

# Understanding Patient Expectations Before Implantation Using the Cochlear Implant Quality of Life–Expectations Instrument

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**IMPORTANCE** Previous research suggests that clinicians view realistic patient expectations as the most important nonaudiological factor in the decision to proceed with a cochlear implant (CI). However, clinicians have few data to determine whether patients' outcome expectations are realistic.

**OBJECTIVE** To address this unmet clinical need through the development and psychometric analysis of a new patient-reported outcome measure, the CI Quality of Life (CIQOL) Expectations.

**DESIGN, SETTING, AND PARTICIPANTS** This cross-sectional study was conducted at a tertiary CI center from February 26, 2020, to August 31, 2021. First, a team comprising 2 CI audiologists, a CI surgeon, a hearing scientist, and 2 psychometricians with experience in instrument development converted all items from the CIQOL-35 Profile instrument into statements reflecting expected outcomes. Then, cognitive interviews with 20 potential CI users assessed the clarity and comprehensiveness of the new instrument. Next, responses to the CIQOL-Expectations instrument for 131 potential adult CI candidates were psychometrically analyzed using confirmatory factor analysis and item response theory. Finally, degree to which patient expectations changed from before to after and their CI evaluation appointments was measured.

**INTERVENTION** The CIQOL-Expectations instrument.

**RESULTS** Of 178 participants, 85 (47.8%) were female, and there was 1 (0.6%) Asian, 26 (14.6%) Black or African American, 1 (0.6%) Latinx, and 150 (84.3%) White individuals. No major content or grammar changes were identified during the cognitive interviews. Overall, all CIQOL domains demonstrated adequate to strong psychometric properties. Several domains did not meet all a priori established indicators of model fit or ability to separate CI users based on response patterns, but all met most indicators. Potential CI users demonstrated the highest mean (SD) expectation scores for the environment (70.2 [20.8]) and social (68.4 [18.0]) domains. In addition, the entertainment (20 [15.3%]) and environment (31 [24.4%]) domains had the highest percentage of patients with expectation scores of 100. Yet, normative CIQOL-35 Profile data from experienced CI users suggested few patients obtain this high degree of functional benefit after implant.

**CONCLUSIONS AND RELEVANCE** The results of this cross-sectional study suggest that the CIQOL-Expectations instrument may provide an opportunity to assess potential CI users' expected outcomes using modification of an established CIQOL instrument and a patient-centered framework. The included items and domains reflect real-world functional abilities valued by CI users and may provide opportunities for an evidence-based shared decision-making approach to the CI evaluation process. With this instrument, clinicians can compare individual patients' pre-CI outcome expectations with established normative data and provide appropriate counseling.

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The evaluation process for potential adult cochlear implant (CI) recipients comprises audiological testing and counseling regarding the CI process. For those who meet audiological criteria for implant, Prentiss et al<sup>1</sup> reported that audiologists believe that realistic patient expectations is the most important factor that determines whether they recommend patients proceed with a CI. However, other than average speech recognition scores for experienced CI users, clinicians have few data to (1) determine whether patients have realistic expectations or (2) counsel patients about their expectations.

The sole use of speech recognition scores is insufficient for such outcome expectations discussions for several reasons. First, post-CI speech recognition outcomes demonstrate large and unexplained variability.<sup>2-5</sup> Yet, despite extensive research, post-CI speech recognition outcomes are difficult to predict based on patient preoperative characteristics.<sup>4,6-8</sup> Second, speech recognition outcomes demonstrate absent-to-low associations with patients' real-world, self-reported communication abilities.<sup>9-12</sup> In addition, a sole focus on speech recognition ability ignores effects of cochlear implantation that have been shown to be valuable to patients, such as decreased listening effort and improved social abilities and emotional state.<sup>13,14</sup>

The transition from patients struggling to communicate using hearing aids to hearing with a CI is likely marked and difficult to comprehend for anyone who has not undergone this process. Prior qualitative interviews with experienced CI users suggest that before surgery most patients did not feel they had a clear understanding of realistic outcomes following surgery.<sup>15,16</sup> However, to our knowledge, clinicians currently lack the tools to measure CI user outcome expectations prior to implantation and determine whether patients' expectations align with actual CI user functional abilities. This is especially important, as previous research has suggested that pre-CI patient expectations may be associated with CI user outcomes.<sup>17</sup> Therefore, there is a clear need to enhance the ability to counsel patients in this area.

