

Enjoyment of Music by Elderly Hearing-Impaired Listeners

DOI: 10.3766/jaaa.19.6.7

Marjorie R. Leek*†
Michelle R. Molis*†
Lina R. Kubli*
Jennifer B. Tufts*‡

Abstract

Background: Anecdotal evidence suggests that hearing loss interferes with the enjoyment of music, although it is not known how widespread this problem currently is.

Purpose: To estimate the prevalence of music-listening difficulties among a group of elderly hearing aid wearers.

Research Design: Interview. Telephone interviews were conducted with patients who wore hearing aids. Questions regarding several aspects of music listening were included.

Study Sample: Sixty-eight hearing-impaired people served as subjects. They had all been seen in the audiology clinic for hearing aid evaluation during the previous year.

Data Collection and Analysis: Subjects were asked questions concerning their use of hearing aids, the importance of listening to music in their lives, their habits and practices concerning music, and difficulties they experienced in listening to music.

Results: Almost 30% of the respondents reported that their hearing losses affected their enjoyment of music. About half of the respondents indicated that music was either too loud or too soft, although only about one-third reported difficulties with level contrasts within musical pieces. In contrast to a similar survey carried out 20 years ago, there were many fewer complaints about listening to music. This result may be due in large part to improvements in hearing aids, especially with regard to nonlinear compression.

Conclusions: Although new hearing aid technologies have somewhat reduced problems of music enjoyment experienced by hearing-impaired people, audiologists should be aware that some 25–30% of patients may have difficulties with listening to music and may require extra attention to minimize those problems.

Key Words: Hearing loss, music

Abbreviations: WDRC = wide dynamic range compression

Sumario

Antecedentes: La evidencia anecdótica sugiere que la hipoacusia interfiere con el disfrute de la música, aunque no se sabe cuán común es actualmente este problema.

Propósito: Estimar la prevalencia de las dificultades para escuchar música entre un grupo de usuarios mayores de auxiliares auditivos.

Diseño de Investigación: Entrevista. Se realizaron entrevistas telefónicas con pacientes que utilizaban auxiliares auditivos. Se incluyeron preguntas en relación con varios aspectos involucrados al escuchar música.

*Army Audiology and Speech Center, Walter Reed Army Medical Center, Washington, DC; †Currently at National Center for Rehabilitative Auditory Research, Portland VA Medical Center, Portland, OR; ‡Currently at Department of Communication Sciences, University of Connecticut, Storrs, CT

Marjorie R. Leek, Ph.D., National Center for Rehabilitative Auditory Research, 3710 SW U.S. Veterans Hospital Road, Portland, OR 97207; Phone: (503) 220-8262, ext. 54692; Fax: (503) 721-1402; E-mail: Marjorie.Leek@va.gov

Portions of this research were reported at the annual meeting of the American Auditory Society, March 2005, Scottsdale, AZ. This work was supported by NIH grant DC 00626.

Muestra del Estudio: Sesenta y ocho personas hipoacúsicas sirvieron como sujetos del estudio. Todos habían sido vistos en la clínica audiológica para una evaluación de sus auxiliares auditivos en el pasado año.

Recolección y Análisis de los Datos: Los sujetos fueron interrogados en relación con el uso de su audífono, la importancia en sus vidas de escuchar música, sus hábitos y prácticas en relación a la música, y las dificultades que experimentaban al escuchar música.

Resultados: Alrededor del 30% de los que respondieron reportaron que sus pérdidas auditivas afectaban su disfrute de la música. Cerca de la mitad de los que respondieron indicaron que la música era muy intensa o muy suave, aunque sólo un tercio reportó dificultades entre los contrastes de volumen dentro de las piezas musicales. En contraste con una encuesta similar llevada a cabo 20 años atrás, ahora se dieron menos quejas sobre la apreciación de la música. Esto puede deberse en mucho a las mejoras en los auxiliares auditivos, especialmente en relación a la compresión no lineal.

Conclusiones: Aunque la nueva tecnología en auxiliares auditivos ha reducido de alguna forma los problemas de disfrute de la música experimentados por las personas hipoacúsicas, los audiólogos deberían ser conscientes que alrededor de un 25–30% de los pacientes tienen dificultades para escuchar música y puede requerir una atención adicional para minimizar tales problemas.

