



# SELF-EVALUATION SCORES OF HEARING DIFFICULTIES AND QUALITY OF LIFE COMPONENTS AMONG RETIRED WORKERS WITH NOISE-RELATED HEARING LOSS

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This study is intended to clarify the relationships between hearing loss caused both by noise exposure and aging and self-rated scores of hearing disabilities and to elucidate the structure of the quality of life (QOL) determinants and their moderating conditions among retired workers with noise-related hearing loss. The questionnaire consisted of three parts: background questions, the hearing disabilities and handicap scale (HDHS), and questions regarding QOL covering five areas, self-rated health, personal health practice, social support network, life satisfaction, and life events. Two hundred ten retired workers aged 56–65 years old ( $60.6 \pm 1.6$ ) with noise-related hearing loss responded to our questionnaire. All were previously engaged in noise exposed work such as shipbuilding, steel and woodwork. According to the hearing disability score (DIS score), subjects were divided into three groups and comparisons were made of the hearing handicap score (HD score) among those groups. Although groups with a higher DIS score showed a higher HD score, a large individual difference in HD score was observed in each of the three groups with the same DIS score level. The results of multiple regression analysis including two variables (life satisfaction and HD score) as the dependent variables and seven variables as the independent variables showed that the strongest explanatory variable for life satisfaction was social support network, followed by handicaps caused by hearing disabilities, self-rated health and personal health practice. It was demonstrated that hearing disabilities and handicap measured by the Japanese version of the HDHS were directly associated with the deterioration in QOL. Measures of the social support network, life satisfaction, and hearing disabilities and handicaps may assist in the detection of workers who can be targeted for a variety of interventions, such as audiological rehabilitation or the creation of a barrier-free community that is supportive of the hearing impaired.

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## 1. INTRODUCTION

Increasing public and scientific concern about quality of life and individual well-being has stimulated a growing body of research in which phenomenological and ecological perspectives and approaches are critical [1–3]. However, there is relatively little information on the effects of hearing disabilities and handicaps on the quality of life of retired workers with noise-related hearing loss [4]. Such knowledge is important because

quite a few workers are still now exposed to noise levels above 85 dB [5] and they are expected to enjoy another 15 to 20 years after retirement during which age-related hearing loss will develop [6]. Needless to say, the individual's integration in society is critical for his health and well-being and the presence of a social support network is of significant importance for all generations. However, hearing disabilities interfere with individuals' ability to interact with persons who are most important to them, people such as family members, neighbors, and friends.

A better understanding of the nature and magnitude of the problems experienced by subjects with communication disorders owing to hearing impairment may stimulate preventive intervention and rehabilitation including social and technological support in noisy workplaces and communities [7–9]. The aim of the present study is twofold: first, to reconfirm the validity of the Japanese version of the hearing disabilities and handicap scale as a self-evaluation measure and, second, to investigate the relationships between hearing handicaps and deterioration in the quality of life among retired workers with noise-related hearing loss.

## 2. METHODS

### 2.1. QUESTIONNAIRE

The questionnaire consisted of three parts: background questions, the hearing disabilities and handicap scale (HDHS), and questions regarding quality of life (QOL). The background data was gathered in questions concerning gender, age and number of people in the household, hearing aids and the number of years the hearing problem existed.

The HDHS was designed for self-administration and was intended to measure three different dimensions—two disability dimensions and one handicap dimension [10]. The first dimension assesses hearing disabilities in verbal sound and the second evaluates hearing disabilities in non-verbal sound. The third dimension addresses emotional and social consequences of hearing disabilities. A four-point scale of the frequency of the problem was adopted. For each question, the direction of the scale was defined such that 1 corresponded to no difficulty or disadvantage and 4 corresponded to severe difficulty or disadvantage. The English version of the HDHS is attached as an Appendix A.

