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RESEARCH PAPER

Higher social distress and lower psycho-social wellbeing: examining the coping capacity and health of people with hearing impairment

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Abstract

Purpose: The objectives of this paper are as follows: (1) propose an explanatory model as to how hearing disability may impact on health and (2) examine the model's utility. **Methods:** Data were collected on the psycho-social wellbeing, disability and physical health of farmers ($n = 56$) participating in an intervention to manage the social impacts of hearing disability. Two models were proposed and examined using multiple hierarchical linear regression. Model 1 used self-rated quality of life and model 2 used capacity to manage hearing and listening impairments, as dependent variables. **Results:** The analyses found that physical measures of hearing impairment (audiograms) were not correlated with physical or mental health outcomes. However, in model 1, self-confidence and self-rated ability to manage hearing impairment were most closely associated with reduced quality of life (anxiety and diastolic blood pressure were positively associated with quality of life). In model 2, higher anxiety and reduced self-confidence were associated with decreasing ability to successfully manage one's hearing impairment. **Conclusions:** The findings support the explanatory model that stress is higher and wellbeing lower when the fit between the person's coping capacity and environmental demands is poor.

► Implications for Rehabilitation

- This paper demonstrates that anxiety is associated with coping with the psycho-social aspects of hearing disability.
- This finding has important implications for the many hearing services, which only provide assessment and devices.
- To negate anxiety and its long-term impacts, rehabilitation providers need to ensure people with hearing disability have the capacity to manage the psycho-social aspects of communication breakdown.

Introduction

More than 20 years ago Wilson et al. [1] observed that hearing impairment was an under-estimated public health problem impacting on 22% of the Australian population (using worse ear measure) and 16% using better ear measures [2]; notably measures in the better ear were comparable with a similar population study conducted by Adrian Davis [3]. Hearing impairment is most marked in those older than 50 years, with the prevalence being 5.2% for the non-indigenous population aged 15–49 years and then rapidly increasing post 50 years of age. For the non-indigenous population aged 50–59 years, the prevalence is 28.3%, for those aged 60–69 years, it is 28.7% and for those over 70 years, it is 73.5% [1].

There is consistent and growing literature that associates the experience of disability related to hearing impairment with poorer health outcomes [4–11]. These papers document that people with hearing disability (controlling for age) report poorer health-related quality of life across a range of domains including elevated cardio-vascular risks (diabetes and high blood pressure), increased rates of significant cardiovascular events (e.g. stroke and heart attack) and an increased all-cause mortality rate among men. It has also been reported that members of this cohort are higher users of general practitioners, more likely to be taking prescribed medications and at a higher risk of some psychiatric disorders [1,10,12].

Despite this consistent and growing literature, it has been difficult for health practitioners to imagine how it may be that microscopic damage to the auditory process might be linked to health outcomes in some kind of causal fashion [13]. Two major factors impede a more ready acceptance of hearing impairment as a risk to health. The first is the absence of an explanatory model that passes an informed yet common sense judgement about

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causal pathways in hearing and health. The second is the absence of any measured data to support the testing of any such explanatory model, with many of the above studies limited by being based on self-reported measures.

This paper seeks to address these gaps in the research in two ways. First, by drawing on the literature, it proposes a feasible explanatory model as to how hearing impairment may impact on health and second, by using data from a clinical intervention to examine the utility of this model.

An explanatory model of the possible impact of hearing impairment on health

Typically, hearing impairment (as it is technically known) is commonly acquired through excess noise exposure and/or ageing, with less prevalent causes associated with diseases of the ear and the mastoid [7,14]. Our analysis of the *Survey of Ageing, Disability and Carers* [8] and re-confirmed against the current 2009 dataset for the purposes of this paper) shows that only 14% of the population report being born deaf or with a hearing impairment. Another 14% report acquiring hearing impairment as a result of disease processes (e.g. diseases of the ear, mastoid and infections) and 32% identify simply as being deaf or having a hearing impairment (but where such impairment was not congenital in nature), whereas 36% identify as having a noise-induced hearing impairment. Psycho-social impacts have been associated with the traumatic, but less common events of sudden acquired hearing impairment [15,16]. Similarly, there have been extensive discussions about the psychological impacts of various degrees of hearing impairment in the literature [11,17–19]. In this paper, we are concerned with the psycho-social (and subsequent health) impacts (if any) of hearing impairment that is acquired slowly and where such onset is not readily personally observed. In such circumstances, individuals commonly spontaneously adapt to the personal impacts of this impairment. Such adaptations can be less than ideal. Hetu and Getty [20] reported that people misperceive the effects of the hearing impairment, are reluctant to acknowledge any difficulties and attribute any difficulties arising to interpersonal conflict rather than hearing impairment.

