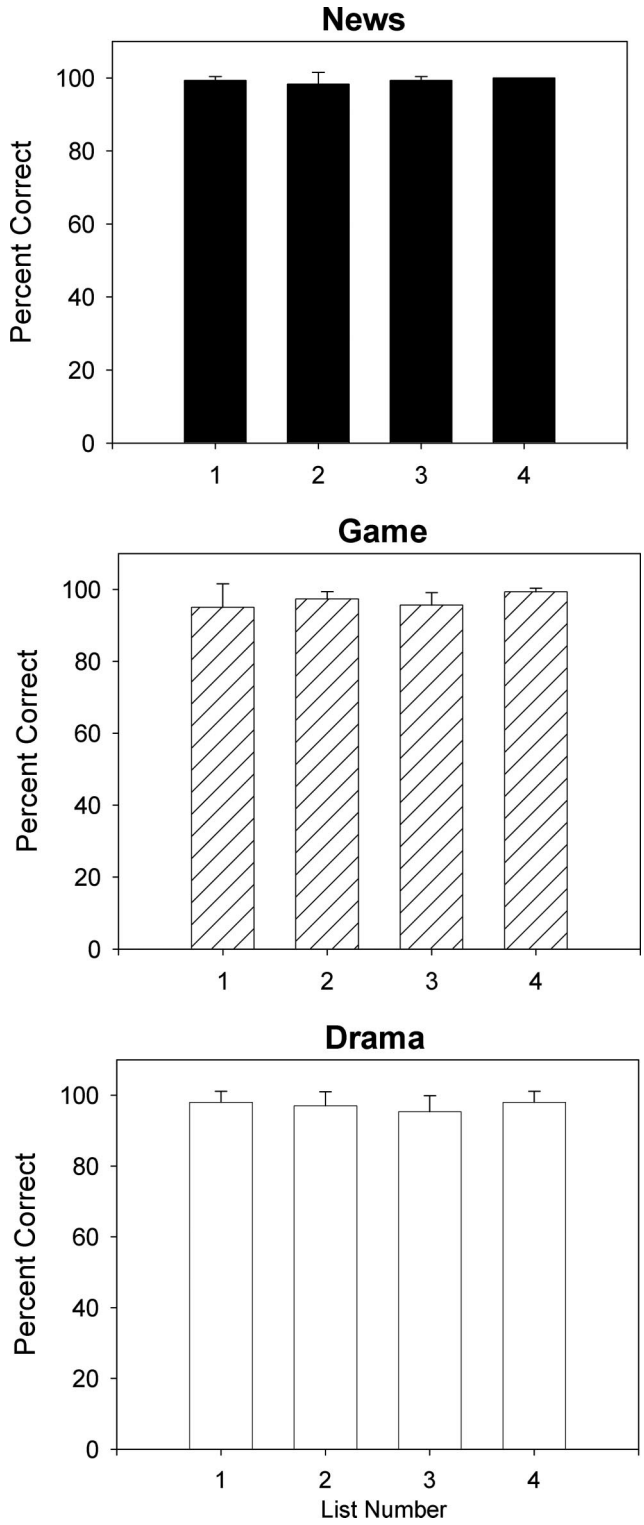

Fig. 2. Percent correct scores of young, normal-hearing listeners ($N = 11$) for four lists of televised speech stimuli, shown separately for each of three program types, in the viewing condition with closed captioning only (sound turned off). Error bars represent 1 SD.

ance revealed a significant main effect of program ($F[2,28] = 11, p < 0.01$) and condition ($F[1.51, 21.13] = 48.24, p < 0.01$) and a significant interaction between program and condition ($F[6,84] = 4.16, p < 0.01$). Post hoc simple main effects analyses and multiple comparison tests (Bonferroni) indicated that the scores obtained in the HA + CC and CC conditions were significantly higher than scores obtained in the BSLN and HA conditions for all programs. There were no differences in scores obtained in the HA + CC versus CC conditions across