Questions on QOL covered five areas: self-rated health, personal health practice, social support network, life satisfaction, and life events. Self-rated health was measured by the question “Would you say your overall health is very good, good, fair, rather poor or poor?” scaled from “5” (very good) to “1” (poor). Personal health practices (HP) consisted of seven question areas, eating breakfast, 7 or 8 hr of sleep, recreation/exercise activities, regularity of meals, smoking, alcohol in moderation, and rest periods. A two-point scale, rating “yes” responses as 1 and “no” responses as 0, was selected. The HP score that ranges from 0 to 7 was calculated by adding the scores of each of the seven questions. Four questions on the social support network (SN) were designed to measure social support and social roles that can be a buffer against the various stresses and difficulties in everyday life. The questions were “Do you have someone with whom you feel easy and relaxed when you are together?” “Do you have someone who agrees with your ideas and behavior and supports you?” “Do you have someone you can share your most private feelings with?” and “Do you think you are a useful member of society and needed by others?” For these questions, a three-point scale gave a score of 2 for a response indicating agreement, a score of 1 for undecided and 0 for disagreement. The SN score was calculated by adding the scores of each of the four questions. As an index of QOL, the life satisfaction index (LSI), which covers general feelings of well-being among older people, was used to identify “successful aging”. There

exist several versions of the LSI. The original, the LSI A, comprises 20 items, of which 12 are positive and eight are negative. We adopted a third version, the LISZ, which contains 13 items. Stressful life events were addressed by asking subjects whether they had experienced the death of a spouse, personal injury or illness, injury or illness of a spouse, divorce, and so on. If respondents had experienced some of these life events, they were also asked to evaluate the degree of stress and difficulty: not at all, not much, a little, great, or very great.

## 2.2. SUBJECTS & DATA ANALYSIS

Two hundred ten persons, all retired workers who had worked at noisy workplaces for many years responded to our questionnaire. SPSS 10.0 J for Windows was used to make such statistical analyses as factor analysis and multiple regression analysis. The reliability of the HDHS subscales was evaluated by calculating Cronbach's  $\alpha$ .

## 3. RESULTS

Figure 1 shows the percentage of workers who had difficulty listening to verbal- and non-verbal sound in various settings. The percentage of subjects replying either "always" or "often" ranges from 74.3% (Q17) to 91.4% (Q5) for verbal sound and 49.0% (Q14) to 70.0% (Q6, Q10) for non-verbal sound. Figure 2 shows responses to questions concerning handicap where the respondents were divided into two groups. To questions directly related to face to face communication, 64.8% (Q11) to 73.8% (Q4, Q7) of the subjects replied either "always" or "often". To questions concerning such rather serious handicaps as feelings of isolation or lack of self-confidence, the responses were 35.2% (Q15) to 53.8% (Q20) respectively.

Alpha coefficients were calculated to assess the reliability of HDHS. Cronbach's  $\alpha$  for two disability sub-scales and one handicap sub-scale were 0.86, 0.86 and 0.92, respectively, all at a satisfactory level. To confirm our assumptions on the factor structures of HDHS, i.e., two disability sub-scales and one handicap sub-scale, factor analysis was done for 20 items concerning hearing disabilities and handicaps. The results of the factor analysis through

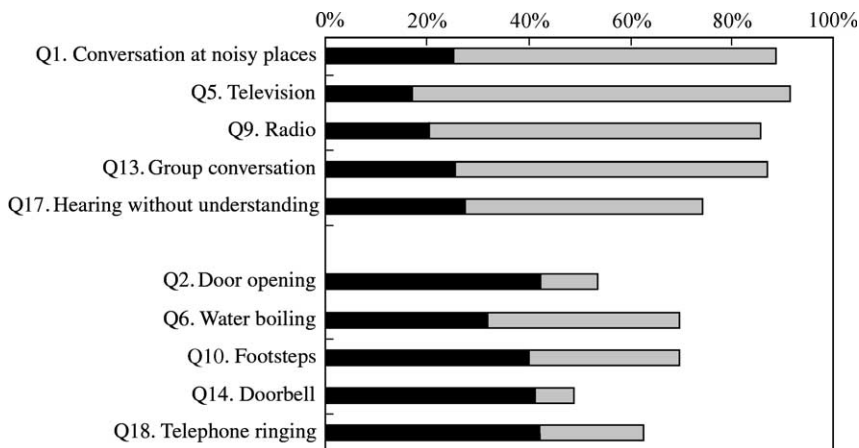


Figure 1. Percentage of the responses (always/often) on the questions concerning hearing disabilities in verbal and non-verbal sounds. ■, always; ▒, often.



Figure 2. Percentage of the responses (always/often) on the questions concerning handicaps. ■, always; ▒, often.