Hetu and Getty [20] also reported that partners and close family members are often the first to notice the impacts of the increasing hearing impairment and may be (unintentionally) yelled at or experience misunderstandings that potentially result in conflict (due to the individual not hearing everything that is said). Conflicts and increasing social isolation may result in lower partner self-esteem as the affected individual increasingly avoids social interactions. A loss of intimacy may also occur. Presentation for hearing help is often motivated by the insistence of the partner that the individual take action or because the individual becomes so embarrassed by a faux pas that they feel compelled to take action. For example, a man with a hearing impairment telephones his wife at work and engages in an intimate conversation only to realise that he was not talking to his wife but an office co-worker.

Upon presentation for hearing help, those affected commonly report experiencing reduced confidence, decreasing engagement in social activities, interpersonal conflict due to hearing and distress [8]. These psycho-social impacts of hearing impairment are not correlated with the degree of impairment, although they may be more commonly experienced by those with a more severe impairment [21].

Hogan et al. [22] proposed that some people's exposure to the psycho-social impacts of hearing impairment served as a chronic mental stressor, which could be severe enough to stimulate autonomic and neuro-endocrine responses leading to physical diseases. They reported that the association between exposure to

chronic stressors generally, such as social isolation, and poorer physical and mental health has been well documented [see for example 23–28]. Based on the insights from these papers, Hogan et al. [22] hypothesised that the key determinant of stressors could be characterised by the “fit” between the individual's hearing-related coping capacity (e.g. social ability to manage hearing impairment) and their perceived and objective demands of the environment (the need to communicate in noisy settings where the efficacy of hearing devices is quite limited). This paper seeks to test the explanatory model that stress is higher and psycho-social wellbeing is lower when the fit between the person's hearing-related coping capacity and environmental demands is poor.

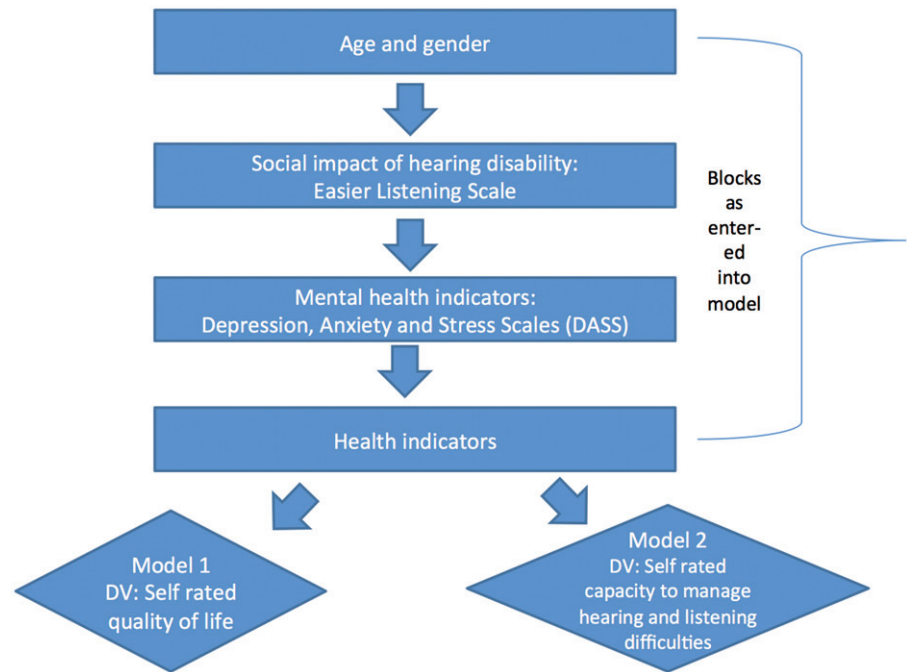
Methods

The data used to test our explanatory model were collected as part of a broader study funded by the National Health and Medical Research Council (grant APP1033151). This broader study tested the extent to which participation in a program for managing the social impacts of hearing impairment could contribute to participants being more engaged in activities to prevent their exposure to harmful levels of noise. This study had ethics approval from Deakin University and The Australian National University (2011/694). Details of this study can be found on the Australian and New Zealand Clinical Trials Registry (ACTRN12614000075684). Briefly, farmers who self-identified as having a hearing impairment were invited to participate in the delivery of a series of workshops based on the Montreal Hearing Help Program [20] and the Sustainable Farm Families program [29–31] offered by the National Centre for Farmer Health, Victoria, Australia. Participants ($n = 56$) completed the following measures prior to the workshops:

- *Depression, Anxiety and Stress Scale* [DASS; 32]: as the name suggests, this well-validated and highly cited psychological measure distinguishes between depression, anxiety and stress.
- *Easier Listening Scale* [33–35]: both participants and their partners completed this scale. It assessed the social impact of hearing impairment and was derived from an initial set of indicators of hearing disability developed by Hetu and Getty [20].
- *Audiometric screening*: both participants and their partners underwent audiometric screening (250 Hz–8000 Hz; both ears) and otoscopic examination.
- *Baseline health checks*: these included measures of fasting glucose and lipids (10-h fast), body mass index, systolic and diastolic blood pressure and waist circumference. A number ($n = 6$) of observations for lipids were missed due to malfunctioning of the testing equipment at one remote rural site.

In keeping with the focus of this paper and to examine our explanatory model in relation to findings already in the literature, correlations between key variables (physical and mental health indicators and capacity to manage hearing impairment in social settings) were examined. Only statistically significant correlations are reported with full tables available from the authors. Multiple hierarchical linear regression was used to test the explanatory model [36]. Within this analysis, we entered variables in blocks according to our hypotheses (see Figure 1, and as described above) using health indicators as dependent variables. In keeping with the proposed explanatory model we tested two models. In the first model, the dependent variable was self-rated quality of life (*how would you rate your quality of life 1–10*), whereas in the second model, it was self-rated capacity to manage hearing and listening impairments (*thinking about how you are going now, how would you rate your ability to manage your hearing and*

Figure 1. Variables as entered in blocks in the hierarchical linear regression.



listening impairments overall?), with all additional variables being entered into their respective models in the same blocks.

Results

In this study, approximately two-thirds (64%) of the participants with a hearing impairment were men and the average age of both women and men in the study group was 59 years (SD = 8 years). Audiometric data were available for all of the participants. The mean three frequency hearing impairment for the left ear was 42 dB (SD = 25) and 39 dB for the right ear (SD = 22). That is, most participants had a moderate degree of hearing impairment as measured on presentation. As is evident in Table 1, at least 1:5 participants were found to have five of the seven health risk factors considered in this study (the most common being high systolic blood pressure and stress); 25% of participants ($n = 14$) were taking prescribed antihypertensive medication, 9% ($n = 5$) were taking lipid-lowering medication, 4% ($n = 2$) were on medication for diabetes, 13% ($n = 7$) were taking antidepressants and 37.5% ($n = 21$) reported taking no prescribed medications.

The moderate degree of hearing impairment reported above manifested itself in respondents' lives in a variety of ways: 22% reported that hearing impairment reduced their confidence, 7% said it left them stressed and tired, whereas up to 30% indicated that difficulties with hearing (e.g. difficulties with telephones, doorbells and the television) had social impacts for the person concerned. Respondents' partners also reported that 18% of those with a hearing impairment were stressed and tired because of their hearing, 30% experienced social impacts (e.g. being left out in groups and difficulties with the telephone and television) and 27% reported that hearing impairment reduced the person's quality of life.

At presentation, physical measures of the participant's hearing impairment were not correlated with measures of blood pressure, fasting blood glucose or total cholesterol. However, a number of important health measures were correlated with measures of hearing disability:

- Measures of systolic blood pressure were correlated with the participant being stressed and tired due to hearing impairment ($r = 0.30$; $p < 0.03$) and their partner not understanding the difficulties they experience ($r = 0.38$; $p < 0.004$).

Table 1. Health-risk factors present in participants.

Risk factor ($N = 56$)	% at risk
Systolic blood pressure ≥ 135	45
Diastolic blood pressure ≥ 90	18
Fasting blood glucose ≥ 5.5 mmol	27
Fasting total cholesterol ≥ 5.5 mmol	28
Depression (DASS) (\geq mild)	18
Anxiety (DASS) (\geq mild)	11
Stress (DASS) (\geq mild)	29

DASS, Depression Anxiety and Stress Scale.