Palabras Clave: Hipoacusia, música

Abreviaturas: WDRC = compresión de rango dinámico amplio

Listening to music is an enjoyable part of many people's lives. The quality of life of hearing-impaired people can be significantly affected by an inability to hear music as well as they once did. Patients may report that music is distorted, that melodies are difficult to recognize, and that they have forgone a formerly enjoyable aspect of their lives. However, because audiological rehabilitation tends to focus on improving speech intelligibility, concerns about music listening may not be recognized or addressed.

For people who have greater than a mild hearing loss, distortions in auditory processing by the damaged ear may result not only in a loss of audibility, but also in an inability to appreciate some important features of music (Gfeller and Knutson, 2003). A general impoverishment of the auditory representation of some musical characteristics has been observed among people with sensorineural hearing loss. For example, the pitch of complex sounds is generally weaker and less stable in people with sensorineural hearing loss (Larkin, 1983; Leek and Summers, 2001) and is also often distorted (Arehart and Burns, 1999). Tufts et al (2005) found that hearing-impaired listeners did not distinguish differences in dissonance among chordlike sounds as clearly as normally hearing listeners did, perhaps as a result of differences in roughness perception (Tufts and Molis, 2007). The detection and discrimination of amplitude modulation have also been shown to be generally poorer in the presence of hearing loss (Grant et al, 1998).

Despite a relative dearth of information regarding the effect of sensorineural hearing loss on the perception of music, hearing aid manufacturers acknowledge the importance of music to their clients by incorporating programs into digital hearing aids that are designed to improve the sound quality of music. Manufacturers

apply various approaches to developing special music processing programs, but many of these programs provide a broad bandwidth and include more low frequencies in the response of the hearing aid. These characteristics are based largely on reports by Punch (1978) and Franks (1982). Punch measured preferences for different frequency responses for normally hearing and hearing-impaired subjects listening to music. Both groups of listeners preferred configurations that included strong representation of low frequencies. Franks supplemented that finding by showing that hearing-impaired listeners did not like a high-frequency emphasis when listening to music, but they did like having access to low frequencies. He suggested that manufacturers provide hearing aid wearers with the ability to switch among different hearing aid characteristics for different listening goals (e.g., maximizing speech intelligibility or improving the quality of music). This capability is, of course, now typically included in multiple-memory hearing aids. Following Punch and Franks, Keidser et al (1996) recommended a flat frequency response for music programs in hearing aids.

More recently, Chasin (2003) and Chasin and Russo (2004) developed recommendations for optimizing hearing aid processing for listening to music. They noted that music has much greater variability in amplitude and frequency relative to speech, and that a single, fixed frequency response might not work best for all music-listening situations. The dynamic range and overall amplitude of music are typically considerably greater than those of speech sounds. Therefore, hearing aids programmed for music listening must process high levels without distortion, and the compression characteristics of those programs must be set to allow the listener to experience the wide dynamic range of music.

Finally, the programs should have only one broad channel so that the temporal and spectral interactions of high and low frequencies are not disturbed.

Although there is considerable anecdotal support and some research support for the detrimental effect of hearing loss on music perception, studies of music enjoyment by hearing-impaired listeners are rather rare in the literature. It is not known how common it is for the hearing-impaired population to find music unpleasant or distorted, nor how debilitating and distressing this reaction might be to patients. The most complete survey investigating the music enjoyment and listening habits of an unselected clinical population was published in German 20 years ago (Feldmann and Kumpf, 1988). In that report, a sizeable majority (79%) of respondents felt that their hearing loss hindered their enjoyment of music. Complaints included difficulty understanding the words of songs as well as distortions of pitch and melody. Although most respondents found that their hearing aids either improved or caused no change in their enjoyment of music, they reported having to continually change the volume settings on their hearing aids while listening to music.

Many technological developments have improved the quality of hearing aids and the sound quality of recorded music since that survey was undertaken two decades ago. Further, a new generation of elderly hearing-impaired patients now exists—one that has grown old in an era of constantly available broadcast and recorded music. It is possible, given these changing circumstances, that the impact of hearing loss on the ability to enjoy music has abated. For example, modern hearing aids often incorporate sophisticated compression algorithms, thereby reducing the need to rely on adjustment of a volume control wheel. However, such algorithms may not preserve the dynamic quality of most music.

The present survey study was designed to determine the prevalence of problems associated with music listening among a group of current hearing aid wearers. Telephone interviews were conducted with hearing aid wearers to characterize their musical experiences in relation to their hearing losses. The goals of this study were (a) to determine the extent to which music listening presents difficulties for people with hearing loss and (b) to ascertain whether hearing aids affect the perception and enjoyment of music by people with hearing loss. Results of this study will be compared with those of the Feldmann and Kumpf (1988) survey.

