CATASTROPHIZING AND FEAR OF TINNITUS PREDICT QUALITY OF LIFE IN PATIENTS WITH CHRONIC TINNITUS

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Abstract

Objectives: It is well established that catastrophic mis-interpretations and fear are involved in the suffering and disability of patients with chronic pain. This study investigated whether similar processes explain suffering and disability in patients with chronic tinnitus. We hypothesized that patients who catastrophically (mis)interpret their tinnitus would be more fearful of tinnitus, more vigilant towards their tinnitus, and report less quality of life. Moreover, tinnitus-related fear was expected to act as a mediator in reduced quality of life.

Design: Sixty-one tinnitus patients from an outpatient ENT department of the university hospital of Antwerp (Belgium) completed a number of questionnaires about their tinnitus. Hierarchical regression analyses were performed to test hypothesized associations and to assess mediation by tinnitus-related fear. **Results:** Analyses revealed significant associations between catastrophizing and fear, and between catastrophizing and increased attention towards the tinnitus. Furthermore, both tinnitus-related catastrophizing and fear predicted decreased quality of life and moreover, tinnitus-related fear fully mediated the association between catastrophizing about the tinnitus and quality of life. **Conclusions:** The findings confirm earlier suggestions that tinnitus-related concerns and fears are associated with impaired quality of life, which is in line with a cognitive behavioural account of chronic tinnitus. Future research avenues and clinical applications are discussed.

Keywords: Catastrophizing; Cognitive-behavioural; Quality of life; Tinnitus; Tinnitus-related fear

25 **Introduction**

26 Tinnitus is the awareness of a sound without an external source. Several theories regarding its
27 pathophysiology exist of which the most advocated is the hypothesis that tinnitus occurs as a
28 result of spontaneous anomalous neural activity, coinciding with changes in the auditory
29 system at any level along the auditory axis. Tinnitus has been described as a phantom auditory
30 perception and the involvement of non-auditory structures are considered of key importance
31 in clinically relevant tinnitus complaints (Cacace, 2003; Jastreboff, 1990; Jastreboff & Hazell,
32 1993).

33 The larger part of individuals experiencing chronic tinnitus eventually habituates or
34 adapts to the tinnitus sound and is able to function fairly well. Only a small part (5–8 %) of
35 this group tinnitus remains distressing and disabling (Ahmad & Seidman, 2004). In
36 individuals with persistent tinnitus complaints, the acoustical characteristics of the tinnitus
37 (e.g. loudness or pitch) is not univocally related to the severity of the tinnitus or treatment
38 outcome (Jastreboff, 1990; Jastreboff & Hazell, 1993). Only a weak relationship can be
39 established between perceived psycho-acoustic characteristics of the tinnitus (e.g. loudness or
40 pitch) and the severity of complaints. In chronic tinnitus, the interpretation of the sound might
41 be more important in defining the severity of complaints than the sound itself (Andersson,
42 2003; Henry & Meikle, 2000; Hiller & Goebel, 2007; Jastreboff & Hazell, 1993).

43 Severe emotional distress, major declines in concentration, problems in directing
44 attention and sleeping difficulties are the most reported daily activity limitations caused by
45 tinnitus. Most significant in predicting the variability in quality of life of tinnitus patients is
46 psychological distress, including negative attitudes and cognitions, impaired concentration,
47 insomnia, depression, and anxiety (Erlandsson & Hallberg, 2000). Accumulating evidence
48 suggests that cognitive misinterpretations, negative emotional reactivity and attentional
49 processes are crucial in dysfunctional habituation leading to severe tinnitus distress

(Andersson & McKenna, 2006; Erlandsson & Hallberg, 2000; Kroner-Herwig, Frenzel, Fritsche, Schilkowsky, & Esser, 2003; Zachriat & Kroner-Herwig, 2004). In other chronic disorders, like irritable bowel syndrome (Gonsalkorale, 2004), chronic fatigue syndrome (Deary, Chalder, & Sharpe, 2007), and chronic pain disorder (Gatchel, Peng, Peters, Fuchs, & Turk, 2007), psychological mechanisms, predicting or promoting dysfunctional responses to symptoms, have similarly shown to be significant predictors of suffering (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Rief & Broadbent, 2007).

