Published in final edited form as:

J Am Acad Audiol. 2017 ; 28(10): 932–940. doi:10.3766/jaaa.16142.

Is the Device-Oriented Subjective Outcome (DOSO) Independent of Personality?

Yu-Hsiang Wu*, Kelsey Dumanch*, Elizabeth Stangl*, Christi Miller†, Kelly Tremblay†, and Ruth Bentler*

*University of Iowa, Iowa City, IA

†University of Washington, Seattle, WA

Abstract

Background—Self-report questionnaires are a frequently used method of evaluating hearing aid outcomes. Studies have shown that personality can account for 5–20% of the variance in response to self-report measures. As a result, these influences can impact results and limit their generalizability when the purpose of the study is to examine the technological merit of hearing aids. To reduce personality influences on self-report outcome data, the Device-Oriented Subjective Outcome (DOSO) was developed. The DOSO is meant to demonstrate outcomes of the amplification device relatively independent of the individual's personality. Still, it is unknown if the DOSO achieves its original goal.

Purpose—The purpose of this study was to examine the relationship between personality and the DOSO. The relationship between personality and several widely used hearing-related questionnaires was also examined.

Research Design—This is a nonexperimental study using a correlational design.

Study Sample—A total of 119 adult hearing aid wearers participated in the study.

Data Collection and Analysis—The NEO Five-Factor Inventory was used to measure five personality traits (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness). The initial (unaided) hearing disablement, residual (aided) hearing disablement, and hearing aid benefit and satisfaction was measured using the DOSO, Hearing Handicap Inventory for the Elderly/Adult, Abbreviated Profile of Hearing Aid Benefit, and Satisfaction with Amplification in Daily Life. The relationship between personality and each questionnaire was examined using a correlation analysis.

Results—All of the DOSO subscales were found to be significantly correlated to personality, regardless of whether age and better-ear hearing thresholds were controlled. Individuals who reported poorer hearing aid outcomes tended to have higher Neuroticism scores, while those who scored higher in Extraversion, Openness, and Agreeableness were more likely to report better

Corresponding author: Yu-Hsiang Wu, Department of Communication Sciences and Disorders, University of Iowa, Iowa City, IA 52242; yu-hsiang-wu@uiowa.edu.

Portions of this paper were presented at the American Auditory Society annual meeting in Scottsdale, AZ, March 4, 2016.

The authors alone are responsible for the content and writing of the manuscript.

outcomes. Across DOSO subscales, the maximum variance explained by personality traits ranged from 6% to 11%. Consistent with the literature, ~3–18% of the variance of other hearing-related questionnaires was attributable to personality.

Conclusions—The degree to which personality affects the DOSO is similar to other hearing-related questionnaires. Although the variance accounted for by personality is not large, researchers and clinicians should not assume that the results of the DOSO are independent of personality.

Keywords

adults; hearing aids; outcome measure; personality; self-report

INTRODUCTION

For a hearing aid user, the main purpose of amplification is to reduce communication difficulties caused by hearing loss. Therefore, it is critical for researchers and audiologists to determine whether a given intervention (e.g., hearing aid technology, fitting strategy) used to reduce a hearing aid user's communication difficulties facilitates better outcomes compared to absence of/or alternate interventions. Whether in the laboratory or in the clinic, the outcome of the intervention is often measured using speech recognition tests and retrospective self-reports (e.g., standardized questionnaires) to garner real-world perspectives from the hearing aid user. Laboratory measures assess hearing aids in well-controlled environments or situations; however, retrospective self-reports have recently gained much attention because their nature is consistent with the trend toward patient outcome-driven health care (Cox, 2003). Further, many real-world domains of intervention outcomes cannot be adequately assessed in the laboratory setting (e.g., satisfaction, participation restriction; Cox, 2003).