The long-term goal of this research is to develop a mechanism to assess patient outcome expectations to improve the pre-CI evaluation process. This includes moving beyond general discussions in which clinicians must estimate whether patients' expectations are aligned with realistic CI outcomes toward personalized, evidence-based practice in which individual and group CI patient data can be used to guide discussion. This study reports the development, psychometric analysis, and use of an instrument to measure a CI candidate's outcome expectations, the Cochlear Implant Quality of Life (CIQOL)-Expectations. This instrument is based on the framework of the CIQOL-35 Profile instrument, which was developed and validated using a mixed-method design to provide a more comprehensive understanding of real-world functional abilities of CI users.<sup>13,18-20</sup> An early step of this development process included qualitative analysis of the domains and themes that are the most important to CI users.<sup>13</sup> As such, use of this framework can ensure that the included items are of interest to this patient population.

## Key Points

**Question** Is it possible to measure patients' outcome expectations before cochlear implant (CI) to improve counseling discussions during cochlear implant evaluations?

**Findings** In this multistep cross-sectional study of 178 potential CI users, the CI Quality of Life (CIQOL)-Expectations instrument was found to be psychometrically sound. On average, patients' pre-CI expectations in several domains were higher than the functional ability levels of experienced CI users, based on normative data.

**Meaning** The study findings suggest that development and use of the CIQOL-Expectations instrument may provide an opportunity for an evidence-based shared decision-making approach to the CI evaluation process.

## Methods

This study was approved by the institutional review board of the Medical University of South Carolina (Charleston), and consent was not required for the instrument development portion of the study. Participants provided written consent for the modifiability portion of the study. All participants were English-speaking adults (age ≥18 years) with bilateral postlingual moderate to profound hearing loss who were undergoing evaluation for candidacy for cochlear implantation. Patients were excluded if they had a prior CI or were undergoing cochlear implantation for single-sided hearing loss (Table 1).

### Development of the CIQOL-Expectations Instrument

A team comprising 2 CI audiologists, a CI surgeon, a hearing research scientist, and 2 psychometricians with experience in instrument development converted all items from the CIQOL-35 Profile instrument into statements reflecting the expected outcome. For example, the CIQOL-35 Profile item from the communication domain "I am able to have a conversation with a group of 3 or more people" was converted to "I will be able to have a conversation with a group of 3 or more people" for the expectation instrument. The 5 response options for each item in the expectation instrument were identical to the CIQOL-35 Profile and ranged from "never" to "always."

After the team agreed on the item language/content, we performed a series of cognitive interviews. Participants were recruited from consecutive patients who were undergoing CI candidacy evaluation at our institution's CI center for bilateral moderate to profound hearing loss. These semistructured interviews included the following topics: (1) clarity of instrument instructions; (2) clarity of each CIQOL-Expectations item; and (3) if there were topics/themes of interest that were not included in the instrument.

### Psychometric Analyses of the CIQOL-Expectations Instrument

Prior to their CI evaluation, 129 patients completed the newly developed CIQOL-Expectations instrument. Confirmatory factor analysis (CFA) was used to evaluate the assumptions for

Table 1. Demographic and Hearing History Data for Participants in Each Section of This Study

Characteristic	Portion of study, No. (%)		
	Cognitive interviews	Psychometric analyses	Modifiability of expectations
No.	21	129	28
Sex			
Female	9 (42.9)	61 (51.9)	15 (53.6)
Male	12 (57.1)	68 (48.1)	13 (46.4)
Race			
Asian	0	1 (0.8)	0
Black or African American	3 (14.3)	20 (15.3)	3 (10.7)
White	18 (85.7)	107 (81.7)	25 (89.3)
Not reported	0	1 (0.8)	0
Ethnicity			
Latinx	0	1 (0.8)	0
Not Latinx	21 (100)	128 (99.2)	20 (71.4)
Not reported	0	0	8 (28.6)
Hearing modality			
Hearing aids	13 (61.9)	71 (55.0)	22 (78.6)
No hearing aids	7 (33.3)	19 (14.7)	6 (21.4)
Unknown	1 (4.8)	39 (30.2)	0
Age, mean (SD), y	65.3 (12.9)	65.0 (17.0)	65.24 (14.1)
Duration hearing loss, mean (SD), years	26.6 (17.5)	23.6 (15.0)	26.0 (11.2)
CNC Word score, mean (SD)	41.8 (25.4)	30.7 (23.4)	32.6 (27.0)
AzBio Quiet score, mean (SD)	31.3 (27.5)	40.6 (30.9)	39.7 (34.1)
AzBio +10 score, mean (SD) <sup>a</sup>	25.6 (28.6)	35.3 (27.1)	37.4 (17.5)

Abbreviations: AzBio, Arizona Bioindustry Association; CNC, consonant-nucleus-consonant.