METHODS

Subjects

A list was generated of all patients who had been seen for hearing aid evaluations at the Army Audiology

and Speech Center over a recent 4-month period. All patients of the clinic sign a consent form that includes consent to be contacted for participation in approved clinical studies, as well as consent for their patient records to be used for research purposes—with appropriate safeguards for maintaining patient confidentiality. The only criterion for inclusion in the study was that the patient's age be at least 18 years. The list was sorted according to visit date, and an attempt was made to contact each patient by telephone in chronological order from earliest to more recent appointment dates. The calls were made by three different interviewers. If there was no answer to the initial call, several repeat calls were made. To avoid participant self-selection as much as possible, interviewers did not leave messages or callback requests on voice mail or answering machines.

Interviewers worked from a scripted narrative to ask potential subjects if they would be willing to participate in a survey concerning their habits and enjoyment in listening to music. If the respondent agreed, the survey was conducted, and answers were entered on a data sheet, along with verbatim comments where appropriate. Following completion of the interview, interviewers extracted information from the clinic records of each participant, including documented characteristics of his or her hearing loss and the amplification provided.

A total of 262 contacts were attempted. Of those calls, 90 were not answered. Of the remaining 172 calls, 68 (40%) people agreed to be interviewed. The remaining potential participants either declined to participate or were not available by phone at the time of the calls for various reasons (including wrong numbers, deaths, no answer or answering machine, or the targeted participant not being at home). Demographics of the participants are reported in the Results section.

Survey Materials

The survey consisted of 37 questions, some open-ended and some with a closed set of possible responses. Responses to open-ended questions, as well as any other comments made by respondents, were recorded by the interviewer. The questionnaire was divided into four topics:

1. *Characteristics of hearing loss and hearing aid use, including duration of hearing aid use and how often the hearing aid was worn.* Additional information about hearing aid characteristics was extracted from patient clinic files, such as brand, type, and special features of the hearing aids.
2. *Musical habits and practice.* These questions were meant to determine the importance of listening to music for each individual. Questions concerning frequency of music listening, music-listening prefer-

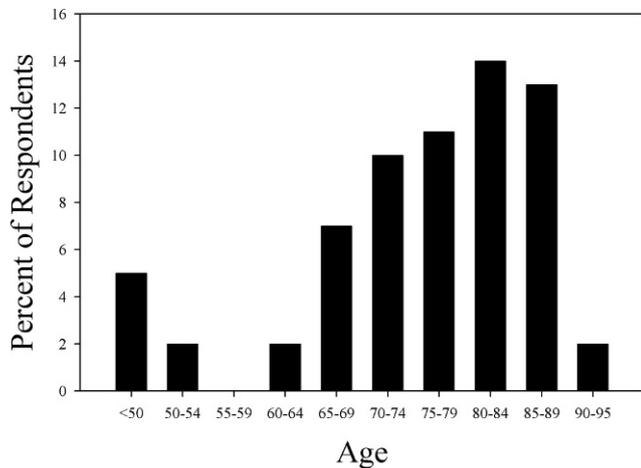


Figure 1. Percentage of respondents in each age group.

ences, and the importance of music listening to the person’s lifestyle were included. Also asked were questions about musical training and experience.

3. *Sound quality of music.* Patients were asked about possible distortions in music listening, including perception of loudness contrasts and loss of timbre or harmonic qualities.

4. *Use of hearing aids when listening to music.* These questions were designed to evaluate how wearing hearing aids affects the perception and enjoyment of music.

RESULTS AND DISCUSSION

Sixty-eight patients completed the survey study. Most were elderly, with a mean age of 75 years, and most were male, as is characteristic of the patient population of the Army Audiology and Speech Center. The age distribution of respondents is shown in Figure 1. Table 1 compares the demographics of the participants in this study with those of the Feldmann and Kumpf (1988) study. The patients in this study were somewhat older, and a greater proportion was male.