Although self-reports provide important insights about the hearing aid users' experiences in the real world, the results must be interpreted cautiously. Because self-report outcome data are measured from the patient's point of view, self-reports are often influenced by psychological factors such as personality (e.g., Gatehouse, 1991; 1994; Saunders and Cienkowski, 1996; Cox et al, 1999; 2007). For example, Gatehouse (1991) tested 240 adults to determine which factors (including personality) affect auditory disability. The Eysenck Personality Inventory (Eysenck and Eysenck, 1975) was used to assess the personality traits, or dimensions, of each participant. Auditory disability was measured using self-report questionnaires and speech recognition tests. For the three indices of self-reported disability, the audiogram and age explained 25–33% of the variance, and a further 15–25% of the variance was accounted for by the user's personality. Interestingly, Gatehouse (1991) did not find a relationship between personality and auditory disability measured using speech recognition tests. In a study designed to assess the relative contributions of patient-centered variables (such as personality) and amplification device-centered variables (such as device maximum output) to self-reports of hearing aid fitting outcomes, Cox et al (2007) tested 205 adults with hearing impairment. Personality traits were measured using the NEO Five-Factor Inventory (NEO-FFI), which assesses the strength of five personality traits: Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness (Costa and McCrae, 1985). The data indicated that many personality traits were associated with self-reported prefitting

and post-fitting disablement (such as activity limitation and sound aversiveness) and self-reported hearing aid benefit. For example, individuals who scored higher in the personality traits of Extraversion, Openness, and Agreeableness less commonly reported that environmental sounds were unpleasant. In contrast, those who scored higher in Neuroticism more commonly reported the opposite (Cox et al, 2007). Further, hearing aid users with a high level of Neuroticism also reported more participation restriction, less hearing aid benefit, and less hearing aid satisfaction. Overall, personality could explain up to 20% of the variance found across the outcome measures used.

Cox et al (2014) later reviewed their previous research to summarize the relationship between personality and several self-report questionnaires that are commonly used as hearing aid outcome measures, including the Hearing Handicap Inventory for the Elderly (HHIE; Ventry and Weinstein, 1982), the Abbreviated Profile of Hearing Aid Benefit (APHAB; Cox and Alexander, 1995), the Satisfaction with Amplification in Daily Life (SADL) Scale (Cox and Alexander, 1999), and the Shortened Hearing Aid Performance Inventory for the Elderly (SHAPIE; Dillon, 1994). Their review indicated that 1–16% of variance in the outcome measures can be accounted for by personality, the highest being the HHIE total score (16%), followed by the Personal Image (PI) subscale of the SADL (14%), and the APHAB Global score (11%) (cf. Figure 1 of Cox et al, 2014). While these measures were most strongly associated with personality, it was discussed that all outcome measures in their study (including the SHAPIE) were at least minimally affected by personality. These results are consistent with other studies described in the literature (e.g., Gatehouse, 1994; Saunders and Cienkowski, 1996; Cox et al, 1999).

While it has been determined that personality can affect the variance in outcome measure data, the link between personality and self-reported hearing difficulty or hearing aid outcomes may not necessarily be undesirable. For example, clinicians could use personality assessments to predict which patients may perceive poorer outcomes and therefore proactively address foreseen areas of difficulty and work to manage realistic patient expectations. However, from a research perspective, the effect of personality on outcomes can be problematic when comparing the technological merit of two or more hearing aids, as these factors may limit the generalizability of the results (Cox et al, 2014).

To reduce personality influences on outcome data and to meet the unfilled need for an outcome measure that can determine the technological merit of a device independent of the individual who is wearing it, the Device-Oriented Subjective Outcome (DOSO) scale was developed (Cox et al, 2014). The development of the DOSO was based on the research finding by Cox et al (2007). In particular, Cox et al (2007) conducted a principal components analysis to understand the underlying structure within the self-report data from different questionnaires. Data obtained from the APHAB, HHIE, SADL, SHAPIE, and a single-time query, which assessed overall satisfaction (“Overall, how satisfied are you with your new hearing aids?”), were subjected to analysis. Three distinct components were discovered and labeled as Device, Success, and Acceptance components. The Device component comprises the items of the SADL Positive Effect and Service and Cost subscales, which address the excellence or merit of the hearing aid device, as does the overall satisfaction score. Cox et al further found that the standardized scores of the Device

component were not associated with personality, while the Success and Acceptance components were. These results suggest that it is possible to develop a questionnaire that is more focused on the hearing aid device itself and is less affected by the personality of the device user.

To minimize the influence of personality, the DOSO was developed to ask individuals questions in reference to the hearing aid in a way that would minimize intro spection; questions were generally written with the exception of the word “you,” and replaced with the phrase “the hearing aids” (Cox et al, 2014). An example question is “How good are the hearing aids at making loud speech clear?” compared to “How well do you hear loud speech with your hearing aid(s)?” The response scale comprises seven categories ranging from “Not At All” to “Tremendously.” For the questionnaire to be feasibly used in both the research and clinical settings, the DOSO has both a long form and a short form. The long form has 40 items, and there are two equivalent versions of the short form with 28 items each. The DOSO contains six subscales related to the amplification device and its features (Speech Cues; Listening Effort; Pleasantness; Quietness; Convenience; Use). The Cronbach’s alpha of the subscales of the short form ranges from 0.67 to 0.94. Norms of each subscale are also available (see Cox et al, 2014, for detailed information).