TABLE 1

*Factor analysis of HDHS: factor loadings after rotation*

	F1	F2	F3
Q1 Conversation at noisy places		0.58	
Q5 Television		0.65	
Q9 Radio		0.71	
Q13 Group conversation		0.77	
Q17 Hearing without understanding	0.41	0.50	
Q2 Door opening			0.73
Q6 Water boiling		0.42	0.57
Q10 Footsteps		0.40	0.59
Q14 Doorbell	0.43		0.53
Q18 Telephone ringing		0.42	0.42
Q3 People find out problem	0.49		
Q4 Difficult—asking for repetitions	0.48		
Q7 Upset when giving wrong answer	0.42	0.53	
Q8 Restricts social or personal life	0.60	0.45	
Q11 Upset, unable to follow	0.69		
Q12 More tense or tired	0.54	0.41	
Q15 People avoid you	0.76		
Q16 Lack of self-confidence	0.73		
Q19 Feeling cut from things	0.78		
Q20 Influence relationship with spouse	0.62		
PCT OF VAR	24.3%	19.4%	13.9%

a combination with principal factor analysis and varimax rotation are shown in Table 1. Three factors consisting of 20 items accounted for 57.6% of the variance. The following factors can be identified: Factor 1: handicap concerning human relations and self-confidence, Factor 2: hearing disabilities in verbal sounds, and Factor 3: hearing disabilities in non-verbal sounds.

The box and whisker plot in Figure 3 shows the relationship between the HD score and DIS1 score. The median HD score in low DIS1 score group ( $n = 74$ ) is 21, while the high DIS1 score group ( $n = 66$ ) shows a score of 33. A significant increase in the HD score was

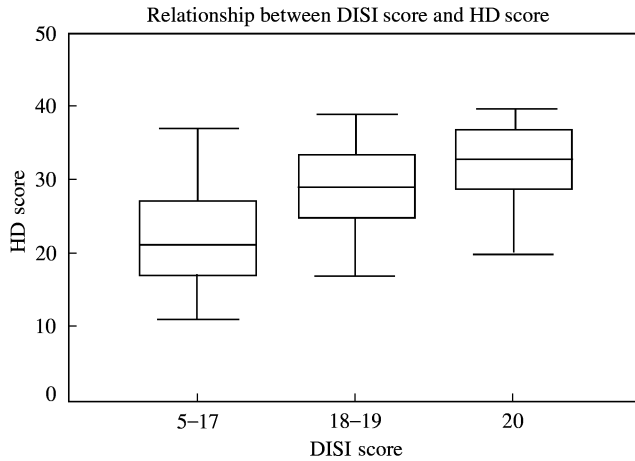


Figure 3. The box and whisker plot showing the relationship between HD score and DIS1 score.

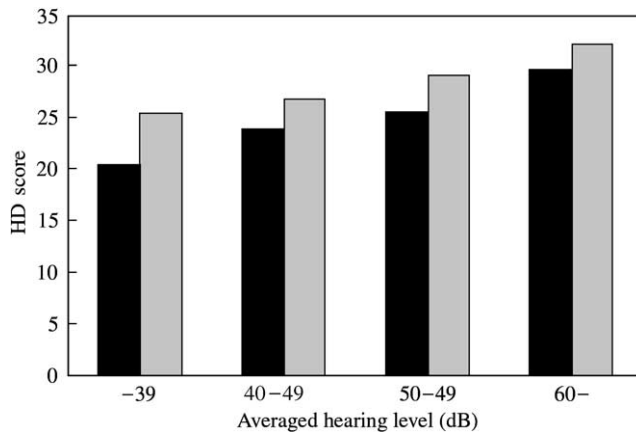


Figure 4. HD scores by averaged hearing level and the number of years that hearing problem existed. ■,  $\leq 9$  years; ▒,  $\geq 10$  years.

observed in the groups with a higher DIS1 score (Jonckheere-Terpstra test,  $p < 0.001$ ). The median HD score for the low DIS1 score group falls toward the bottom of the box, indicating that the distribution is skewed to the right, while that for the high DIS1 score group falls towards the top, indicating that distribution is skewed to the left. While the HD score basically depends on the disability score, each of the three groups shows a relatively large within-group distribution. The same tendency was found in the relation between the HD score and DIS2 score.

Figure 4 shows HD scores by averaged hearing level and the number of years that hearing problems existed. HD scores are closely related to the averaged hearing level and the number of years the hearing problem existed. The mean HD score is highest for the group with greater than a 60 dB averaged hearing level and more than 10 years of hearing problems.