Figure 2 shows the mean audiogram for patients in the current study, with error bars showing standard errors. The audiograms were measured in the clinic during the previous year and were extracted from clinic files. Mean hearing thresholds were nearly identical for left and right ears, and the standard errors of thresholds across this sample were very small. The hearing losses were likely due primarily to presbycusis and noise exposure (given the retired military population), with a mild to moderately severe bilateral sloping configuration. Of the respondents, 93% had sensorineural losses, while 6% had a mixed loss in at least one ear at the time of audiometric testing. Most (59%) had had a hearing loss for more than 10 years. Duration of hearing loss was similarly distributed in this study and in the Feldmann and Kumpf (1988) study. Audiometric infor-

Table 1. Demographic Data from the Current Study and a Previous Survey Study

	Current Study	Feldmann and Kumpf (1988)
Number of respondents	68	206
Mean age	75 (<i>SD</i> = 13)	61 (<i>SD</i> not reported)
Age range	24–91	12–92
Female/male ratio	7/61	101/105
Duration of hearing loss		
1–10 years	41%	32%
11–20 years	25%	27%
> 20 years	34%	40%

mation was not provided in that earlier study, although 96% of those respondents indicated their hearing loss to be moderate or worse.

A majority of the respondents (69%) indicated that they wore binaural hearing aids. The remaining participants had monaural fittings. Nearly all of the hearing aids were programmable, in-the-ear instruments. Half of the aids were digital, with multiple memories. Of the respondents, 38% had worn their hearing aids for 5 years or less, while 38% reported that they had worn aids for more than 10 years. About half of the respondents wore their hearing aids more than 8 hours per day, and three-quarters of respondents found their hearing aids useful in most situations.

By design, some of the questions in this survey were similar to those in Feldmann and Kumpf (1988). Perhaps the most central question asked in both studies was whether respondents thought their hearing loss interfered with their enjoyment of music. In 1988, Feldmann and Kumpf reported that the answer

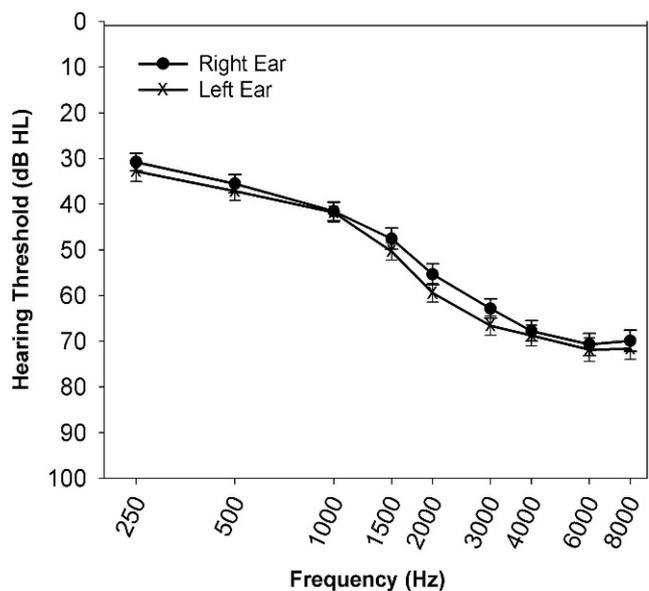


Figure 2. Mean audiogram across respondents. Error bars represent standard errors of the mean.

to this question was 79% *yes* and 13% *no*. In response to a similar question in the current study, only 28% of the subjects responded *yes*, while 66% responded *no* (6% declined to answer this question).

Table 2 lists the problems associated with music listening that were identified by patients in the two studies. Overall, there were many fewer complaints among the current subjects than among participants in the earlier study. The two complaints that were most commonly voiced in both studies were that the music was either too loud or too soft overall, and that it was difficult to understand the words in the music (the percentage was not reported by Feldmann and Kumpf, but it was noted as a common complaint). Perhaps the greatest difference between the two studies concerned the prevalence of difficulties with volume or loudness changes within music (e.g., musical contrast expressed by loudness modulations within a musical piece). Only 34% of the current sample said volume change was a problem, while Feldmann and Kumpf (1988) reported that it was the most annoying feature identified by their subject group. This difference between the two studies is almost certainly a result of improvements in hearing aids over the years, particularly in the development and pervasive use of wide dynamic range compression (WDRC).

In both studies, patients were asked about their use of hearing aids while they are listening to music. An approximately equal percentage of respondents reported using their hearing aids while listening to music, as shown in Table 3. Feldmann and Kumpf (1988) reported that 74% wore hearing aids while listening to music, while 13% did not. In the current study, 78% reported wearing their hearing aids while listening to music, and 19% reported they did not. There was a difference in whether the two groups of respondents found that wearing hearing aids made music more enjoyable. In the earlier study, 67% answered *yes* to that question, 25% answered *no*, and 4% indicated no difference in enjoyment. In the current study, 41% of respondents reported that music was more enjoyable when they were wearing hearing aids, only 6% responded that music was less enjoyable, and 37% indicated no difference.