Because the DOSO was developed to demonstrate outcomes of amplification devices and their technology relatively independent of the user’s personality, it is important to determine if this goal has been achieved. Cox et al (2009) reported interim data regarding the relationship between the DOSO and personality. Personality was measured using the Positive and Negative Affect Schedule (PANAS; Watson et al, 1988). The results revealed that although personality was associated with the Listening Effort and Convenience subscales (~12% variance explained), the contribution of personality to other DOSO subscales was minimal (.2% variance explained). However, to date, no peer-reviewed study has examined if the DOSO is independent of personality. To fill this gap, the purpose of the current study was to investigate the relationship between the DOSO and personality. To examine if the relationship between personality and hearing-related questionnaires described in previous research can be replicated on the participants of the current study, the association between personality and several widely used hearing-related questionnaires was also examined.

METHODS

Participants

The participants included 119 adult hearing aid wearers (46 males and 73 females). Their ages ranged from 29 to 79 yr with a mean of 67.9 yr (standard deviation [SD] = 9.1 yr). The participants were eligible for inclusion in this study if their hearing loss met the following criteria: (a) bilateral, symmetric (within 10 dB) sensorineural hearing loss (air-bone gap <15 dB) with pure-tone thresholds not exceeding 75 dB HL from 250 to 4000 Hz (in reference to ANSI, 2009); (b) experience with hearing aids, defined by use of more than six months with bilateral hearing aids for 1 hr per day or 7 hr per week; (c) native English speakers; and (d) no known neurological, cognitive, or medical deficits as determined by case history and a score of ≥ 22 points on the Montreal Cognitive Assessment (Nasreddine et al, 2005).

Composite audiograms are presented in Figure 1. Participants' hearing aids were from a wide variety of manufacturers and included models available from the last 13 yr. The mean hearing aid use time was 11.2 hr per day (SD = 4.6 hr). The study described in this article is a subset of a larger study on hearing aid outcomes. Participants were recruited from participation pool databases across two sites: the University of Iowa and the University of Washington.

Personality Measure

Personality was quantified using the NEO-FFI. This inventory was selected for two reasons: first, it has been used in several large-scale studies on hearing aid outcomes (Cox et al, 2005; 2007; Bentler et al, 2008), and thus would allow the present data to be compared to historical data from similar literature; and second, the five-factor model is a valid and comprehensive approach to the assessment of variations in normal personality, as these five dimensions are widely recognized by psychologists as the major domains of personality that are reasonably enduring styles of thinking, feeling, and acting throughout the adult life span (Digman, 1990; McCrae and Costa, 1997). The NEO-FFI has 60 items and consists of five subscales pertaining to basic dimensions of normal personality (Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness). These five dimensions of normal personality manifest in varying strengths in each individual. A higher score in Neuroticism is linked to an individual more commonly experiencing feelings of anger, anxiety, and impulsivity. Higher Extraversion scores are associated with more frequent feelings of enthusiasm, talkativeness, and action. A higher score in Openness is related to more regular feelings of curiosity, interest, and insightfulness. Feelings of appreciation, trust, and compliance are linked to a higher score in Agreeableness; and a higher score in Conscientiousness is associated with feelings of efficiency, reliability, and thoroughness. Scoring of the NEO-FFI involves transforming the raw score for each of the five traits into a standard-ized score, and norms are available for both men and women. Further details can be found in McCrae and Costa (1997) and Cox et al (2007).

Self-Report Hearing-Related Measures

In addition to the DOSO, three self-report hearing-related questionnaires were administered so that the data of the current study could be compared to existing literature on the relationship between hearing aid outcomes and personality: HHIE/Hearing Handicap Inventory for Adults (HHIA; Newman et al, 1990), APHAB, and SADL.