Figure 5 shows life satisfaction scores by HD score and social support network in nine subgroups. The group with a low HD score and good social support network shows the highest life satisfaction score. In contrast, the group with a high HD score and not as good a social support network shows the lowest life satisfaction score among the nine groups.

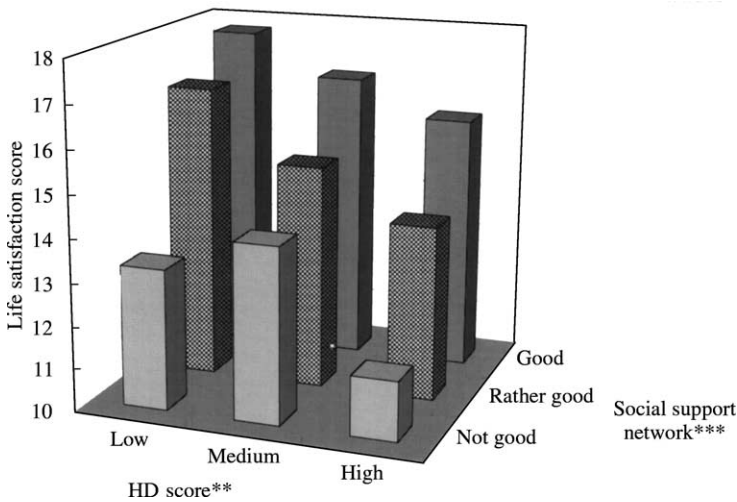


Figure 5. Life satisfaction scores by HD score and social support network in nine subgroups. ANOVA: \*\*,  $P < 0.01$ ; \*\*\*,  $P < 0.005$ .

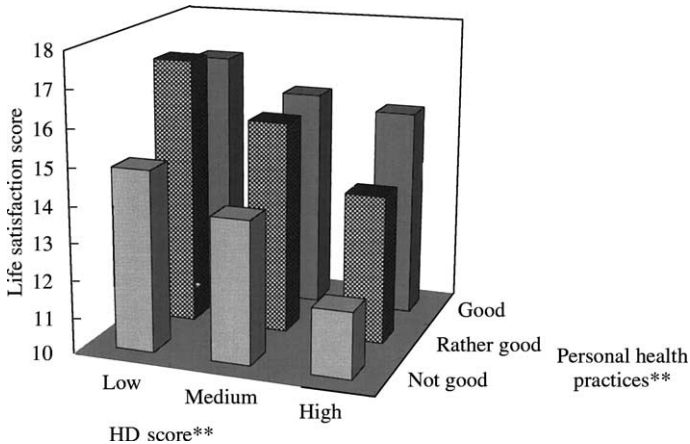


Figure 6. Life satisfaction scores by HD score and personal health practices in nine subgroups. ANOVA: \*,  $P < 0.05$ ; \*\*,  $P < 0.01$ .

Analysis of variance (ANOVA) showed that the main effects of HD score and social support network were both significant at the 1% level, but the interaction of the two factors was not significant. Regardless of social support network, the hearing handicap acts negatively in life satisfaction. The existence of a good social support network is considered to act as a kind of coping resource that relieves stressful situations resulting from hearing disabilities and handicaps. Figure 6 shows life satisfaction scores by HD score and personal health practices. Having good personal health practices might contribute to life satisfaction in the same manner as does the social support network. Figure 7 shows life satisfaction scores by HD score and self-rated health. The groups with a low or medium HD score and good self-rated health report the highest life satisfaction score, while the group with a high HD score and poor self-rated health reports the lowest life satisfaction score among the nine groups. A perception of good health contributes a great deal toward relieving negative effects of hearing handicaps on life satisfaction.