Given that many fewer participants in the current study indicated that wearing a hearing aid interfered with listening enjoyment, it might appear that some aversive aspects of hearing-aid-processed music have been reduced over the 20 years since the earlier study was conducted. However, a larger percentage in the current study than the earlier one indicated that they received no greater music enjoyment when wearing a hearing aid. These conflicting findings might indicate that there is less distortion in the newer hearing aids that might reduce interference with enjoyment of music, but the newer aids do not necessarily contribute benefit. In fact, one factor might be that as the result of

Table 2. Percentage of Respondents in Two Survey Studies Who (a) Indicated That Hearing Loss Results in a Loss of Music Enjoyment and (b) Identified Particular Difficulties in Listening to Music

	Current Study	Feldmann and Kumpf (1988)
a) Has hearing loss interfered with your enjoyment of music?		
Yes	28%	79%
No	66%	13%
No response	6%	8%
b) Problems associated with listening to music		
Too loud or soft	47%	40%
Melody Recognition	16%	37%
Understanding words	65%	“common complaint”
Volume changes in music	34%	“most annoying feature”

a flattening of the amplitude changes that were meant to provide emotion and expression in music, less benefit might be obtained from some compression hearing aids (Chasin and Russo, 2004).

Overall, some 70% of respondents in this study indicated that listening to music was an important part of their lives. It is possible that the impact of hearing loss on music perception is related to the basic importance of music to the respondents. Of the respondents, 28% indicated that their enjoyment of music had changed after they developed a hearing loss, while 66% indicated no change. For those indicating that their music enjoyment had changed, 88% reported that music was important to them. Music was also important to the group reporting no change in enjoyment, but it was less so (67% of that group reported that music was important to them).

The audiograms of these two subgroups of respondents—those who indicated that music enjoyment had changed since they developed a hearing loss and those who said it had not—were compared. Figure 3 shows the mean audiograms and speech-recognition scores (NU-6 in quiet) of the two subgroups extracted from clinic files. Because some patients did not undergo speech testing during clinic visits, not all participants contributed to these mean scores. The mean audio-

Table 3. Percentage of Respondents Who (a) Wear Hearing Aids While Listening to Music and (b) Report That Music Is More or Less Enjoyable When Wearing Hearing Aids

	Current Study	Feldmann and Kumpf (1988)
a) Do you wear your hearing aids while listening to music?		
Yes	78%	74%
No	19%	13%
No response	3%	5%
b) Does wearing your hearing aids make music more enjoyable?		
More enjoyable	41%	67%
Less enjoyable	6%	25%
No difference	37%	4%

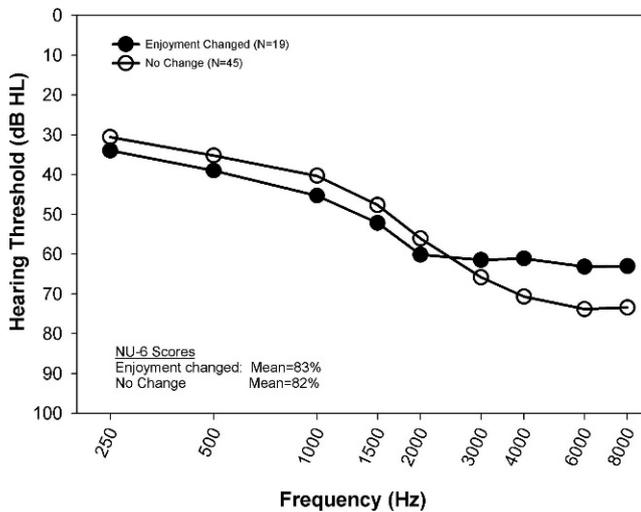


Figure 3. Mean audiogram of two subgroups of respondents representing those who have noticed a change in their enjoyment of music ($n = 19$) and those who have not noticed such a change ($n = 45$). Mean scores on NU-6 word-lists in quiet (taken from clinic files) are shown. Data are means of right- and left-ear thresholds of the members of the two subgroups. Speech scores were not available for 5 participants in the “no change” subgroup and for 3 participants in the “enjoyment changed group.” The scores shown are the averages for the participants in each subgroup for whom scores were available.

grams of these two groups were very similar except above 3000 Hz, where those who noted a change in music enjoyment showed slightly less hearing loss, with a flatter configuration. This group also had slightly more hearing loss at 2000 Hz. However, scores on NU-6 tests in quiet were nearly identical between the two groups.