<sup>a</sup> AzBio +10 signal-to-noise ratio data were available for 63 patients in the psychometric analysis portion of the study and 12 patients in the modifiability of expectations portion of the study.

item response theory (IRT) analysis. The assumption of unidimensionality for each domain was analyzed with an ordered-category CFA with diagonal weighted least squares estimation using the package lavaan in the statistical software R (R Foundation).<sup>21</sup> Multiple types of fit indicators were examined, including those reflective of absolute fit (standardized root mean square residual) and comparative fit indicators (comparative fit index and Tucker-Lewis index [TLI]). Next, we performed 1-parameter logistic IRT. Rating scale models with joint maximum likelihood estimation were conducted using WINSTEPS, version 3.90.0.<sup>22</sup> Results of the IRT analyses were examined using the same multistep approach we used to develop the CIQOL Item Bank<sup>20</sup> (see eMethods in the Supplement for full description).

### Comparison of Patient Expectations With Normative Data of Experienced CI Users

The pre-CI CIQOL-Expectations domain and global scores of candidate CI patients were compared with CIQOL-35 Profile domain and global score normative data.<sup>23</sup> These normative data were collected in a multisite study that included 705 experienced ( $\geq 12$  months) CI users. Demographic and hearing data for the normative sample were published previously.<sup>23</sup> Student *t* tests were used to compare mean CIQOL-Expectations domain and global scores with corresponding normative CIQOL-35 Profile domain and global scores. Instead of *P* values, effect sizes and Cohen *d* were used to quantify the magnitude of differences for all statistical tests. An effect size of 0.2 to 0.49 was considered small, 0.5 to 0.79 medium, 0.8 to 1.29 large, and greater than 1.3 very large.<sup>24</sup>

### Modifiability of CI Patient Expectations

To determine the degree to which outcome expectations before surgery were modifiable, an independent cohort of 28 patients completed the CIQOL-Expectations instrument before and after their CI candidacy evaluation. The CI candidacy evaluation process at our center included visits with a CI audiologist and CI surgeon on the same day. There were no established scripts or patient handout materials used to explain post-CI expectations. Rather, clinicians had open-ended discussions with patients on this topic and answered any specific questions. We anticipated interclinician variability regarding the patient discussions, but to our knowledge this has not been formally studied. Rather, the goal of this portion of the study was to provide preliminary data regarding the extent to which patient expectations changed from before to after routine CI candidacy evaluations. Using descriptive statistics, domain-specific expectation scores were compared as a group and as individual scores between these 2 periods.

## Results

### Cognitive Interviews

Twenty-one patients undergoing CI candidacy evaluations participated in the cognitive interviews. Two participants recommended clarifying the instructions, which was completed after the 13th interview. After the changes were made, no additional changes were suggested by participants. All participants were able to accurately express the intended meaning of each item. There were no suggestions for additional

Table 2. Results From the Psychometrical Analyses for the CIQOL-Expectations Instrument

Domain	CFA results				IRT analysis results						
	Absolute fit index, SRMR	Comparative fit indices		Items with nonsignificant standardized factor loadings, No.	Item misfit	Person misfit (%)	Ceiling/floor (%)	Person reliability	Person strata	Mean person measure (logits)	Cronbach $\alpha$
CFI	TLI										
Communication	0.045	0.999	0.999	0	1	16.0	4.5/0	0.87	3.8	1.5	0.93
Emotional	0.037	1.000	1.000	1	1	7.6	6.9/0	0.77	2.8	0.6	0.83
Entertainment	0.015	1.000	1.000	1	1	13.7	15.3/0	0.63	2.1	1.2	0.84
Environment	0.045	0.997	0.994	0	0	7.0	24.8/0	0.85	3.5	2.3	0.93
Listening effort	0.206	0.966	0.931	0	0	11.6	3.9/0	0.85	3.5	0.9	0.93
Social	0.247	0.980	0.959	0	0	8.5	12.4/0	0.73	2.6	1.1	0.81
Global	0.123	0.961	0.950	1	1	18.3	2.3/0	0.76	2.7	1.0	0.83

Abbreviations: CFA, confirmatory factor analysis; CFI, comparative fit index; CIQOL, Cochlear Implant Quality of Life-Expectations instrument; IRT, item response theory; SRMR, standardized root mean square residual; TLI, Tucker-Lewis index.

content to be added to the instrument, and no grammar changes were suggested.