DOSO—Short form A of the DOSO was used in the present study. This inventory consists of 28 items, divided into six subscales (Speech Cues, Listening Effort, Pleasantness, Quietness, Convenience, and Use) that range from three to seven items in length. Scoring of the questionnaire follows a 7-point response scale, with numbers 1–7 assigned to the responses (i.e., not at all = 1, a little = 2, somewhat = 3, medium = 4, considerably = 5, greatly = 6, and tremendously = 7). The score is computed for each of the six subscales by averaging the scores of the items within that subscale, and a higher score is associated with a better outcome. Although Cox et al (2014) did not suggest computing a global score for the DOSO, the scores for all 28 items were averaged to generate a global score (in a manner

similar to the global score of the SADL, in “SADL” section) so that a general relationship between the DOSO and personality could be examined.

HHIE or HHIA—The HHIE/HHIA is a 25-item inventory designed to evaluate the social and emotional impact of hearing loss on an individual’s life. The questionnaire is divided into two subscales, ranging from 12 to 13 items in length: the Social subscale, which assesses the extent to which social aspects of an individual’s life are impacted by hearing loss, and the Emotional subscale, which measures how emotional responses in an individual’s life are influenced by hearing loss. The user rates the degree of the impact with “Yes” (4 points), “Sometimes” (2 points), or “No” (0 points). Scores are added for each subscale; the total score is the sum of the scores for all 25 items. Higher scores indicate that the individual is more handicapped (socially and/or emotionally) by the hearing loss.

APHAB—The APHAB (Cox and Alexander, 1995) is a 24-item inventory designed to evaluate benefit experienced from hearing aid use and to quantify the degree of communication difficulty experienced in various situations due to hearing loss. The questionnaire is divided into four subscales, each consisting of six items. The Ease of Communication subscale measures communication effort in favorable listening conditions. The Background Noise subscale assesses speech understanding in settings with high background noise levels. The Reverberation subscale gauges speech understanding in reverberant settings and the Aversiveness(AV) subscale evaluates the individual’s response to unpleasant environmental sounds. The user rates how often they experience a given listening situation on a scale from Never (1% of the time) to Always (99% of the time). Scores are added and averaged for each subscale; the global score is the mean of the scores for the Ease of Communication, Background Noise, and Reverberation communication subscales. Higher scores represent a greater degree of communication difficulty.

SADL—The SADL is a 15-item inventory designed to evaluate an individual’s satisfaction with his/her hearing aids. The questionnaire is divided into four subscales that range from three to six items in length. The Service and Cost subscale measures the adequacy of service provided by the dispenser and the cost of the devices. The Negative Features subscale assesses undesirable aspects of hearing aid use, such as feedback problems. The Positive Effect subscale quantifies improved performance while using the hearing aids, such as reduced communication disability. Finally, the PI subscale evaluates the domain of self-image and hearing aid stigma. The user rates the amount of satisfaction on a scale from “Not At All” (1 point) to “Tremendously” (7 points); the exceptions are reversed items. Scores are added and averaged for each subscale; the global score is the mean of the scores for all 15 items. Higher scores indicate that the user is more satisfied with hearing aids and therefore has received a better outcome.

Procedure

After agreeing to participate in the study and completing the consent form, participants’ pure-tone thresholds were measured, case history information was gathered, and the Montreal Cognitive Assessment was administered. If participants met the inclusion criteria, the questionnaires, as well as a series of assessments for the larger study on hearing aid

outcomes, were administered. The NEO-FFI, DOSO, HHIE/HHIA, APHAB, and SADL questionnaires were completed using a pen and paper response format. The administration order of the questionnaires varied across the participants, although it was not systematically randomized. For participants aged >65 yr, the HHIE was used; otherwise, the HHIA was administered. For both the APHAB and HHIE/HHIA, participants completed two questionnaires to describe their initial (unaided) and residual (aided) disablement. The difference between the unaided and aided scores derives the benefit score.

RESULTS

DOSO

The relationship between personality and the DOSO was examined using a correlation analysis. The top portion of Table 1 shows the linear correlation coefficient between each personality trait measured using the NEO-FFI and each DOSO subscale. All subscales significantly correlated to at least one personality trait. Stronger correlations were observed in the Listening Effort, Quietness, and Convenience subscales. Among the five personality traits, Agreeableness has the strongest association with the DOSO subscales. The correlation coefficient among personality traits and the Global score of the DOSO is also shown in the table. In general, those who scored higher in Neuroticism tended to report poorer hearing aid outcomes, while individuals who scored higher in Extraversion, Openness, and Agreeableness were more likely to report better outcomes. Personality explained up to 11% of the variance. To compare the results of the current study to the literature (i.e., Gatehouse, 1991) in which the effects of age and hearing loss were controlled for, the coefficient of the partial correlation between personality and the DOSO, controlling for participants' age and better-ear pure-tone average (PTA; averaged across 0.5, 1, and 2 kHz) is shown in the bottom portion of Table 1. In general, the association does not change after controlling for age and better-ear PTA.