Given the analogies between chronic tinnitus and chronic pain (Folmer, Griest, & Martin, 2001; Tonndorf, 1987), the current study is an attempt to apply a cognitive behavioural model of chronic musculoskeletal pain and disability to the problem of chronic tinnitus. The Fear-Avoidance (FA) model, originally proposed by Lethem et al. (Lethem, Slade, Troup, & Bentley, 1983) and further elaborated by Vlaeyen and Linton (Vlaeyen & Linton, 2000), is based on classical and operant conditioning paradigms. In case of injury, automatic emotional and sympathetic responses are elicited. Through classical conditioning a threatening situation, signaling pain or (re) injury, elicits conditioned fear responses such as increased arousal, hypervigilance, and avoidance and escape behaviors, negatively reinforced through instant diminishing fear. Although these protective behaviours may be adaptive in the acute phase, they maintain fear in the long run and lead to increased functional disability.

The FA model builds upon these principles and includes pain catastrophizing and pain-related fear as key factors. Pain catastrophizing can be defined as the process in which pain receives an extremely negative meaning, consisting of magnification of the stimulus, rumination about its possible consequences, and perceived helplessness and loss of control (Sullivan, Kues, & Mayhew, 1996). Pain related fear can be defined as the fearful reactions towards pain and pain-related activities and fear of (re)injury, including fearful beliefs about causes of pain. The FA model predicts that if pain is misinterpreted catastrophically, it will

75 elicit specific pain-related fear associated with safety behaviours. These behaviours may be
76 functional in the short-term as fear is decreased, but paradoxically they worsen the problem in
77 the long run, because of disuse and increased disability.

78 The importance of pain-related fear in the development of pain-related disability has
79 been previously established as being pivotal in the development of pain-related disability,
80 contributing to disability more than biological or physical factors do (Crombez et al., 1999;
81 Gheldof et al., 2006; Goubert, Crombez, & Van Damme, 2004). Especially, the mediating
82 role of pain-related fear has been postulated, and in fact it has been found in earlier studies
83 that pain-related fear mediates the association between catastrophizing about pain and
84 functional disability (Gheldof et al., 2006). The role of mediators in the maintenance of
85 tinnitus distress has been proposed previously as well. Andersson and Westin (2008)
86 theorized that conditioned responses, such as fear, are likely to act as mediators in the
87 maintenance of chronic tinnitus distress.

88 Similar to chronic pain, catastrophic misinterpretations of tinnitus are likely to lead to
89 tinnitus-related fear, which is likely to be associated with escape/avoidance behaviours and
90 heightened awareness of the sound. Catastrophizing and tinnitus-related fear, may lead to
91 increased attention towards the stimulus, at the cost of the necessary attention for daily
92 activities, in turn leading to frequent interruptions of daily tasks, interference with daily
93 functioning, and compromised quality of life. Additionally, tinnitus-related fear may have a
94 mediating effect on the association between catastrophic misinterpretation of the tinnitus and
95 general quality of life.

96 The present aim is to investigate the applicability of the FA model in patients with
97 chronic tinnitus in a cross-sectional study. We hypothesized that patients who catastrophically
98 misinterpret their tinnitus would be more fearful of tinnitus, and that both catastrophic
99 misinterpretations and heightened fear are associated with increased attention towards the

tinnitus. We also expected a strong inverse association between tinnitus-related catastrophizing and fear, and quality of life, moreover tinnitus-related fear was expected to mediate the effect of catastrophic misinterpretations on quality of life.