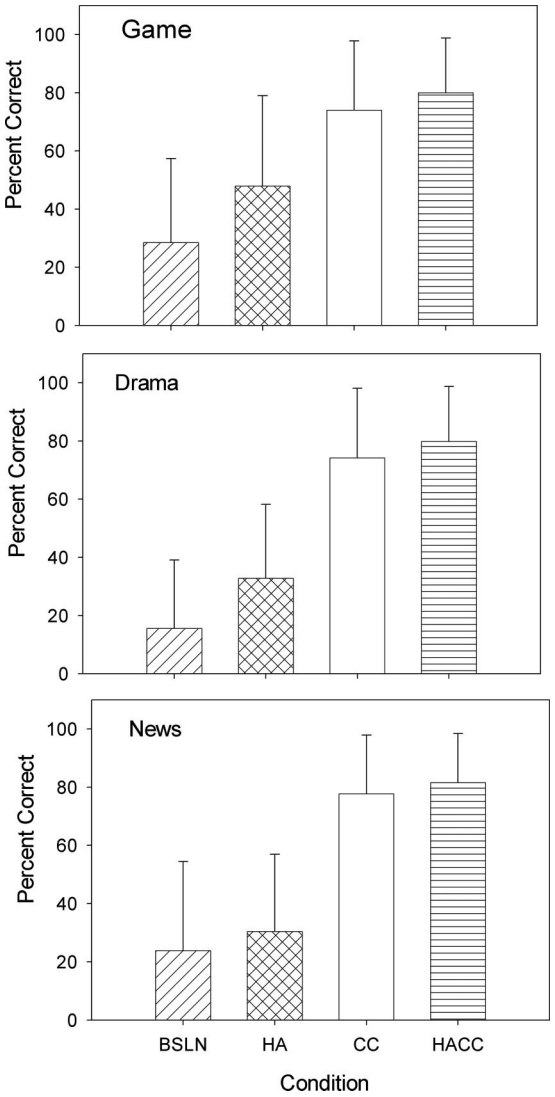

Fig. 3. Percent correct scores of older listeners ($N = 15$) in four viewing conditions, for three program types (top panel; game, middle panel: drama; lower panel: news). Error bars represent 1 SD.

programs. Similarly, there were no significant differences in the scores measured between the BLSN and HA conditions for all three program types. The source of the interaction effect seemed to be the magnitude of the difference in scores measured in the CC versus HA only conditions. For both drama and news programming, these differences were highly significant at the $p < 0.001$ level, whereas for the game show, this difference was significant at the $p < 0.05$ level.

A secondary hypothesis was that different program types might produce significantly different word recognition scores. Simple main effects analyses indicated no significant differences between word recognition scores for the different types of programming in each listening/viewing condition (BSLN: $F[2,42] = 0.78$, $p > 0.05$; HA: $F[2,42] = 1.45$, $p > 0.05$; CC: $F[2,42] = 0.01$, $p > 0.05$; HA + CC: $F[2,42] = 0.01$, $p > 0.05$).

The possibility that word recognition scores might be correlated with the amount of time spent watching television was investigated. Bivariate correlation analyses of the amount

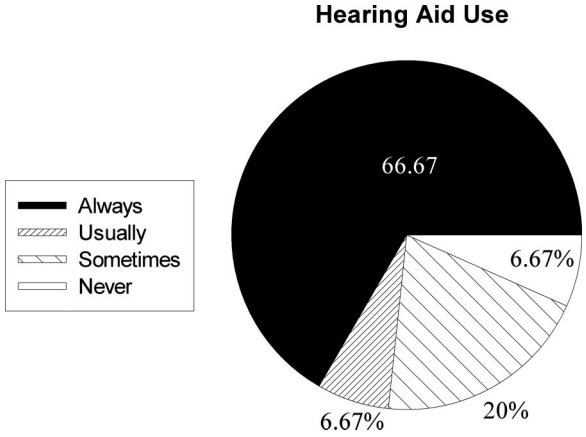

Fig. 4. Frequency of participants' ($N = 15$) self-reported hearing aid use while watching television.

of television viewed and performance in each condition showed that none of the correlations was significant ($p > 0.05$).

Participants were asked to rate the frequency of use of their HAs and CC while watching television every day. It was anticipated that these variables might correlate with performance, but the data were too skewed to permit meaningful analyses. Figures 4 and 5 show the frequency of HA and CC use, respectively, among the 15 participants. Approximately 73% of the participants reported "always" or "usually" wearing their HAs while watching television. However, only 13% noted always using the CC when watching television (none of them reported using the captions usually while television viewing). Surprisingly, 87% of the participants reported "never" using the captioning when watching television.

DISCUSSION

The performance of the elderly hearing-impaired listeners in the BSLN condition was quite poor, with an overall average score of 23% correct across the three program types. This level of performance indicates that without any assistive device, this sample of elderly people with hearing impairment understood a very small proportion of a spoken televised message. A striking finding was that the performance of the older adults did not improve significantly with the use of binaural HAs compared with performance in the BSLN condition, despite the fact that the listeners had audible speech information and speech-

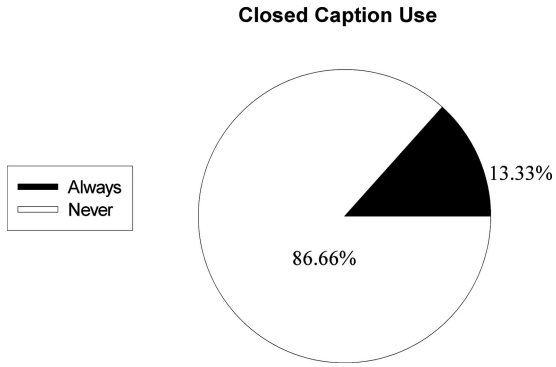

Fig. 5. Frequency of participants' ($N = 15$) self-reported use of closed captioning while watching television.