Figure 2 shows the maximum variance of a given DOSO subscale explained by personality (regardless of which trait). The data estimated from Cox et al (2009) are also shown in the figure for comparison. For most subscales (i.e., Speech Cues, Pleasantness, Quietness, and Use), the variance accounted for by personality is higher in the current study than that reported by Cox et al (2009). Note that Cox et al used the PANAS to measure personality, rather than the NEO-FFI used in the current study.

HHIE/HHIA, APHAB, and SADL

To examine if the relationship between personality and hearing-related questionnaires described in previous research can be replicated on the participants of the current study, the data of the NEO-FFI, HHIE/HHIA, APHAB, and SADL were subjected to correlation analyses. To facilitate data comparison, the HHIE/HHIA, APHAB, and SADL data were divided into three categories as suggested by Cox et al (2007). The category of initial disablement consists of the unaided HHIE/HHIA total score, the unaided APHAB Global score, and the unaided APHAB AV subscale score. The residual disablement category comprises the aided HHIE/HHIA total score, the aided APHAB Global score, and the aided APHAB AV score. The benefit/satisfaction category consists of the HHIE/HHIA benefit

score (the difference between unaided and aided scores), APHAB benefit Global score, and SADL PI subscale and Global scores. Only the PI subscale of the SADL was examined in the analysis because it has stronger associations with personality than the rest of SADL subscales (Cox et al, 2007).

Table 2 shows the correlation coefficient of the linear correlation and partial correlation (controlling for age and better-ear PTA) among personality and the hearing-related questionnaires. The correlation coefficient data retrieved from Cox et al (2007), which used the same NEO-FFI and hearing-related questionnaires as the current study, are shown at the bottom of the table for comparison. Both studies indicate that participants who scored higher in Neuroticism tended to report more initial and residual disablement (HHIE/HHIA and APHAB) and were less satisfied with hearing aids (SADL PI subscale). The strongest correlation was between Neuroticism and unaided HHIE/HHIA: up to 17.4% (the current study) and 21.2% (Cox et al) of the variance is explained by personality. The two studies differ in that, although Cox et al found several significant correlations between self-reported disablement and the personality traits of Extraversion, Openness, and Agreeableness, the current study did not. Further more, the current study demonstrated that users scoring higher in Openness and Agreeableness tended to report more hearing aid benefit (APHAB benefit score, $r = 0.2$ and 0.25 , respectively), while this is not the case in the study by Cox et al (2007). Regardless, both studies demonstrated that personality is associated with hearing-related questionnaires.

Figure 3 shows the maximum variance of a given hearing-related measure explained by personality (regardless of which trait). The data from Cox et al (2007) are also shown in the figure for comparison. With the exception of the unaided APHAB Global and AV scores and APHAB benefit score, the amount of variance accounted for by personality is very similar across the two studies.

DISCUSSION

The purpose of the current study was to determine the contribution of personality to outcomes measured by the DOSO. Personality was measured using the NEO-FFI. Results indicated that the DOSO is associated with personality. In particular, significant correlations were consistently found across all DOSO subscales as well as the global score, regardless of whether age and better-ear PTA were controlled (Table 1). Across the six DOSO subscales, the maximum variance explained by personality traits ranged from 6% to 11% (Figure 2), with an average of 7.5%. In contrast, Cox et al (2009) indicated that the maximum variance of the DOSO subscales attributable to personality ranged from 0.5% to 12%, with an average of 4.7%. Cox et al (2009) also suggested that four of the six DOSO sub-scales (Speech Cues, Pleasantness, Quietness, and Use) were minimally influenced by personality (2% variance explained).

One reason for the difference in the DOSO–personality relationship between the two studies is that different inventories were used to measure personality: the NEO-FFI was used in the current study while Cox et al (2009) used the PANAS. The NEO-FFI is based on the five-factor model of personality structure (Digman, 1990; John, 1990; McCrae and John, 1992)

and measures five domains of normal personality. In contrast, the PANAS focuses on the structure of human emotions (Watson et al, 1988) and assesses two emotion dimensions (Positive Affect and Negative Affect). Although these two types of personality measures are often correlated (e.g., Neuroticism associates with Negative Affect, Extraversion associates with Positive Affect; Watson and Clark, 1992), they may have different effects on hearing-related questionnaires.