### Psychometric Analyses

A summary of CFA results used to evaluate unidimensionality, item local independence, and factor loadings is provided in Table 2. Fit indices reflected adequate-to-good model fit for the communication, emotional, entertainment and environment domains. The listening effort and social domains did not meet fit criteria for the standardized root mean square residual but did meet criteria for comparative fit index and TLI. In reference to the listening effort domain, a TLI value of 0.95 was considered good, and values greater than 0.90 were considered adequate.<sup>25</sup> The emotional, entertainment, and global domains all had a single item that had standardized factor loadings of 0.32 or greater on their respective domains. This was not observed in the remaining domains. These single items remained in the final instrument, as they contained information determined to be important to patients and clinician/researchers interested in comparing CIQOL-Expectations data with CIQOL-35 Profile outcomes. Only 1 of the 5 items in these domains had nonsignificant factor loadings. Moreover, removing such items is more important when developing item banks for computerize adaptive tests in which patients may be presented with different sets of items.<sup>26</sup>

The summary of the IRT analyses are provided in Table 2. As expanded on in the discussion, a more lenient interpretation of the IRT analyses was allowed because of unique aspects of self-reports of expectations rather than functional abilities, such as CI candidates possibly inflating scores because they were presuming how they may perform with their CI, which would tend to use less of the “rarely” and “never” scale responses for patients who are considering undergoing surgery. In addition, it was important to align the items of the CIQOL-Expectations instrument with the established CIQOL-35 Profile so they could be directly compared in clinical and research settings. The rating scale for the emotional, listening effort, and social met the 3 a priori criteria. The rating scales of the 3 additional domains and global measure met some, but not every, criterion. The communication, emo-

tional, and entertainment domains and the global measure each had 1 item that misfit the measurement model.

The percentage of patients who misfit the model ranged from 7.0% (environment:  $n = 9$ ) to 18.3% (global:  $n = 24$ ). No floor effects were observed for any domain, but 20 patients (15.3%) in the entertainment domain and 32 patients (24.8%) in the environment domain reported that they expected to “always” be able to endorse each item (scores of 100). Mean person measures were at or near the criteria for all domains except the communication and environment domains. For the communication domain, the mean patient scores were slightly higher than the mean item difficulty. However, only a very small proportion of patients showed a ceiling effect for this domain, so the full expectation range was being measured. In contrast, patients’ mean scores for the environment domain were higher than the mean item difficulty scores and there was a substantial ceiling effect. Taken together, this likely means that some patients’ expectations for the environment domain may be higher than the instrument’s measurement capacity.

Only the communication, environment, and listening effort domains achieved strong person reliability and the capacity to separate individuals into statistically distinct person strata that could be reliably differentiated. The emotional, entertainment, and social domains and global measure were all close to meeting person reliability criteria, but all differentiated patients into fewer than 3 strata. Taken together, the person reliability and person strata results suggested that there was not large differentiation in expected ability levels of CI candidates for these domains. Cronbach  $\alpha$  values for each domain suggested good internal consistency reliability.

### Comparison of Patient Expectations With Normative Data of CI Users

The mean expectation scores for each CIQOL domain and global measure for participants in the current study are displayed in Table 3. Previously published normative data for each domain of the CIQOL-35 Profile instrument for 705 adult CI users with more than 12 months of experience are also displayed in Table 3.<sup>23</sup> Comparisons suggested that potential CI users, on average, had substantially higher domain-specific

**Table 3. Comparison of Mean CIQOL-Expectations Domain Scores of Study Participants With Established Normative CIQOL-35 Profile Domain Scores in Experienced CI Users**