Materials and Methods

Participants

Sixty-one (mean age = 55.4 yrs, SD = 12.1) participants suffering from chronic tinnitus were recruited from an outpatient ENT department (See table 1 for demographic data). From all incoming ENT patients only those were included who reported to be mainly troubled by their tinnitus. Thirteen participants experienced difficulties in balance and dizziness secondary to their tinnitus, 4 subjects reported to be also incapacitated by their hearing loss and 1 reported to be troubled by hyperacusis next to the tinnitus. Duration of tinnitus was on average 2.6 years (SD=.9).

Table 1. *Demographic data: Age, Gender, Duration and Education*

Procedure

Research instruments were administered in an outpatient ENT department of the university hospital of Antwerp (Belgium) during a period of 6 months. The battery of instruments was administered after the purpose of the study was explained to participants and informed consent was obtained. The research protocol was approved by the ethical board of the faculty of Psychology and Educational Sciences of the Ghent University in Belgium.

Measures

Distress caused by the tinnitus or tinnitus severity was assessed by the Tinnitus Questionnaire (TQ). The TQ consists of 52 items rated on a 3-point scale and assesses the psychological distress associated with the tinnitus. Psychometric properties of the TQ have proven excellent in different languages (Baguley, Humphriss, & Hodgson, 2000; McCombe et al., 2001).

General distress was measured with the Hospital Anxiety and Depression Scale (HADS), which was successfully used in tinnitus research previously (Andersson, 2002). The Dutch version of the HADS contains 14 items and has good reliability and validity (Spinhoven et al., 1997).

Tinnitus severity and general distress were assessed for descriptive purposes. The following measures were used to assess Quality of life, Catastrophizing about tinnitus, Tinnitus-related fear, and attention towards the tinnitus.

Quality of life was assessed by the Short Form – 36 (SF36) (Hays, Sherbourne, & Mazel, 1993) which comprises 36 items to assess various aspects of quality of life, including physical functioning, bodily pain, emotional functioning, mental health, vitality and social functioning. Two general subscales can be calculated: physical and mental health. In the current study the mean of both scores has been used as a single measure for overall health (El Refaie et al., 2004).

Catastrophizing about tinnitus was measured by the Tinnitus Catastrophizing Scale (TCS). The TCS (see appendix 1) is an adapted version of the Pain Catastrophizing Scale (Sullivan et al., 1996; Van Damme, Crombez, Bijttebier, Goubert, & Van Houdenhove, 2002). The word ‘pain’ was substituted by the word ‘tinnitus’. The TCS has 13 items to be rated on a 5-point scale (0 = not at all, 4 = always).

Tinnitus-related fear was assessed with the Fear of Tinnitus Questionnaire (FTQ). Of this novel measure, items were included that were believed to capture worries and fears of

patients experiencing tinnitus (see appendix 2). Some of the FTQ items were derived from the Tampa scale for Kinesiophobia (Roelofs et al., 2007) and the Pain Anxiety Symptoms Scale (McCracken, Zayfert, & Gross, 1992). The FTQ was pretested with patients. The FTQ has 17 items to be rated on a true or false scale.

Attention towards the tinnitus was measured by the Tinnitus Vigilance and Awareness Questionnaire (TVAQ). This novel 18-item measure (see appendix 3) is based on the 16-item Pain Vigilance and Awareness Questionnaire (PVAQ) (Roelofs, Peters, McCracken, & Vlaeyen, 2003). Items 2, 3, 4, 6, 7, 8, 9, 10, 13 and 14 are PVAQ items, in which the word ‘pain’ was substituted by the word ‘tinnitus’. The remaining items that were included were believed to capture heightened awareness of tinnitus. Items are to be rated on a 6-point scale (0 = never, 5 = always).