Figure 4 shows the age distributions of these two groups. People who noticed a change in their enjoyment of music are scattered more evenly across the age range of subjects queried, while subjects reporting no change tended to be older. People who reported a change in music enjoyment also tended to have had a hearing loss for a shorter time (mean of about 12.3 years) relative to those experiencing no change in music enjoyment (mean of about 13.3 years), and they had worn hearing aids for a shorter period of time (on average, 7 years versus 10 years), as shown in Figure 5.

Nearly 50% of the respondents had canal or completely in-the-canal hearing aids, and about 60% of those patients reported that their enjoyment of music had not changed since their hearing losses had developed. In-the-ear full-shell and half-shell hearing aid wearers (38% of respondents) also were more likely not to have perceived changes in their enjoyment of music, while the 8% who wore behind-the-ear aids reported more changes in enjoyment. It is tempting to speculate that the latter group had hearing loss that was significant enough to distort music, while the canal-aid wearers had milder losses. Finally, more than 64%

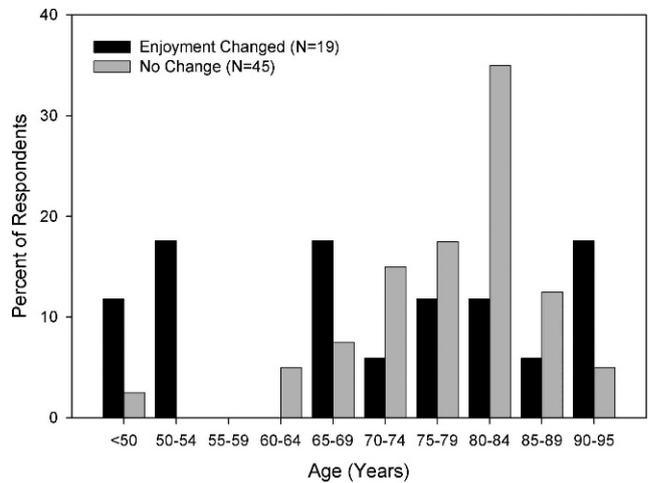


Figure 4. Percentage of respondents reporting that their enjoyment of music has or has not changed, as a function of age.

of respondents wore their hearing aids 5 or more hours per day, and of those respondents, 30% reported difficulty listening to music. Listeners who wore their aids less than 2 hours per day tended to report no change in their enjoyment of music, perhaps indicating a milder hearing loss that did not distort music in a significant way, or suggesting that they did not use their hearing aid often enough to notice any change.

About half of the survey respondents listened to music at least daily (51%), while only 9% listened less than once a week. The respondents listened primarily to the radio (82%), recorded media (72%), live music (43%), and television (41%). The most common places for them to listen were in the car (75%), in the house (66%), and at church (24%). Classical music was the most popular style of music among the respondents (68%). They also reported that 28% listened to jazz, 32% listened to oldies and rock music, and 25% listened to pop and easy-listening music.

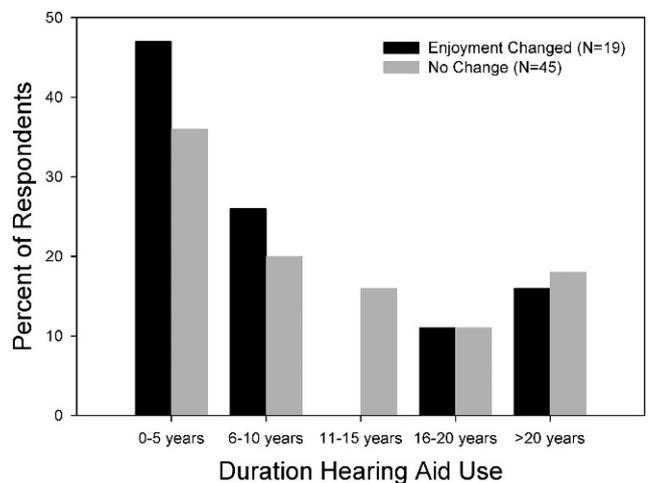


Figure 5. Percentage of respondents reporting that their enjoyment of music has or has not changed, as a function of duration of hearing aid use.

Nearly half of the respondents had had some formal music training, primarily as children in school. Respondents with musical training were more likely to report a loss in their enjoyment of music since developing a hearing loss (40% versus 28% in the entire sample). Participants reported that 16% currently play a musical instrument or sing in an organized group, and about half of those reported a change in enjoyment of music.