Domain	Mean (SD)		Cohen <i>d</i> (95% CI)
	Expectations	CI users	
Communication	62.1 (16.1)	51.4 (13.3)	0.78 (0.59 to 1.0)
Emotional	62.5 (18.7)	64.7 (15.9)	-0.14 (-0.36 to 0.05)
Entertainment	68.0 (18.7)	55.8 (23.0)	0.55 (0.36 to 0.74)
Environment	70.3 (20.5)	61.0 (17.7)	0.51 (0.32 to 0.70)
Listening effort	54.8 (16.7)	41.5 (14.8)	0.88 (0.69 to 1.1)
Social	68.3 (18.2)	67.7 (19.1)	0.03 (-0.16 to 0.22)
Global	59.9 (11.9)	52.6 (10.9)	0.60 (0.46 to 0.85)

Abbreviations: CI, cochlear implant; CIQOL, Cochlear Implant Quality of Life-Expectations instrument.

outcome expectations than the functional abilities of typical CI users for all domains except emotional and social. The largest discrepancy between patient expectation and normative scores were observed in the communication and listening effort domains. **Figure 1** displays the percentage of experienced CI users, based on normative data, who obtained CIQOL domain scores at or greater than the mean expectation scores for the cohort. As expected, based on the data in Table 3, these percentages varied by domain. For example, 78 experienced CI users (60.3%) obtained CIQOL-Emotional domain scores at or greater than the cohort's mean expectation score, but only 24 (18.6%) for the listening effort domain.

### Modifiability of CI-Related Expectations

To determine the degree to which patient CI-related expectations were modifiable, we compared CIQOL-Expectations scores for 28 patients who completed the instrument before and after their pre-CI candidacy evaluation and counseling. Mean scores changed very little before and after the evaluation for all domains (mean [SD] change: global, 0.5 [2.3]; communication, -3.6 [18.2]; entertainment, 0.8 [17.2]; environment, -0.4 [24.3]; listening effort, 1.8 [17.7]) except emotion (9.5 [18.8]) and social (7.1 [21.4]), which increased after the CI evaluation. However, the large SDs suggest there was substantial variability in the association of the CI evaluation with CIQOL-Expectations scores. This is demonstrated in the waterfall plots in **Figure 2** of the pre-/post-CI evaluation CIQOL-Expectations scores. Mean data for the cohort concealed large changes in both directions for several individuals for all domains.