The current study also found significant associations between personality and questionnaires that measure initial (unaided) disablement, residual (aided) disablement, and hearing aid benefit and satisfaction (Table 2). Across all questionnaires and subscales shown in Figure 3, the maximum variance of hearing-related questionnaires explained by personality ranged from 3% to 18%, with an average of 8.7% (Figure 3). Although not identical, the results of the current study are fairly similar to the study by Cox et al (2007), which used the same personality and hearing-related questionnaires as the current study and found that the maximum variance explained by personality ranged from 0.5% to 21% (Figure 3), with an average of 9.9%.

The current study further indicates that the degree to which personality affects the DOSO is fairly similar to other hearing-related questionnaires. In particular, the maximum variance attributable to personality averaged across the six DOSO subscales is 7.5% (Figure 2), which is close to the maximum variance explained by personality averaged across all hearing-related questionnaires/subscales shown in Figure 3 (8.7%). Therefore, although the variance accounted for by personality is not large, the DOSO is not superior to most hearing-related questionnaires in terms of personality independence.

The association between the DOSO and personality suggests that the approach used to minimize the effect of personality, that is, developing items that would “point to” the hearing aid and minimizing wording that might promote introspection, was likely unsuccessful. According to Robinson and Clore (2002), when people are asked to report their experience in retrospective questionnaires, they tend to use semantic memory to help guide their reports. Because semantic memory consists of certain beliefs that are rarely updated, retrospective self-reports are often biased by situation-specific beliefs (e.g., “vacations are enjoyable”) and identity-specific beliefs (e.g., “women are more emotional than men”). Because personality is about coherent narratives about oneself (beliefs about oneself), personality is a source of identity-specific beliefs that can bias retrospective self-reports. From this perspective, it is likely that retrospective self-reports would more or less be affected by personality, regardless of how the wording of the questions asked is manipulated.

Finally, because hearing-related questionnaires such as the DOSO, HHIE/HHIA, SADL, and APHAB are influenced by personality, it might be beneficial for a study that aims to assess the technological merit of hearing aids to use a personality scale like the NEO-FFI with participants. Reporting and controlling the effect of personality on hearing aid outcomes would increase the generalizability of the study.

CONCLUSIONS

The degree to which personality affects the DOSO is similar to other hearing-related questionnaires, such as the APHAB and SADL. Although the variance accounted for by personality is not large, researchers and clinicians should not assume that the results of the DOSO are personality-free.

Acknowledgments

The authors thank Christopher Bishop, Ashley Moore, Kelly Trapp, and Erin Stewart for assisting in the recruitment of participants and in data collection.

This work was supported by research grants from NIH/NIDCD, grants R01 DC012769 and P30 DC004661, and NIH/Clinical and Translational Science Award (CTSA) program, grant U54TR001356.

Abbreviations

APHAB	Abbreviated Profile of Hearing Aid Benefit
AV	Aversiveness
DOSO	Device-Oriented Subjective Outcome
HHIA	Hearing Handicap Inventory for Adults
HHIE	Hearing Handicap Inventory for the Elderly
NEO-FFI	NEO Five-Factor Inventory
PANAS	Positive and Negative Affect Schedule
PI	Personal Image
PTA	pure-tone average
SADL	Satisfaction with Amplification in Daily Life
SD	standard deviation
SHAPE	Shortened Hearing Aid Performance Inventory for the Elderly

References

- American National Standards Institute (ANSI). Methods for Manual Pure-Tone Threshold Audiometry. New York, NY: ANSI; 2009. ANSI S3.21-2004
- Bentler R, Wu YH, Kettel J, Hurtig R. Digital noise reduction: outcomes from laboratory and field studies. *Int J Audiol*. 2008; 47(8):447–460. [PubMed: 18698521]
- Costa, PT., McCrae, RR. The NEO Personality Inventory Manual. Odessa, FL: Psychological Assessment Resources; 1985.
- Cox RM. Assessment of subjective outcome of hearing aid fitting: getting the client's point of view. *Int J Audiol*. 2003; 42(1, Suppl):90–96.
- Cox RM, Alexander GC. The abbreviated profile of hearing aid benefit. *Ear Hear*. 1995; 16(2):176–186. [PubMed: 7789669]