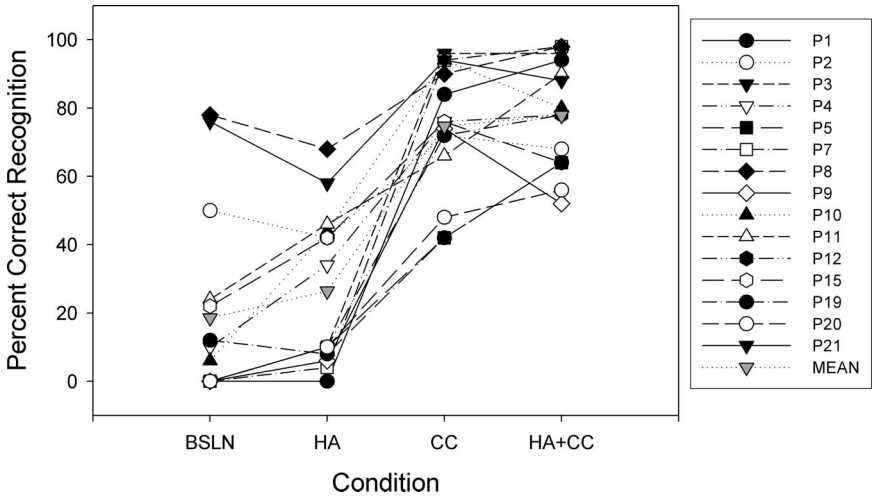

Fig. 6. Individual percent correct scores and the group mean scores in the four viewing conditions for the news program. BSLN, baseline; HA, hearing aid; CC, closed captioning.

reading cues. Studies of listener performance with HAs usually report that listeners derive significant benefit with amplification for understanding speech presented alone and even greater benefit when amplification is combined with visual speechreading cues (Walden et al. 2001). The lack of congruence between the current findings and those reported previously are likely due to numerous differences in the speech stimuli across studies. For example, previous studies typically have used a single talker who faced the camera with good lighting and pronounced the words in a clear and deliberate style (known as recitation style). Speechreading cues seem to be consistent and readily available in these types of video recordings. The televised stimulus materials of the current study, however, likely did not provide consistent speechreading cues because the talker did not always face the camera while speaking, which may have contributed to the inability of participants to integrate auditory and speechreading cues in the HA condition. The talker varied from sentence to sentence in the present study and represented male and female talkers who may have had different jaw movements, speech rates, or dialects. Older adults have difficulty adapting to changes in the talker from one stimulus to the next, a phenomenon known as perceptual normalization (Sommers 1997). Finally, the overall rate of speech in the televised programs was generally faster and more variable than that characterized by recitation style speech (Wingfield & Tun 2001; Uglova & Shevchenko 2005). As noted earlier, older adults have considerable difficulty in accurately understanding a spoken message presented at a rapid rate (Gordon-Salant & Fitzgibbons 1993). The participants' scores in the HA condition while watching television (mean score = 37% correct) were lower than their aided word recognition scores in quiet, as measured during the audiological assessment (mean score was 56% correct). Considering that visual cues were available in the televised materials, which should have aided performance, this observation suggests that televised speech is quite degraded for older listeners compared with standardized speech materials presented in audiometric evaluations. Clearly, HAs alone cannot compensate for the resulting deficit. It is noteworthy that the young adult listeners with normal hearing in the pilot study obtained excellent word recognition scores for these same televised speech materials presented without CC. Thus, while televised speech is easily understood by younger adults, it is not well recognized by older adults with hearing impairment, even when they use HAs.

One possible source of the minimal benefit of amplification in this sample was that participants with mild hearing losses or profound hearing losses might not have exhibited performance increments in the HA condition over the BSLN condition because they either heard the BSLN signals too well (in the case of mild hearing losses) or could not hear the amplified signals (in the case of profound hearing losses). To examine this possibility, the individual participant data were redrawn for one representative program, news, because news is the type of program watched most frequently by older people (Mares & Woodard 2006). Figure 6 presents these individual data, together with the mean data. It is apparent that there is considerable variability in performance across all of the listening conditions, particularly in the BSLN and HA conditions. The individuals with severe to profound hearing losses were participants 1 and 7. Both of these individuals showed very poor recognition scores in the BSLN and HA conditions, but other participants who exhibited this trend (participants 9, 19, and 20) had moderate hearing losses. The individual with the mildest hearing loss, participant 21, did not exhibit ceiling performance in the BSLN condition. Thus, examination of the individual data suggests that at least for this small sample, the wide range of hearing losses does not seem to be a consistent reason for the lack of significant improvement in the HA condition over the BSLN condition.