- Diastolic blood pressure was correlated with the participant's partner's understanding of their hearing impairment ($r = 0.32$; $p < 0.02$), whereas being stressed and tired due to hearing impairment approached significance ($r = 0.23$; $p < 0.09$).
- Correlations for total cholesterol levels were not statistically significant. However correlations approached statistical significance for people complain that I don't hear the doorbell ring and people complain if I have the radio or TV up too loud ($r = -0.25$; $p < 0.09$ and $r = -0.24$; $p < 0.09$, respectively). High-density lipoproteins were negatively correlated with feeling left out in groups and hearing impairment reduced my confidence ($r = -0.28$; $p < 0.05$ and $r = -0.28$; $p < 0.054$, respectively).
- Blood glucose levels were correlated with the participant being stressed and tired due to hearing impairment ($r = 0.398$; $p < 0.003$), whereas the correlation for this risk factor and their partner not understanding the difficulties they experience approached significance ($r = 0.25$; $p < 0.06$).

Table 2 presents unstandardised beta values and standardised beta values derived from the hierarchical regression analyses showing all (and only) the variables that made a significant independent contribution to explaining variance in the outcome self-rated quality of life. Included in the models reported here (and in this order) were factors concerned with: age and gender, social impacts of hearing disability, mental health and health

Table 2. Associations between indicators of coping with hearing and self-rated quality of life^a.

Final model	B	SE B	B	R ²
My friend avoids “phone” because it is difficult to understand what is being said	0.49	0.13	0.41 ^b	0.63 ^b
Hearing impairment reduce my friends quality of life	-0.29	0.09	-0.37 ^b	
Self-rated ability to manage hearing and listening impairments	0.32	0.08	0.60 ^b	
My hearing impairment reduced my confidence ^c	0.52	0.14	0.55 ^b	
My hearing impairment leaves me feeling stressed and tired	-0.52	0.17	-0.43 ^d	
Total anxiety score	0.11	0.05	0.33 ^d	
Total depression score	-0.08	0.03	-0.38 ^d	
Diastolic blood pressure	0.03	0.01	0.24 ^d	

^aSelf-rated quality of life assessed using the question “How would you rate your quality of life at present?” (1–10).

^b $p < 0.001$.

^cNegatively scored.

^d $p < 0.01$.

Table 3. Associations between indicators of coping with hearing and self-rated capacity to manage hearing impairment^a.

Final model	B	SE B	B	R ²
My hearing impairment reduced my confidence ^b	-0.78	1.6	-0.43 ^c	0.57 ^d
Self-rated quality of life	0.49	0.19	0.26 ^d	
Total anxiety score	-0.30	0.06	-0.48 ^d	

^aSelf-rated capacity to manage hearing impairment assessed by the question “Thinking about how you are going now, how would you rate your ability to manage your hearing and listening impairments overall?” (1–10).

^bNegatively scored.

^c $p < 0.001$.

^d $p < 0.01$.

outcomes. The items making up these factors are listed in Table 2. Full details of each of these models, including variables that did not contribute significantly to explaining variance, can be obtained from the authors. The model was statistically significant ($F = 8.8$ (8,41), $p < 0.001$) with 63% ($R^2 = 0.63$; SE 0.81) of the variance accounted for by the model. Notably, a loss of self-confidence due to hearing impairment and one’s self-rated ability to manage hearing and listening impairments were most closely associated with reduced quality of life. Increasing self-reported stress due to hearing and depression (as measured by the DASS) was associated with reducing quality of life. Within this model, total anxiety (DASS) and diastolic blood pressure were positively correlated with self-rated quality of life.

Table 3 presents unstandardised beta values and standardised beta values derived from the hierarchical regression analyses showing all (and only) the variables that made a significant independent contribution to explaining variance in the outcome variable self-rated ability to *manage your hearing and listening impairments overall*. The items making up these factors are listed in Table 3.

The model was statistically significant ($F = 21.8$ (3,53), $p < 0.001$) with 57% ($R^2 = 0.57$; SE 1.5) of the variance accounted for by the model. While self-rated quality of life was positively associated with the capacity to self-manage hearing and listening impairments, better management of such problems was negatively correlated with self-confidence (taking into account the fact that it was negatively scored) and anxiety. That is, higher anxiety and reduced self-confidence due to hearing impairment were associated with a decreasing ability to successfully manage one’s hearing and listening impairments.