- Cox RM, Alexander GC. Measuring Satisfaction with Amplification in Daily Life: the SADL scale. *Ear Hear.* 1999; 20(4):306–320. [PubMed: 10466567]
- Cox RM, Alexander GC, Gray G. Personality and the subjective assessment of hearing aids. *J Am Acad Audiol.* 1999; 10(1):1–13. [PubMed: 9921721]
- Cox RM, Alexander GC, Gray GA. Who wants a hearing aid? Personality profiles of hearing aid seekers. *Ear Hear.* 2005; 26(1):12–26. [PubMed: 15692301]
- Cox RM, Alexander GC, Gray GA. Personality, hearing problems, and amplification characteristics: contributions to self-report hearing aid outcomes. *Ear Hear.* 2007; 28(2):141–162. [PubMed: 17496667]
- Cox, RM., Alexander, BG., Xu, J. Development of the Device-Oriented Subjective Outcome Scale (DOSO). Refereed Poster Presented at the Annual Meeting of the American Auditory Society; March 2009; Scottsdale, AZ. 2009.
- Cox RM, Alexander GC, Xu J. Development of the Device-Oriented Subjective Outcome (DOSO) scale. *J Am Acad Audiol.* 2014; 25(8):727–736. [PubMed: 25380119]
- Digman JM. Personality structure: emergence of the five-factor model. *Annu Rev Psychol.* 1990; 41:417–440.
- Dillon H. Shortened Hearing Aid Performance Inventory for the Elderly (SHAPIE): a statistical approach. *Aust J Audiol.* 1994; 16:37–38.
- Eysenck, HJ., Eysenck, SBG. *Manual of the Eysenck personality questionnaire.* London: Hodder & Stoughton; 1975.
- Gatehouse S. The role of non-auditory factors in measured and self-reported disability. *Acta Otolaryngol.* 1991; 111:249–256. [PubMed: 2068910]
- Gatehouse S. Components and determinants of hearing aid benefit. *Ear Hear.* 1994; 15(1):30–49. [PubMed: 8194678]
- John, OP. The “big five” factor taxonomy: dimensions of personality in the natural language and in questionnaires. In: Pervin, LA., editor. *Handbook of Personality: Theory and Research.* New York, NY: Guilford; 1990. p. 66–100.
- McCrae RR, Costa PT Jr. Personality trait structure as a human universal. *Am Psychol.* 1997; 52(5): 509–516. [PubMed: 9145021]
- McCrae RR, John OP. An introduction to the five-factor model and its applications. *J Pers.* 1992; 60(2):175–215.
- Nasreddine ZS, Phillips NA, Bédirian V, Charbonneau S, Whitehead V, Collin I, Cummings JL, Chertkow H. The Montreal Cognitive Assessment, MoCA: a brief screening tool for mild cognitive impairment. *J Am Geriatr Soc.* 2005; 53(4):695–699. [PubMed: 15817019]
- Newman CW, Weinstein BE, Jacobson GP, Hug GA. The Hearing Handicap Inventory for Adults: psychometric adequacy and audiometric correlates. *Ear Hear.* 1990; 11(6):430–433. [PubMed: 2073976]
- Robinson MD, Clore GL. Belief and feeling: evidence for an accessibility model of emotional self-report. *Psychol Bull.* 2002; 128(6):934–960. [PubMed: 12405138]
- Saunders GH, Cienkowski KM. Refinement and psychometric evaluation of the Attitudes Toward Loss of Hearing Questionnaire. *Ear Hear.* 1996; 17(6):505–519. [PubMed: 8979038]
- Ventry IM, Weinstein BE. The hearing handicap inventory for the elderly: a new tool. *Ear Hear.* 1982; 3(3):128–134. [PubMed: 7095321]
- Watson D, Clark LA. On traits and temperament: general and specific factors of emotional experience and their relation to the five-factor model. *J Pers.* 1992; 60(2):441–476. [PubMed: 1635050]
- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol.* 1988; 54(6):1063–1070. [PubMed: 3397865]

Figure 1.
Mean hearing thresholds for the participants. Error bars indicate 1 SD.

Figure 2. Maximum variance explained by personality traits across DOSO subscales. SpchCue = Speech Cues; LstEfrt = Listening Effort; Plsnt = Pleasantness; Quiet = Quietness; Conv = Convenience.

Figure 3.
Maximum variance explained by personality traits across hearing-related questionnaires.