The availability of CC provided significant benefit to the elderly hearing-impaired listeners. The mean percent correct scores across the three program types with CC alone was 75% and with CC + HA was 81%. Recall that overall percent correct scores for the BSLN and HA conditions were 23 and 37%, respectively. Although no significant differences in performance were observed between the two CC conditions, older adults clearly derived considerable advantage for understanding televised speech with CC compared with both the BSLN and HA conditions. The visual text signal provided by CC conveys unambiguous information about the spoken message and is not affected by the audibility of the speech signal nor the availability of clear speechreading cues. One limitation of CC, however, is that it does not convey information cued by the fundamental frequency, such as prosody and emotional

content. Nevertheless, CC seems to be a simple, cost-effective, and readily available assistive listening device that can improve accurate recognition of televised speech by older adults with hearing loss.

Given the consistency of the CC signal and its clear representation of the stimulus, it is curious that the performance with CC was not 100% for the older adults. Mean scores for the young normal-hearing listeners while viewing the sentence lists with CC and the sound turned off was 98% correct (range, 95 to 100%), verifying that these CC stimuli are highly intelligible for young people without hearing loss. The source of the older listeners' suboptimal scores with CC may be associated with some cognitive changes with aging that could impact performance on this task. For example, the speed with which some of the sentences appeared on the screen may have been too fast for older viewers to process the information. Typical captioning speed is 141 wpm, which is a comfortable caption speed for most young adults (Jensema et al. 1996). Studies have shown that older readers process text, particularly complex text, at a slower rate than younger readers (Smiler et al. 2003; Kemper & Liu 2007). Additionally, aging is thought to be accompanied by a reduced ability to inhibit irrelevant information (Hasher & Zacks 1988; McDowd & Birren 1990; Kemper & McDowd 2006), resulting in excessive difficulty by older adults in focusing on relevant information when irrelevant information is present. Although the CC was consistent and unambiguous, the televised picture contained varied and continuously changing visual images, which may have made it more difficult for the older adults to parse relevant information from irrelevant information. Finally, the presence of three inputs (auditory, visual-speechreading, and visual-CC) may have placed a heavy cognitive load on older adults so that these inputs could not be adequately integrated. Despite these possible limitations, CC made a substantial difference in the viewing experience for older adults with hearing loss.

Demographic data from this limited sample of participants showed that most of these HA users wore their HAs for television viewing on a daily basis. This is somewhat surprising, given that understanding of the televised message was rather poor among this group, even with amplification. Even more revealing is the finding that 87% of the participants reported never using CC. This observation underscores the original premise for this study that older people with hearing loss rarely use CC, despite its obvious benefit for understanding television. The limited use of CC by this older hearing-impaired sample may reflect a preconceived notion that this technology is primarily intended for "deaf" people.

Some limitations of the current research include the sample size, auditory characteristics of the participants, HA fittings, and type of speech material. The sample size was small, with complete data reported for only 15 participants. The participants were quite heterogeneous in their degree and configuration of hearing loss, as well as the type of HA they wore, which reflects the varied characteristics of the older hearing-impaired population. Thus, it is difficult to generalize the current findings to all older listeners with hearing loss who use HAs. The HAs worn by this sample were not necessarily an ideal fit for each participant; rather, the goal was to evaluate a random sample of HA users who wore their HAs on a regular basis, as they were worn in everyday life. Although these initial findings are quite robust, future investigations should assess the effects of HAs and CC for older people with different degrees of hearing loss, different types of HA fittings, and verified well fit HA configurations. Another useful area of future research is the benefit obtained with other assistive devices for television viewing, such as infra-red systems, in comparison with HAs and CC. New stimuli were created for this experiment, which were derived from actual television programs in an effort to have face validity. However, the sentences were presented in isolation and out of context to obtain immediate identification responses that would minimize memory demands. In real life, people derive meaning from a television program's context over a period of time (about 10 min). Thus, while the stimuli themselves were commonplace, the task was somewhat novel.

CONCLUSIONS

The results of this initial investigation showed that HA use, on average, did not provide significant improvement in understanding televised speech materials compared with a BSLN (unaided) condition for a small sample of older adults with hearing loss. However, CC resulted in large and significant improvements in word recognition by older adults with varying degrees of hearing impairment. Most of the older adults indicated that they had never used CC technology, despite its potential to improve understanding of television dramatically for older adults. Because the aging population is growing and the prevalence of age-related hearing loss is high, primary care physicians, geriatricians, and audiologists need to be aware of simple assistive tools that could enhance their patients' quality of life. CC seems to be an excellent option for a low-cost, high-quality assistive tool for older adults to improve their understanding of television, which is a common leisure activity enjoyed by this population.

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