## Discussion

### Psychometric Properties of the CIQOL-Expectation Instrument

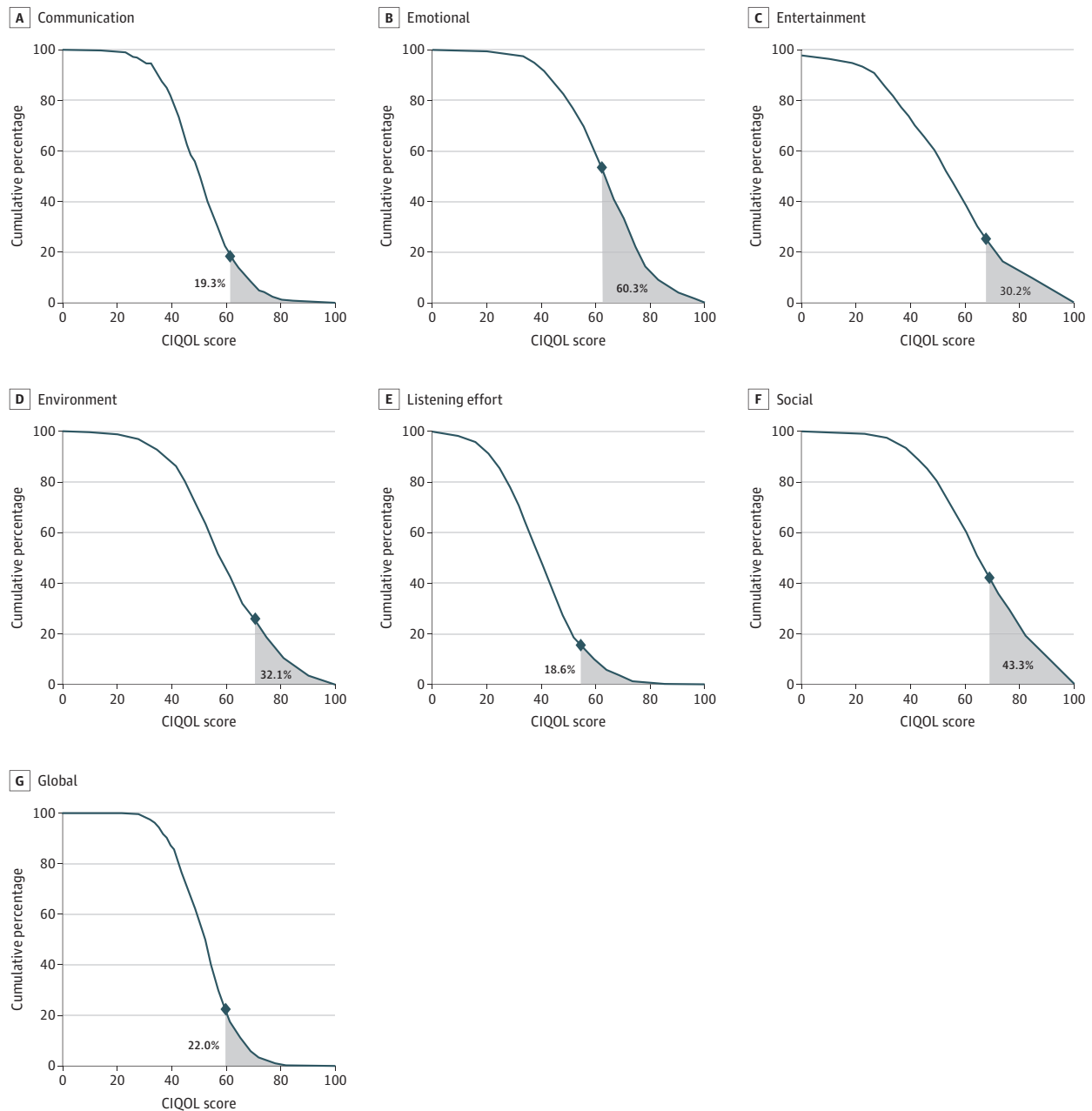
The results of the current study support the use of the CIQOL-Expectations instrument for research and clinical use. Although the psychometric properties of the CIQOL-Expectations instrument were not as strong as the CIQOL-35 Profile and CIQOL-10 Global, most analyses demonstrated acceptable psychometric properties. Several domains had misfitting items and decreased ability to reliably separate patients into distinct statistical groupings. Our research team followed strict criteria for the psychometric analyses used to develop the CIQOL-35 Profile instrument and CIQOL-10 Global measure but permitted

more leniency for the CIQOL-Expectations instrument for 2 primary reasons. First, potential CI users were being asked to predict how they will perform after cochlear implantation. We assumed that most potential CI users will anticipate substantial improvement in functional abilities or else they would not be considering implantation. Thus, we anticipated that scores in most but not all domains would be skewed toward the higher end of the scoring range, leaving few to no scores near the lower end. This was strongly associated with the psychometric analyses of the instrument. Second, Harris et al<sup>15</sup> reported that patients generally have very poor understanding of the anticipated impact of cochlear implantation. Thus, completing the CIQOL-Expectations instrument represents a projection to future abilities by the patient in contrast to completing the CIQOL Profile/Global instruments that assess the patient's actual functional abilities that are experienced on a daily basis. Therefore, the potential to misfit the measurement model based on response patterns may be higher. Taken together, the results of the collective analyses suggest that the CIQOL-Expectations instrument has adequate face, content, and construct validity and adequate ability to measure pre-CI outcome expectations.

### Comparison of CIQOL-Expectations With Normative CIQOL Outcomes

The comparison of the cohort's pre-CI CIQOL-Expectations scores with normative data (**Figure 1**) demonstrates interesting trends. Namely, on average, patients believed they would have better functional abilities than the average experienced CI user for all domains except emotional and social. There are a few prior studies that have examined patient pre-CI expectations and the degree to which they were or were not met, and the current results are somewhat consistent with these available data. Using retrospective survey data, Illg et al<sup>16</sup> reported that most CI users felt their social abilities improved at or beyond their expectations. However, communication-related responses were more nuanced in that study. Most (94%) had their expectations met regarding conversation in quiet, but more than half had unfulfilled expectations regarding communication in background noise. Given the established hierarchical ability model, higher CIQOL-communication scores represent better communication in more difficult listening environments, such as a greater ability to communicate with more partners when background noise is present.<sup>18,27</sup> Therefore, the cohort's expectation scores in this domain are consistent

Figure 1. Normative Cochlear Implant Quality of Life (CIQOL) Scores for Each Domain



The square in each graph shows the mean CIQOL-Expectations domain score for the patient cohort, with the shaded region (and value) representing the percentage of experience cochlear implant users who obtained scores at that level or higher.

