**Appendices**

**Appendix A**

The following search string was used in the MEDLINE (PubMed) database:

(‘Cochlear Implants’[Mesh] OR ‘Cochlear Implantation’[Mesh] OR (cochlear implant\*)) AND (‘Quality Of Life’[Mesh] OR quality[Text Word] OR life[Text Word] OR benefit[Text Word] OR self-report[Text Word] OR self-reported[Text Word] OR selfreported[Text Word] OR patient-report[Text Word] OR patient-reported[Text Word]) AND (adult[Text Word] OR adults[Text Word]) AND (‘Aging’[Mesh] OR ‘Aged’[Mesh] OR ‘Geriatrics’[Mesh] OR elder[Text Word] OR elderly[Text Word] OR elders[Text Word] OR old[Text Word] OR older[Text Word] OR aged [Text Word] OR aging[Text Word] OR ageing[Text Word] OR senior[Text Word] OR seniors[Text Word] OR geriatric[Text Word] OR geriatrics[Text Word])

**Appendix B**

The following search string was used in the Cochrane Library database:

(cochlear NEXT implant\*) AND (quality of life) AND (old\* OR adult OR aging OR aged OR senior OR elder\* OR elderly)

**Appendix C**

**C.1 HRQoL questionnaires**

**C.1.1 Disease-specific HRQoL questionnaires**

The **Nijmegen Cochlear Implant Questionnaire (NCIQ)** (Hinderink, Krabbe, & Van Den Broek, 2000) is a validated 60-item self-assessment HRQoL inventory assessing health-related states on psychological, physical and social domain in CI users. NCIQ consists of the following six subdomains: basic sound perception, advanced sound perception, speech production, self-esteem, activity and social interaction. Items are formulated as statements with the following 5 response alternatives indicating the degree to which the statement is true: never (1), sometimes (2), often (3), mostly (4) and always (5). Response alternatives of five of the 60 items represent the CI user’s ability to perform the stated task and are as follows: no (1), poorly (2), moderate (3), adequate (4) and good (5). Not applicable can also be answered throughout the questionnaire.

The **Hearing Handicap Inventory for the Elderly (HHIE) and Hearing Handicap Inventory for Adults (HHIA)** (Ventry & Weinstein, 1982) are similar validated 25-item questionnaires developed to evaluate the degree of restriction respondents aged 65 years and older (HHIE) and adults aged under 65 (HHIA) with hearing loss experience regarding emotional and social adjustment. The questionnaires comprise two subscales; the emotional (thirteen items) and the social or situational (twelve items) subscale. Each question is answered using a three-point response scale including the following response alternatives: yes (four points), sometimes (two points) and no (zero points). Scores vary from 0 to 100, with higher scores indicating greater handicap. HHIA and HHIE differ by two questions, reflecting slight differences in the emotional and situational challenges of both age groups.

The **Hearing Handicap Questionnaire (HHQ)** (Noble, Jensen, Naylor, Bhullar, & Akeroyd, 2013)is a twelve-item self-assessment instrument evaluating the effect of hearing impairment on respondent’s personal and social environment. Questions were derived from the Hearing Disabilities and Handicaps Scale (Hétu, Getty, Philibert, Noble, & Stephens, 1994) and the Glasgow Health Status Inventory (Gatehouse, 1997). The questionnaire consists of the following five response alternatives for each question: (i) never, (ii) rarely, (iii) sometimes, (iv) Often, (v) Almost always. Scores range from 0 to 100, with higher scores indicating greater handicap.

The **Speech Spatial and Qualities of Hearing Scale (SSQ12)** (Noble et al., 2013) with twelve items is an abbreviated version of the 49-item Speech Spatial and Qualities of Hearing Scale (SSQ) (Gatehouse & Noble, 2004). The self-assessment questionnaire evaluates hearing disabilities in complex situations. SSQ12 consists of the following three subscales: speech, spatial and qualities. The speech subscale concerns speech understanding in various contexts, while sound localization, distance and movement of sounds are part of the spatial hearing subscale. Naturalness and clarity of everyday sounds are included in the qualities of hearing subscale. Respondents rate their ability to perform a given task from zero to ten, with higher scores implying less hearing disabilities.

The **Oldenburg Inventory (OI)** (Holube & Kollmeier, 1994) is a twelve-item self-assessment questionnaire assessing hearing abilities in daily-life situations using three domains: hearing in quiet, hearing in background noise and sound localization. Scores per question vary from one to five, with higher scores reflecting greater hearing abilities.