Discussion

This paper was concerned with the extent to which psycho-social impacts of managing hearing impairment, if any, may be associated with physical or mental health-risk factors. The analyses found that physical measures of hearing impairment (audiograms) were not correlated with physical or mental health outcomes. However, a number of psycho-social impacts of managing hearing impairment were correlated with measures of elevated diastolic blood pressure (e.g. being stressed and tired due to hearing impairment, partner not understanding the difficulties experienced and self-rated capacity to manage hearing and listening impairments). Fasting blood glucose levels were correlated with participants *being stressed and tired due to hearing impairment*, while a number of other indicators showed correlations that approached significance for this risk factor as well as for total cholesterol levels.

As the measures of correlations were relatively low, it was justified to further examine the relationship between risk factors, the psycho-social experience of living with hearing impairment and outcome variables of interest [37]. These models were tested using quality of life and a measure of coping as outcome or dependent variables. The first model found that self-confidence due to hearing impairment and one’s self-rated ability to manage hearing and listening impairments were most closely associated with reduced quality of life. Noting that increasing self-reported stress due to hearing and depression were also associated with reducing quality of life. Total anxiety and diastolic blood pressure were positively associated with self-rated quality of life. The second model found that higher anxiety and reduced self-confidence due to hearing impairment were associated with a decreasing ability to successfully manage one’s hearing and listening impairments. A potential association between diastolic blood pressure and the capacity to self-manage hearing impairment was also noted. We also note that at baseline, 25% of participants were taking anti-hypertensive medication.

As with the thesis that underpins the proposed explanatory model, self-confidence moved in a systematic fashion in response to one’s perceived capacity to manage hearing and listening impairments and the markers typically considered negative (increasing anxiety and diastolic blood pressure) increased with one’s perceived ability to achieve quality of life. The second model suggested a slightly different insight that anxiety increases and self-confidence falls as the capacity to manage hearing and listening impairments also falls. Over time, a pattern may emerge, wherein it may be an effort to make communication go well but it comes at a particular personal cost if it fails. These insights sit well with the initial thesis that stress is higher and wellbeing

lower when the fit between the person's coping capacity and environmental demands is poor. These findings raise important questions for rehabilitation. Most notably, these findings suggest that hearing service providers need to attend not only to the effects of impairment but also give consideration to the social and health impacts of residual hearing disability. We note, in particular, the significant changes that arose in the clinical treatment of sleep apnoea following the realisation that cardio-vascular effects were associated with that condition [38]. Similarly, Hogan and Phillips [39] propose the need for substantive changes in the delivery of hearing services.

The utility of these insights have to be considered within the context of the data collection protocol. In keeping with the demands of the Montreal Hearing Help Program, trust needed to exist between participants and the study coordinators so that participants could be effectively engaged in a change process. Consequently, this study was situated within an existing program of intervention, where farmers (in this instance) had previously been engaged in the Sustainable Farm Families project [31]. A consequence of this engagement is that participants had already undergone interventions concerned with reducing cardio-vascular and other health risks. In addition, although some of the measures of cardio-vascular risk reported in this study may be high in real terms, it is also feasible that the participants had been improving their wellbeing for some time, unlike most people with hearing impairment. To this end, while we found statistically significant associations with measures of hearing disability and mental health, the various physical indicators were not found to be statistically significant in this study, albeit many of these indicators approached significance. In non-intervention populations, it may well be found that the physical indicators would also be associated with the effective management of hearing disability [40].

Similarly, we note that the sample size in this study is limited to 56 participants taken from differing farming industries but one sector across seven or eight communities. While the initial insights from this study provide some initial support for the thesis that health effects are associated with poorer management of the psycho-social impacts of hearing impairment, a study based on a more representative sample of the population could be undertaken. As well as examining basic health indicators, a well-designed and ethically considered randomized control study could examine the extent to which autonomic and neuro-endocrine responses arise during the course of simulated yet typical everyday interactions. Since effective and acceptable methods and protocols already exist for such research projects [41], such a study may serve as the next step in better understanding the nature of the phenomenon, which is at play in this situation.

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Declaration of interest

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