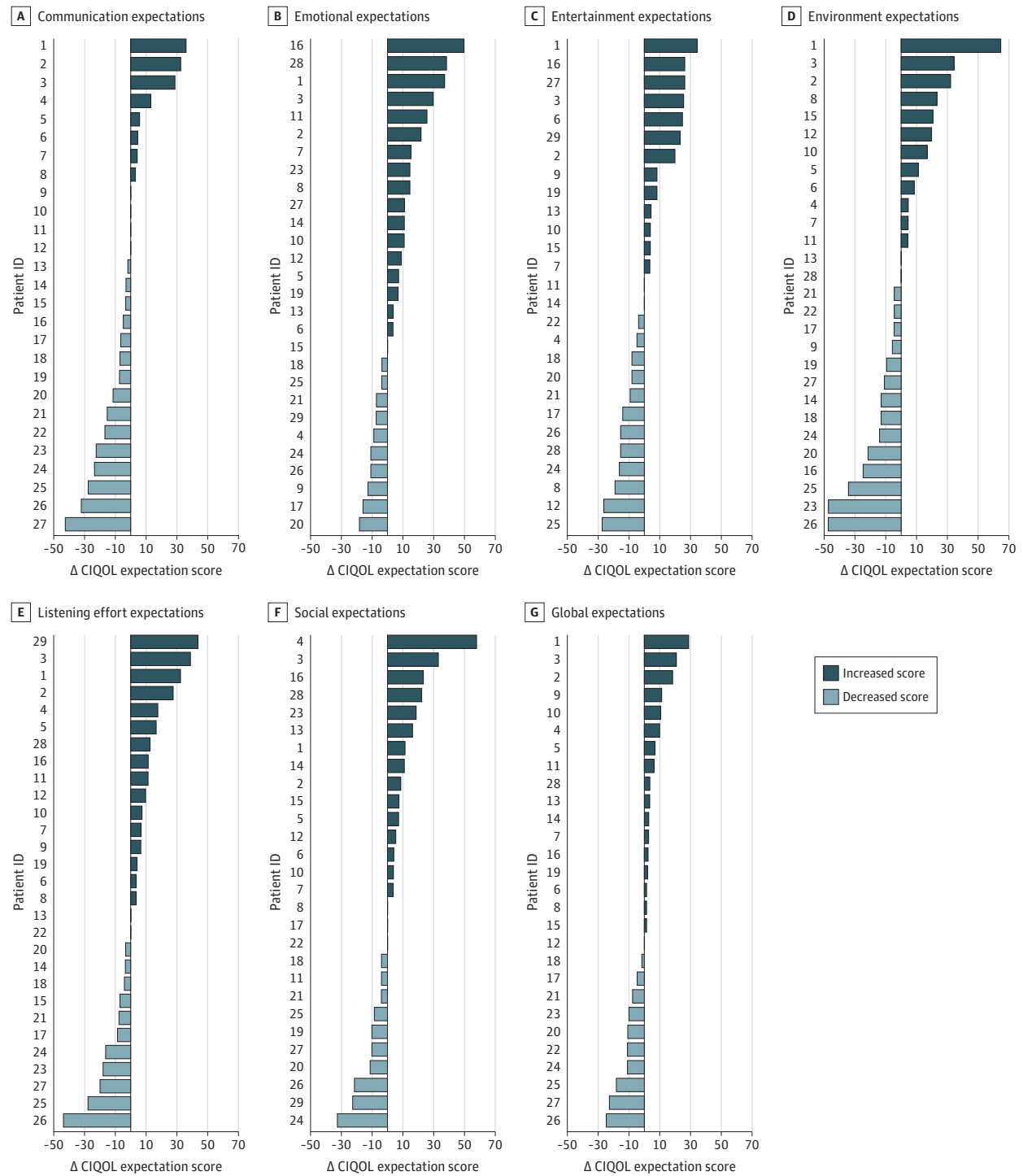
with the findings from this previous study. These findings will need to be confirmed in prospective studies in which patients' pre-CI CIQOL-Expectations domain scores are compared with the same patients' post-CI CIQOL-35 Profile domain scores. Only then will we be able to avoid recall bias and measure the degree to which CI users' expectations are met.