The **Hearing Implant Sound Quality Index -19 (HISQUI-19)** (Amann & Anderson, 2014)quantifies the sound quality CI users experience in daily life. The self-assessment instrument includes nineteen statements respondents need to evaluate based on the degree to which the statement is true. Response alternatives are the following: always (99%), almost always (87%), frequently (75%), mostly (50%), occasionally (25%), rarely (12%) and never (1%). Each response alternative corresponds with a numerical value, from never (1) to always (7). Total scores vary from 19 to 133 points and are classified on the following five-point scale: very poor, poor, moderate, good and very good self-perceived auditory benefit. Higher scores indicate greater self-perceived auditory benefit.

The **Abbreviated Profile of Hearing Aid Benefit (APHAB)** (Cox & Alexander, 1995) evaluates hearing impairment in daily-life situations with and without hearing aids. The self-assessment instrument comprises the following subscales: ease of communication, reverberation, background noise and aversiveness of sounds. Respondents need to indicate the degree to which 24 statements are true based on the following response alternatives: always (99%), almost always (87%), generally (75%), half-the-time (50%), occasionally (25%), seldom (12%) and never (1%). Higher scores indicate less hearing disability, except for the aversiveness subscale where a lower score indicates less hearing disability.

**C.1.2 Generic HRQoL questionnaires**

The **Medical Outcome Study Short Form-36 (SF-36)** (Ware & Sherbourne, 1992) is a 36-item questionnaire measuring health status based on eight domains: concepts: physical functioning, role limitations because of physical health problems, bodily pain, social functioning, general mental health (psychological distress and psychological well-being), role limitations because of emotional problems, vitality (energy/fatigue) and general health perception. Items are formulated as open or closed questions, which can be answered using given response alternatives per question. SF-36 scores can be summarized in two measures: the physical component measure (PCM) and the mental component summary (MCS). Raw scores are scaled to scores ranging from 0 to 100, with higher scores indicating a better health status.

The **World Health Organization Quality of Life Assessment for elderly people (WHOQOL-OLD)** (WHO, 1998) is developed to provide a cross-cultural, international quality of life assessment instrument for elderly people. The instrument consists of 24 items divided into six subdomains: sensory abilities, autonomy, past present and future activities, social participation, death and dying and intimacy. Questions can be answered using a five-point response scale from one (very poor) to five (very good). The higher the score, the better the self-perceived QoL. Total scores range from 6 to 120.

**C.2 Utility questionnaire**

The **Health Utilities Index 3 (HUI-3)** (Horsman, Furlong, Feeny, & Torrance, 2003) is a seventeen-item questionnaire system measuring QoL and health states. HUI-3 can be applied in a wide variety of subjects, diseases, interventions and therapies. The following three different types of outcome measures can be derived: attribute levels, single- and multi-attribute scores. Attribute levels represent health states and are as follows: vision, hearing, speech, emotion, pain, ambulation, dexterity and cognition. Levels range from one (no disability) to seven (severe disability). Single-and multi attribute scores are derived from these attribute levels and range from 0 (dead) to 1 (perfect health). Single-attribute scores represent HRQoL per attribute level, while multi-attribute scores provide a general HRQoL value.

**C.3 Daily life performance questionnaires**

**C.3.1 Mental well-being questionnaires**

The **Hospital Anxiety and Depression Scale (HADS)** (Snaith, 2003) assesses anxiety and depressive symptoms and consists of fourteen statements respondents need to answer based on the degree to which the statement is true. Four response alternatives are given per statement, each corresponding with a score ranging from zero to three. The questionnaire is divided into two subscales; anxiety and depression, each comprising seven questions. Scores are calculated per subscale and range from 0 to 21. A score of zero to seven is considered normal, whereas scores of eleven or higher indicate presence of a mood disorder and scores ranging from eight to ten suggest a mood disorder could be present (borderline).

The **General Anxiety Disorder Screener (GAD-7)** (Löwe et al., 2008) is a seven-item self-assessment questionnaire used to detect the presence of anxiety disorders and the severity of related symptoms. Respondents are asked how often they have been bothered by given problems related to anxiety the last two weeks. Response possibilities are as follows: not at all (0 points), several days (1 point), over half the days (2 points), nearly every day (3 points). Scores vary from 0 to 21, with higher scores reflecting more severe anxiety symptoms. The cut-off points taken for mild, moderate and severe anxiety are five, ten and fifteen points.