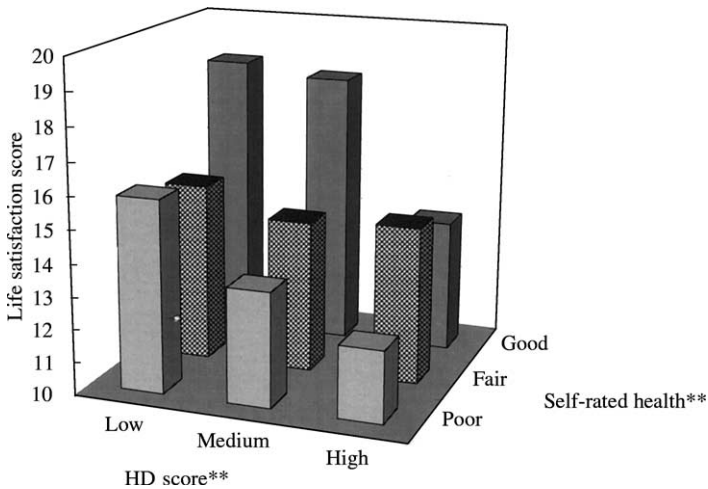


Figure 7. Life satisfaction scores by HD score and self-rated health in nine subgroups. ANOVA: \*\*,  $P < 0.01$ .

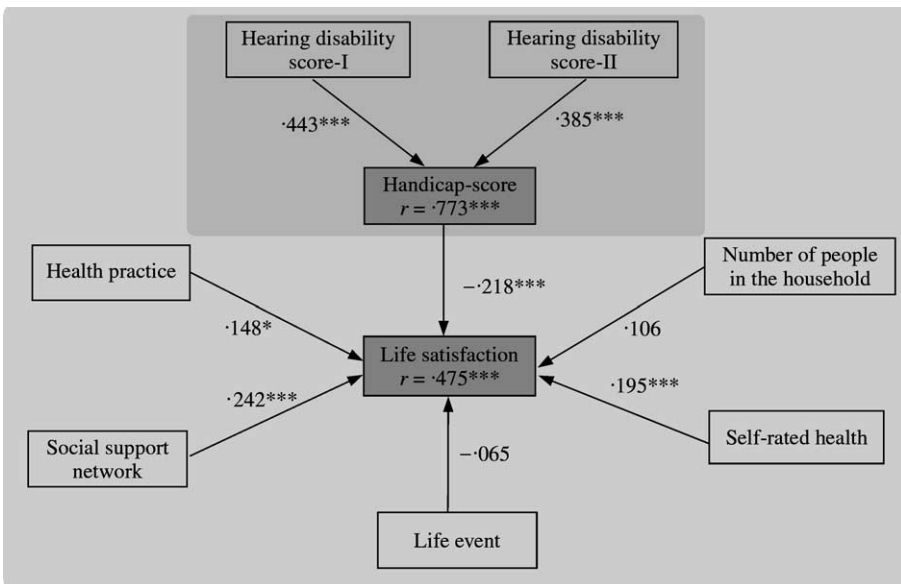


Figure 8. A tentative model for predicting life satisfaction score in relation to HD score. \*\*\*,  $P < 0.005$ ; \*\*,  $P < 0.01$ ; \*,  $P < 0.05$ .

Figure 8 summarizes the results of multiple regression analysis including two dependent variables, namely life satisfaction score and handicap score, and seven independent variables. Numerical values shown with arrows between variables are standardized partial regression coefficients. As expected, social support network scores and HD scores have a strong influence on life satisfaction scores. The effects of self-rated health and personal health practice were also significant.

## 4. DISCUSSION

Audiometric procedures such as pure tone audiometry and speech audiometry provide valuable information about the extent and the type of hearing impairment, but these procedures do not necessarily reflect the various problems experienced by subjects with a given hearing impairment in daily life situations [11, 12]. Self-report procedures have become a valuable tool for the assessment of auditory disability [13–16] because an understanding of how individuals feel about a hearing impairment, how they behave, and how they cope with problems caused by hearing loss in real world communication situations is of critical importance. As to the Japanese version of HDHS, Cronbach's  $\alpha$  coefficients for two disability sub-scales and one handicap sub-scale were in the range of 0.86–0.92, showing a high internal consistency as a scale for self-evaluation of hearing disabilities and handicaps. The factor structure of the questionnaire consisting of 20 items assessed by factor analysis with Varimax rotation was basically consistent with our original concept of hearing disabilities and handicap, suggesting a high construct validity of the HDHS (Table 1).