#### Clinical Application of the CIQOL-Expectations Instrument

The development and validation of the CIQOL-Expectations instrument potentially provides an opportunity to measure ex-

pected outcomes of CI candidates using an established patient-centered framework. Through this, patients can project their expected functional abilities following implantation across 6 domains that are known to be important to CI users.<sup>13</sup> Thus, the results of the CIQOL-Expectations instrument can potentially serve as a guide for clinicians for preoperative counseling, especially if expectations are viewed to be unrealistic. That is, individual patient responses can be compared with published means and cumulative distributions of CIQOL-35 Profile normative data<sup>23</sup> of established CI users to determine

Figure 2. Change in Cochlear Implant Quality of Life (CIQOL)-Expectations Scores Before and After Cochlear Implant Evaluation



Bars to the right of the vertical line identify patients whose CIQOL-Expectations scores increased after the evaluation while those to the left identify those whose scores decreased. Patient identification numbers are in order for the

Communication domain score (A) and then stay consistent throughout the remainder of the panels (B-G).

the likelihood of their outcome meeting their expectations. To our knowledge, this is the first time that such evidence will be available so that these discussions can be performed.

The use of the CIQOL-Expectations has the potential to serve a vital role for developing future shared decision-making protocols. One of the most important elements of

shared decision-making for surgical procedures is the ability of patients to have a clear understanding of the potential outcomes. The availability of the CIQOL-Expectations to provide direct assessments of patient expectations is novel to the field and has potential to further the application of shared-decision making in cochlear implantation. Moreover, alignment of patient preoperative expectations with their actual outcomes has been shown in numerous fields to be associated with increased patient satisfaction,<sup>28,29</sup> but to our knowledge, this has never been studied in cochlear implantation. This underscores the importance of the transformation of each item in the CIQOL-35 Profile to expectation-based items, which will allow the direct measurement of how well preoperative expectations and patient outcomes align.

### Future Directions

Results from the comparisons of individual patients' expectations before and after CI evaluation suggested that patients' expectations were a modifiable trait. This is important, as we have previously demonstrated that patient pre-CI outcome expectations may be associated with their long-term functional outcomes.<sup>17</sup> Because our previous study used an expectations survey that had not been psychometrically analyzed, these results will need to be confirmed in a larger sample using the CIQOL-Expectations. If patients' pre-CI outcome expectations are found to be associated with long-term outcomes, then the significance of the modifiability of patient expectation could be substantial. In addition, further research will be needed to identify the mechanism for effect, such as the association of patient expectations with postimplant behaviors (eg, increase hours of CI use<sup>30,31</sup> or increase use of computer-based auditory training<sup>32</sup>). However, more research is needed to provide the evidence to guide pre-CI outcome ex-

pectation discussion that can optimize CI outcomes. This is particularly important, as most patient-related factors that are associated with CI outcomes are nonmodifiable (eg, neural health, cognition, and age).<sup>4,10</sup>

### Limitations

Future studies will need to address the fact that clinicians differ in how they counsel patients during a CI evaluation and how they discuss expectations, given the absence of a standardized approach or script. It will also be important to include a multicenter design to enhance generalizability. Finally, the current study does not address CI-related outcome expectations for pediatric patients or patients receiving CIs for single-sided hearing loss. Additional research beyond the scope of this study will be required for these topics given that they represent patient populations that were not included in establishing the CIQOL framework used in the current study.

### Conclusions

Development of the CIQOL-Expectations instrument through this cross-sectional study complements our previous patient-centered approach to improving CI care using CIQOL instruments. The included items and domains reflect real-world functional abilities that are valued by CI users and potentially provide an opportunity to reexamine how outcomes and patients' outcome expectations are discussed during the CI candidate evaluation process. Moreover, future work will focus on the effect of setting realistic outcome expectations and developing outcome models to better predict individual patient improvement patterns.

#### ARTICLE INFORMATION

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**Concept and design:** McRackan, Dubno.

**Acquisition, analysis, or interpretation of data:** All authors.

**Drafting of the manuscript:** McRackan, Hand, Chidarala.

**Critical revision of the manuscript for important intellectual content:** McRackan, Hand, Dubno.

**Statistical analysis:** McRackan, Hand, Chidarala.

**Obtained funding:** McRackan.

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**Additional Information:** The CIQOL-Expectations instrument and scoring manual are available at no cost at <https://education.musc.edu/CIQOL>.

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