Statistical procedures

First, for all tinnitus self-report measures and the quality of life measure, Cronbach’s Alpha was calculated in order to test internal consistency. Second, Pearson correlation coefficients were calculated in order to test bivariate associations between measures. Third, a series of multiple hierarchical regression analyses was carried out to test the hypotheses that [1] catastrophizing about tinnitus is associated with fearful responses, [2] both catastrophizing about tinnitus and tinnitus-related fear are associated with increased attention towards tinnitus, and that [3] both predict poorer quality of life. Additionally, [4] to test for mediation of tinnitus-related fear on the association between tinnitus catastrophizing and general quality of life the asymptotic and re-sampling procedure for estimating the indirect effects proposed by Preacher and Hayes (Preacher & Hayes, 2004, 2008) was chosen since this approach has more power over the more frequently used method proposed by Baron and Kenny, which includes the Sobel-test to test for mediation (Baron & Kenny, 1986). Moreover, this

procedure provides a quantified estimate of the indirect effect with associated confidence limits. Predicted associations are illustrated in figure 1. In all regressions analyses, as well as in the re-sampling procedure to test for mediation, age, gender, and education level were entered as covariables. For all statistical procedures SPSS version 18.0 for Windows was used.

Figure 1. *Predicted associations between catastrophizing about tinnitus (TCS), tinnitus-related fear (FTQ), Increased attention towards tinnitus (TVAQ) and Quality of life (SF36)*

Results

Descriptive data

Patients reported a mean TQ-score (tinnitus distress) of 50 (SD=16.8) indicating that on average severe distress associated with tinnitus was experienced (TQ- cut off = 46). In line with suggestions from McCombe et al. (McCombe et al., 2001) we further classified patients in terms of their TQ-scores. Scores on the TQ and location of the tinnitus in the current sample are depicted in figure 2.

Mean scores on the HADS depression and anxiety subscales were 6.4 (SD=4.5) and 7.6 (SD=4.6) respectively. Scores below 8 indicate that pathological anxiety or depression is absent (Spinhoven et al., 1997). On the depression subscale, 43.3% of respondents scored above this clinical cut-off score. On the anxiety subscale this was 48.3% of respondents. No significant differences were found between male and female patients in age, tinnitus severity, or depressive or anxious mood.

The internal consistency (Cronbach's α) of all self-report measures were excellent (TCS, α = .93, FTQ, α = .82, TVAQ, α = .81, and SF36, α = .93, TQ= .90, HADS Depression and Anxiety, α = .86 and α = .85 respectively).

198

199 Figure 2. (a) *Scores on the Tinnitus Questionnaire (TQ) and (b) Tinnitus location*

200

201 ***Correlations***

202 Table 2 displays means, standard deviations and Pearson correlations among the TQ, TCS, the
203 FTQ, the TVAQ, the SF36 and age. Correlations between TQ, TCS, FTQ, TVAQ, SF36 on
204 the one hand and age on the other hand were not significant. As was expected, correlations
205 among the tinnitus scales were significantly positive. The significant correlations between the
206 TQ and the TCS, FTQ, and the TVAQ support the convergent validity of these new scales.
207 Significant negative correlations were found between quality of life and distress due to
208 tinnitus, catastrophizing about tinnitus, tinnitus-related fear, and increased attention towards
209 tinnitus, supporting the divergent validity.

210

211 Table 2. *Means, Standard Deviations, and Pearson correlation coefficients*

212

213 ***Regression analyses***

214 *Catastrophizing about tinnitus is associated with Tinnitus-related fear*

215 In order to investigate whether the level of catastrophizing (TCS) contributes to tinnitus
216 related fear (FTQ), a hierarchical regression analysis was performed. The first step in the
217 analysis included the control variables age, gender, and education. This model yielded no
218 significant F-value. Catastrophizing was added in the next step (see table 3) and significantly
219 contributed to total explained variance of tinnitus related fear. The control variables did not
220 reach significance. See table 3 for statistics from regression equations.

221

Table 3. *Statistics from regression equations: Tinnitus catastrophizing (TCS) as independent variable and Tinnitus-related fear (FTQ) as dependent variable*

Catastrophizing about tinnitus and Tinnitus-related fear are associated with increased attention towards the tinnitus

To assess whether catastrophic interpretations (TCS) of tinnitus are associated with increased attention towards the tinnitus (TVAQ), a second regression analysis was performed. Again demographic variables were entered first (age, gender, and education). This model did not reach significance. Adding catastrophizing in the next step yielded a significant model (see table 4; model 2 a).