The ability to communicate is of vital importance to QOL, especially concerning social interaction [17–19]. Regardless of the etiology and the type of hearing loss, hearing-impaired individuals are likely to suffer anxiety, lack of self-confidence, depression and/or social isolation which may reduce the chances for successful aging [6, 20–22]. It must be noted that successful aging is not a personal characteristic. It depends on the relationships among people's adaptive competence, their communities and their broader societal setting [23]. Scientific interest has recently focused on the importance of the social network and its direct and indirect impacts on QOL [24]. As shown in Figure 9, hearing disabilities and handicaps and the number of people in the household are considered to be quality of life determinants, and personal health practices, social support network and life events are considered moderating conditions. The present study investigated how hearing disabilities and handicaps and social support network relate to life satisfaction. Multiple regression analysis yielded a modestly successful model for predicting LS scores, in relation to the subjective feelings and perceptions of hearing disabilities and handicaps. The strongest explanatory variable for life satisfaction was the social support network, followed by the handicap score, self-rated health, personal health practices and the number of people

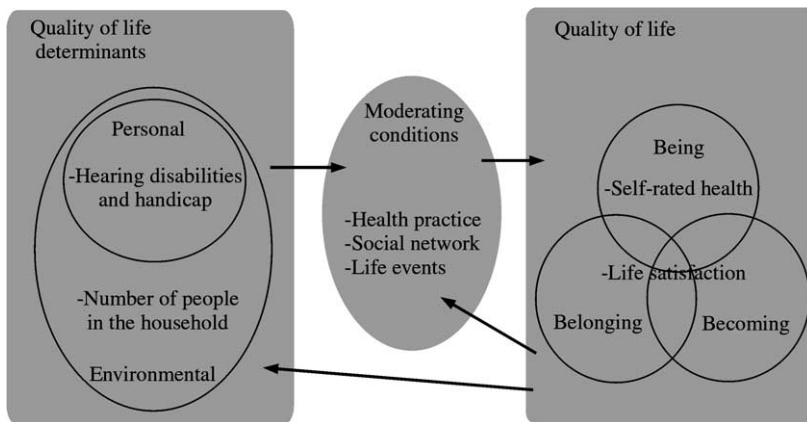


Figure 9. Quality of life field: comprehensive health, well-being and quality of life framework (Reference [1] modified by T. Miyakita).



in the household. In this analysis, HD scores had a direct negative influence on life satisfaction scores. Our model is not the only or necessarily the best model for showing the relationships among hearing disabilities and handicaps, self-rated health, life satisfaction, social support networks and other related factors. It is just a step in the right direction. This model may be helpful for understanding issues of concern and for developing health-promoting interventions in the workplace and communities for preserving good hearing.

To our knowledge, this is the only study to examine the relationship between disabilities and handicaps caused by noise-related hearing loss and the quality of life of retired workers, although there are several confounding factors that should be included in our future analysis. Measures of self-rated health, life satisfaction, and hearing disabilities and handicaps may assist in the detection of workers who can be targeted for a variety of interventions, such as audiological rehabilitation. Eventually, this kind of approach may stimulate preventive interventions in noisy workplaces and communities.

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#### APPENDIX A: HEARING DISABILITIES AND HANDICAP SCALE (HDHS)

- (1) Do you have difficulty following a conversation normally in any of the following situations: at work, in a bus or a car, or when shopping?
- (2) Can you hear the sound of the door opening when you are inside the room?
- (3) Do you worry that people will find out that you have a hearing problem?
- (4) Is it difficult for you to ask people to repeat themselves?
- (5) Do you have difficulty hearing what is being said on TV if someone other than yourself adjusts the volume?
- (6) Can you hear the water boiling in the pan when you are in the kitchen?
- (7) Do you get upset if you give the wrong answer to someone because you have misheard them?
- (8) Does your hearing condition restrict your social or personal life?
- (9) Do you have difficulty hearing what is being said on the radio if someone other than yourself adjusts the volume?
- (10) Do you hear the footsteps of someone coming into the room without you seeing them?
- (11) Does it bother or upset you if you are unable to follow a conversation?
- (12) Do you find that you are more tense and tired because of your hearing difficulty?
- (13) Do you have difficulty hearing in group conversation?
- (14) Can you hear it when someone rings the doorbell or knocks on the door?
- (15) Do people avoid you because of your hearing difficulties?
- (16) At present, would you say that you lack self-confidence because of your hearing difficulty?
- (17) Do you find that although you can hear someone speaking, you cannot understand what they are saying?
- (18) Can you hear the telephone ringing from another room?
- (19) Do you ever get the feeling of being cut off from things because of your hearing difficulty?
- (20) Do you feel that your hearing condition has an influence on the relationship you have with your spouse or a person close to you?