At the conclusion of the interview, participants who expressed a loss of enjoyment in music listening were asked how they would change the way music sounded so that they would enjoy it more. Common responses included the following: lyrics should be clearer, volume of music should be either louder or softer, and high frequencies should be clearer. Several wistfully responded that they would enjoy music more if they did not have a hearing loss.

DISCUSSION

One of the goals of this study was to ascertain whether the enjoyment of music by hearing aid wearers is changed by the presence of hearing loss. Of the participants in this survey, 28% indicated that their hearing losses had interfered with their ability to enjoy music. This group of respondents tended to be slightly younger, to have better high-frequency hearing, to have worn hearing aids for a shorter time, and to wear the smallest hearing aids. These characteristics, taken together, suggest that changes in music enjoyment might be more apparent to people who have recently developed a hearing loss significant enough to wear hearing aids. It is possible that the musical memories of these people are somewhat fresher than in those with more long-standing hearing loss. This group also had a greater percentage of respondents who reported that music was an important part of their lives, compared with respondents whose enjoyment of music had not changed.

One might ask whether aging in itself results in music becoming less important in people's lives, independent of a hearing loss. Although this survey study cannot address that question, Wikstrom (2004) reported that music and other arts were considered very important to a group of subjects over age 65, and that 80% of the subjects indicated they participated in musical listening at least daily.

Important methodological differences exist between this survey and the German survey study of Feldmann and Kumpf (1988). Data were collected in this study by telephone interview with people who had had hearing aid evaluations during the previous year. Feldmann and Kumpf mailed questionnaires to people who had been seen in their audiology/ENT clinic. All of their questionnaire recipients had hearing loss, and most had received their hearing aids through the clinic. Degree of hearing loss was rated by the respondents, with 96% indicating their loss was moderate or worse.

(Although audiograms were not reported, there was a comment in the article that the actual losses were not as severe as the patients perceived them to be, at least as categorized by clinic staff.)

Mail-in questionnaires almost certainly reflect the interests of the respondents (i.e., someone not interested in music might not take the time to respond). The telephone interview, while permitting subjects to decline to participate, was probably less sensitive to subject self-selection biases. This methodological difference may explain in part why a much larger percentage of respondents in Feldmann and Kumpf's survey reported that hearing loss had interfered with their enjoyment of music (79% compared with 28% in the current study). However, it is not clear that people with hearing loss who wear hearing aids can separate the effects of the loss from the alterations in music produced by the hearing aids. The large difference in responses to questions about the effects of hearing loss on music enjoyment may actually reflect more the benefits of improved hearing aid processing than any other difference between the earlier German population and the current participants.

Difficulty with the overall volume or loudness of music (i.e., music being either too loud or too soft) continues to be a frequent complaint, but changes in loudness within a piece of music cause less difficulty than for respondents in the 1988 study. In that study, respondents commonly reported that they needed to change the volume setting on their hearing aids continually while listening to music. Modern hearing aids, in contrast, frequently incorporate wideband nonlinear compression and automatic volume control, which would reduce this annoyance. In fact, the development of WDRC since the previous questionnaire study was published may be the primary source of many of the differences in findings between the two studies.

Just as Feldmann and Kumpf (1988) found, a common complaint of people with hearing impairment continues to be understanding the lyrics in vocal music; this complaint may be more reflective of the difficulty of hearing speech sounds in background noise than of a problem specific to music listening. Many of the respondents indicated they listened to music on the radio and television, two media which typically use only one sound source for both music and lyrics. The task of understanding lyrics then becomes one of separating a speech signal (lyrics) from a background (music), nearly always a challenge for people with hearing loss.

A second goal of the survey was to ascertain whether hearing aids affect the perception and enjoyment of music. Only 6% of respondents reported that hearing aids interfered with their enjoyment of music, compared with 25% from Feldmann and Kumpf (1988). This marked difference probably reflects the technological improvements in hearing aids over the past 20 years.

It is possible that more complaints would be observed in a sample of subjects who did not receive good audiological care or state-of-the-art hearing aids. As beneficiaries of the U.S. military health-care system, all of the participants had received excellent audiological services, probably for several years, and all had had a hearing aid evaluation within the previous year. These factors suggest that the results reported here are best-case examples and that more typical elderly hearing aid clients might be more likely to report difficulties regarding music listening.