Next, catastrophizing about tinnitus was replaced by tinnitus-related fear to assess whether heightened fear is a predictor for increased awareness towards the tinnitus. Results show that in this case fear of the tinnitus added significantly to the model, controlled for age, gender, and education (See table 4; model 2 b).

A final analysis was performed to test whether heightened fear is related to increased attention towards the tinnitus, above and beyond catastrophizing about tinnitus. After controlling for age, gender and education, catastrophizing was added to the model first, and tinnitus-related fear was added last; results show that fear of the tinnitus no longer significantly added to the model (see table 4 for statistics from regression equations).

Table 4. *Statistics from regression equations: Tinnitus catastrophizing (TCS) and Tinnitus-related fear (FTQ) as independent variables and increased attention towards tinnitus (TVAQ) as dependent variable*

245

246 *Catastrophizing about tinnitus and Tinnitus-related fear are associated with Quality of life*

247 A final hierarchical regression analysis was performed to assess whether the level of
248 catastrophizing (TCS) and tinnitus-related fear (FTQ) would both have a unique contribution
249 in explaining poorer quality of life (SF36). The first step in the model included age, gender,
250 and education, none of which reached significance (see table 5). Adding the level of
251 catastrophizing contributed significantly to the model. Adding heightened fearfulness of the
252 tinnitus in the third step again yielded significant results. See table 5 for statistics from
253 regression equations.

254

255 *Table 5. Statistics from regression equations: Tinnitus catastrophizing (TCS) and Tinnitus-*
256 *related fear (FTQ) as independent variables and quality of life (SF36) as dependent variable*

257

258 *Fear of tinnitus mediates the association between catastrophizing and quality of life*

259 In order to assess mediation, the ‘asymptotic and re-sampling’ procedure for estimating the
260 bias corrected indirect effects (Preacher & Hayes, 2004, 2008) was chosen. Both test statistics
261 and the confidence interval of the indirect effects indicate a full mediating effect of tinnitus
262 related fear on the association between tinnitus catastrophizing and quality of life (see figure 3
263 for the mediator model and statistics). In table 6 the coefficients and test statistics of the
264 control variables (age, gender and education) and the mediation paths (see figure 3) are listed
265 and in table 7 the confidence intervals of the indirect effect after re-sampling are listed.

266

Figure 3. The mediator model with Tinnitus related fear (FTQ) as the mediator in the association between catastrophizing about tinnitus (TCS) and Quality of life (SF36). Standardized Beta's of individual paths, and the standardized Beta of the direct effect.

Table 6. *Partial effect of control variables on dependent variables and indirect, total and direct effects of the mediation model*

Table 7. *Mediation of the effect of Tinnitus Catastrophizing on Quality of Life through Tinnitus Related Fear*

Discussion

The current study investigated whether catastrophic misinterpretations of tinnitus and tinnitus-specific fear would be important in explaining chronic tinnitus suffering and quality of life. A novel framework explaining chronic tinnitus complaints was presented; the fear-avoidance model of pain served as a heuristic framework to formulate specific hypotheses. Previous findings in tinnitus research corroborate the possible applicability of the FA model for chronic tinnitus. The importance of classical and operant learning principles in the maintenance and possible treatment avenues in chronic tinnitus complaints have been postulated before (Wilson, 2006). One of the assumptions of the neurophysiological model of tinnitus (Jastreboff, 1990; Jastreboff & Hazell, 1993; Jastreboff & Hazell, 2004), is that conditioned reflexes in processing the tinnitus sound are especially important in the development, habituation processes and recovery of disabling tinnitus. The neurophysiological model also postulates that in the generation and maintenance of chronic bothersome tinnitus, the perception and interpretation of the signal is strongly related to heightened negative emotional states, eliciting increased attention towards the tinnitus, enhancing the perception itself

(Jastreboff, 1990). This is in accordance with the currently proposed FA model, which expands on these notions and incorporates a possible cognitive-behavioural account for the onset and maintenance of chronic bothersome tinnitus. Our findings support both models, in that they postulate the importance of the relation between interpretation of the signal and heightened negative emotional responses, with increased attention towards the signal and enhanced perception as a result.