The **Depression Scale (ADS-L)** (Meyer & Hautzinger, 2001) is a German 20-item questionnaire developed to identify a range of depressive symptoms. Respondents are asked to indicate how often they experienced the given problems in the last few weeks. Response alternatives are as follows: rarely or never (less than one day) (0 points), sometimes (for a day or two) (1 point), often (three or four days), almost all the time (five or more days). Scores starting from 18 points reflect other patient groups such as anxiety patients. The cut-off value for a clinically relevant depression is 23 points.

The **Geriatric Depression Scale (GDS)** (Sheikh & Yesavage, 1986) is a 30-item self-assessment screening tool for depression in older adults. Items are formulated as closed questions the respondents need to answer with yes (1 point) or no (0 points) based on their emotional state. Scores can be interpreted as follows: not depressed (0-10 points), mild depressive symptoms (11-20 points), severe depressive symptoms (21-30 points).

The **Hamilton Depression Rating Scale (HDRS)** (Hamilton, 1960) is a seventeen-item questionnaire administered by an interviewer. The questionnaire was developed to evaluate depressiveness severity in patients who were already diagnosed as suffering from depression or an affective disorder. The interviewer asks the given questions to the patients and verifies which of the response alternatives fits the patients state best. Responses are classified using a three-point (eight items) or a five-point scale (nine items). Scores of 26 and higher indicate severe depressive symptoms, scores ranging from 18 to 25 suggest moderate depressive symptoms, scores ranging from 8 to 17 point to mild depressive symptoms and scores below 8 represent lack of depressive symptoms.

The **Perceived Stress Questionnaire (PSQ-30)** (Levenstein et al., 1993) is a 30-item self-assessment questionnaire assessing subjective stress levels and related emotions. Items are formulated as statements, which respondents evaluate based on how often they applied to them in general during the last year or two. Response alternatives are as follows: almost never (one point), sometimes (two points), often (three points) and usually (four points). Worries, tension, joy and demands are the four subscales of PSQ. The raw total score needs to be subtracted by 30 and divided with 90 to obtain the PSQ index score ranging from zero to one.

The **Instrumental Activities of Daily Living Scale (I-ADL)** (Lawton & Brody, 1970) is an eight-item questionnaire evaluating the ability to perform everyday tasks. Respondents are asked about their competence in the following eight skills: ability to use the telephone, shopping, food preparation, housekeeping, laundry, mode of transportation, responsibility for own medications and ability to handle finances. Each item is scored dichotomously (1 = more able, 0 = less able). Total scores vary from zero (low function) to eight (high function), with higher scores indicating higher autonomy.

The **UCLA Loneliness scale** (Russell, Peplau, & Ferguson, 1978) is a 20-item questionnaire developed to assess loneliness. Each item explores how frequent respondents experience a certain emotional state, such as feeling part of a group, feeling alone, etc. Response alternatives are the following: never (one point), rarely (two points), sometimes (three points), always (four points). Higher scores reflect greater degree of loneliness. Total scores vary from 20 to 40.

The **Lubben Social Network Scale (LSNS)** (Lubben, 1988) measures social networks in older adults. The questionnaire consists of ten questions about family, friendship, living arrangements, confidant relationships and helping others. Per question, five response alternatives are provided with scores ranging from zero to five depending on the frequency, closeness and size of the respondents’ social network. LSNS total score ranges from 0 to 50. Higher scores reflect more social engagement.

The **Loneliness scale** (de Jong-Gierveld & Kamphuls, 1985) is an eleven-item questionnaire evaluating loneliness and social isolation. Items are formulated as statements of which six items are formulated negatively and five are formulated positively. Response alternatives are the following: yes!, yes, more or less, no, no!. Total scores range from 0 to 11, with higher scores reflecting a higher degree of loneliness.

**C.3.2 Activities questionnaires**

The **International Physical Activity Questionnaire (IPAQ)** (Craig et al., 2003) assesses physical activities in daily life based on 31 items in the following domains: self-powered transport, household and yard work activities, occupational activity, leisure time physical activity and sedentary activity. Scores are assigned using the IPAQ scoring protocol and can be classified in three categories: low, middle or high level of physical activity.

The **Bayer Activities of Daily Living Scale (B-ADL)** (Hindmarch, Lehfeld, de Jongh, & Erzigkeit, 1998) is a 25-item questionnaire assessing the ability to perform everyday activities. It is developed to be completed by proxy-respondents. They have to answer questions using a scale from 0 to 10 indicating the frequency the participant has difficulties with given daily life tasks (0 = never, 10 = always). Scores range from 0 to 250, with higher scores reflecting less difficulties performing everyday activities.

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