The sample in the current survey was predominantly male, in contrast to the nearly equal numbers of females and males in the Feldmann and Kumpf (1988) study. This imbalance is not unexpected, given the survey methodology and the demographics of the patients of the Army Audiology and Speech Center. Surveys were carried out primarily during daytime hours; the people who were at home to answer their phones tended to be older and retired and, therefore, had been in the military services at a time when fewer female soldiers enlisted. It should also be noted that nearly 40% of hearing-impaired persons in the United States are over the age of 65, and elderly men are more likely to have hearing loss than elderly women (Desai et al, 2001). Thus, although younger people were not specifically excluded from this survey, the clinic patient population for hearing aid evaluations tends to be male and elderly, and this demographic was reflected in the survey sample.

CONCLUSIONS

Nearly 30% of survey respondents reported that hearing loss had interfered with their enjoyment of music. Not surprisingly, most of those people indicated that music was important to them. Reduction in music enjoyment was not related to age within this elderly population; however, the hearing impairments of people who reported a loss of music enjoyment tended to have a slightly flatter configuration than did those who reported no loss of enjoyment. The percentage of people who reported a loss in music enjoyment was much lower than the 79% reported by Feldmann and Kumpf (1988), probably as a result primarily of significant advances in hearing aid design and programming, especially the development of WDRC.

Other factors, such as methodological differences between the two studies, may also have contributed to the differences in results. Only 6% of respondents reported that wearing hearing aids made music listening less enjoyable, compared with 25% in Feldmann and Kumpf, thus suggesting that modern hearing aids may provide better sound quality for music listening. However, given that a rather large percentage of hearing-impaired people expressed a loss in enjoyment

of music, audiologists should routinely ask patients about their music-listening habits and should work with them to provide the best possible amplification options for both speech and music listening.

Acknowledgments. We are grateful to Mary Cord for assistance in collecting these data, as well as for useful discussions. We also thank Pamela Richardson and Christine Kaelin for help in translating portions of Feldmann and Kumpf (1988) from the original German into English. Two thoughtful reviewers improved this manuscript, and we thank them. The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of the Army or the Department of Defense.

REFERENCES

- Arehart K, Burns E. (1999) A comparison of monotic and dichotic complex-tone pitch perception in listener with hearing loss. *J Acoust Soc Am* 106: 993–997.
- Chasin M. (2003) Music and hearing aids. *Hear J* 56:36–41.
- Chasin M, Russo F. (2004) Hearing aids and music. *Trends Amplif* 8:35–47.
- Desai M, Pratt LA, Lentzner H, Robinson KN. (2001) Trends in vision and hearing among older Americans. *Aging Trends*, No. 2. Hyattsville, MD: National Center for Health Statistics.
- Feldmann H, Kumpf W. (1988) Musikhören bei Schwerhörigkeit mit und ohne Hörgerät [Listening to music in the hard-of-hearing individual with and without hearing aid]. *Laryng Rhinol Otol* 67: 489–497.
- Franks JR. (1982) Judgments of hearing aid processed music. *Ear Hear* 3:18–23.
- Gfeller K, Knutson JF. (2003) Music to the impaired or implanted ear. *ASHA Leader* 8:1–15.
- Grant KW, Summers V, Leek MR. (1998) Modulation rate detection and discrimination by normal-hearing and hearing-impaired listeners. *J Acoust Soc Am* 104:1051–1060.
- Keidser G, Dillon H, Byrne D. (1996) Guidelines for fitting multiple memory hearing aids. *J Am Acad Audiol* 7:406–418.
- Larkin WD. (1983) Pitch vulnerability in sensorineural hearing impairment. *Audiology* 22:480–493.
- Leek MR, Summers V. (2001) Pitch strength and pitch dominance of iterated rippled noises in hearing-impaired listeners. *J Acoust Soc Am* 109:2944–2954.
- Punch JL. (1978) Quality judgments of hearing aid-processed speech and music by normal and otopathologic listeners. *J Am Audiol Soc* 3:179–188.
- Tufts JB, Molis MR, Leek MR. (2005) Perception of dissonance by people with normal hearing and sensorineural hearing loss. *J Acoust Soc Am* 118:955–967.
- Tufts JB, Molis MR. (2007) Roughness perception in normal-hearing and hearing-impaired listeners. *J Acoust Soc Am* 121: EL161–EL167.
- Wikstrom B. (2004) Older adults and the arts: the importance of aesthetic forms of expression in later life. *J Gerontol Nurs* 30:30–36.