Table 1

Correlation Coefficient of Linear Correlation and Partial Correlation (Controlling for Age and Better-Ear PTA) among Personality Traits and DOSO Subscale and Global Scores

	Speech Cues	Listening Effort	Pleasantness	Quietness	Convenience	Use	Global
Linear correlation							
N	-0.17	-0.15	-0.04	-0.19 [*]	-0.30 ^{**}	-0.025	-0.20 [*]
E	0.15	0.21 [*]	0.19 [*]	0.25 ^{**}	0.23 [*]	0.13	0.25 ^{**}
O	0.24 ^{**}	0.27 ^{**}	0.13	0.15	0.049	0.16	0.23 [*]
A	0.12	0.26 ^{**}	0.25 ^{**}	0.24 ^{**}	0.33 ^{**}	0.30 ^{**}	0.29 ^{**}
C	0.058	0.076	0.13	0.16	0.13	0.11	0.14
Partial correlation, controlling for age and better-ear PTA							
N	-0.21 [*]	-0.18	-0.068	-0.21 [*]	-0.33 ^{**}	-0.02	-0.24 [*]
E	0.14	0.19 [*]	0.18	0.25 ^{**}	0.23 [*]	0.14	0.24 ^{**}
O	0.18	0.26 ^{**}	0.094	0.12	0.014	0.22 [*]	0.19 [*]
A	0.15	0.28 ^{**}	0.27 ^{**}	0.25 ^{**}	0.35 ^{**}	0.29 ^{**}	0.32 ^{**}
C	0.041	0.065	0.12	0.15	0.13	0.12	0.13

Notes: A = Agreeableness; C = Conscientiousness; E = Extraversion; N = Neuroticism; O = Openness.

^{*} $p < 0.05$;

^{**} $p < 0.01$.

Correlation Coefficient of Linear Correlation and Partial Correlation (Controlling for Age and Better-Ear PTA) among Personality Traits and Hearing-Related Questionnaires

Table 2

	Initial Disablement			Residual Disablement			Benefit/Satisfaction			
	Unaided HHIE/HHIA	Unaided APHAB Global	Unaided APHAB AV	Aided HHIE/HHIA	Aided APHAB Global	Aided APHAB AV	Benefit HHIE/HHIA	Benefit APHAB PI	SADL PI	SADL Global
Linear correlation coefficient, current study										
N	0.42**	0.26**	0.2*	0.40**	0.34**	0.20*	0.12	-0.057	-0.18*	-0.17
E	-0.093	-0.023	-0.18	-0.16	-0.14	-0.14	0.044	0.11	0.12	0.17
O	0.046	0.099	0.18	-0.11	-0.092	-0.13	0.18*	0.2*	0.047	0.19*
A	-0.04	0.081	-0.11	-0.14	-0.17	-0.087	0.099	0.25**	0.29**	0.32**
C	-0.054	-0.066	-0.18*	-0.1	-0.1	-0.15	0.036	0.021	0.094	0.14
Partial correlation, controlling for age and better-ear PTA, current study										
N	0.4**	0.24	0.20*	0.39**	0.33**	0.17	0.079	-0.084	-0.19*	-0.18
E	-0.14	-0.056	-0.19	-0.18	-0.16	-0.16	0.02	0.10	0.12*	0.17
O	0.12	0.22*	0.13	-0.072	-0.046	0.11	0.24*	0.26**	0.059	0.20*
A	-0.038	0.087	-0.1	-0.15	-0.17	-0.072	0.11	0.26**	0.29**	0.32**
C	-0.071	-0.08	-0.19*	-0.11	-0.10	-0.17	0.027	0.2	0.095	0.14
Linear correlation coefficient, Cox et al (2007)										
N	0.46**	0.33**	0.38**	0.38**	0.31**	0.22**	0.18**	0.04	-0.32**	
E	-0.27	-0.24**	-0.23**	-0.24**	-0.19**	-0.19**	-0.11	-0.07	-0.26**	
O	-0.13	-0.21**	-0.21**	-0.10	-0.18	-0.12	-0.08	-0.04	0.06	
A	-0.29**	-0.14	-0.29**	-0.28**	-0.15	-0.15	-0.08	-0.02	0.31**	
C	-0.13	-0.10	-0.11	-0.18	-0.21**	-0.07	-0.01	0.07	0.22**	

Notes: A = Agreeableness; C = Conscientiousness; E = Extraversion; N = Neuroticism; O = Openness.

* $p < 0.05$;

** $p < 0.01$.