Catastrophic misinterpretation was expected to influence the fearful response to the tinnitus sound. Furthermore, catastrophic misinterpretations of tinnitus and tinnitus-related fear were expected to be associated with a higher tendency to attend to the tinnitus. Last, we predicted that both catastrophizing about the tinnitus and a higher level of fear of tinnitus would be associated with lower quality of life and that tinnitus-related fear mediated the association between tinnitus catastrophizing and quality of life.

The current findings corroborate the parallels between chronic pain and chronic tinnitus. They suggest that the fear-avoidance model proposed in chronic pain literature extends to patients with chronic tinnitus. Almost all of the associations mentioned earlier were found to be significant. The level of catastrophizing was highly associated with both self-reported tinnitus specific fear and increased attention towards the tinnitus. Higher levels of tinnitus-related fear were associated with increased attention towards the tinnitus as well. However, this association was no longer significant after controlling for catastrophizing first. This might be due to the large conceptual overlap between catastrophizing about tinnitus and fearful reactions towards the tinnitus. Indeed, catastrophizing beliefs may be considered part of the overall fear construct, next to protective behaviours and physiological arousal (Lang, Levin, Miller, & Kozak, 1983). Finally, catastrophic misinterpretations of tinnitus were significantly related to poorer quality of life ratings and heightened fear uniquely added to this model,

above and beyond the contribution of catastrophizing about tinnitus. Moreover, tinnitus-related fear fully mediated the association between tinnitus catastrophizing and quality of life.

Chronic tinnitus complaints are considered complex and difficult to treat or alleviate. It has not been possible to explain daily interference and disability caused by the tinnitus by the characteristics of the sound itself. Tinnitus sufferers report experiencing difficulties in concentration because of the tinnitus, and terms like “intrusiveness of the sound” distinguishes moderate from severe tinnitus in most subjective reports (Andersson & McKenna, 2006). Many theorists have proposed that psychological factors are the main predictors concerning tinnitus severity (Andersson, 2002; Hallam, McKenna, & Shurlock, 2004; Jensen, Turner, Romano, & Karoly, 1991). Moreover, cognitive behavioural therapy has been proven effective in several clinical trials (Andersson, 2002; Dobie, 1999; Kroner-Herwig et al., 2003; Martinez Devesa, Waddell, Perera, & Theodoulou, 2007; Rief, Weise, Kley, & Martin, 2005). Tinnitus complaints might be best explained by adopting a biopsychosocial approach and using a cognitive behavioural framework. The cognitive tinnitus sensitization model proposed by Zenner and Zalaman (Zenner & Zalaman, 2004) introduced an explanation for the significant improvements in tinnitus complaints by cognitive behavioural therapy. Processes of inadequate appraisal, inadequate coping, negative affect, and increased attention towards the tinnitus were distinguished; however, the associations between these processes were not yet specified in a single theoretical framework. The current study is a first step in this direction. Our results are in accordance with previous findings in studies on chronic tinnitus and chronic pain, and seem to support a similar underlying cognitive behavioural model as the one proposed by Vlaeyen & Linton (2000). These findings provide important new insights regarding the role of cognitive misinterpretations and fear in the maintenance of chronic tinnitus. In fact, they suggest that catastrophic misinterpretation of tinnitus is not only highly associated with heightened fear of

the tinnitus sound, but also with increased attention towards the threatening sound and lower ratings of quality of life. Moreover, findings suggest that tinnitus-related fear is associated with increased attention towards the tinnitus and with a decrease in quality of life as well. Interestingly, it was found that tinnitus specific fear fully mediated the relation between catastrophizing about tinnitus and quality of life. This finding suggests that tinnitus-related fear accounts for the relation between catastrophic misinterpretations of tinnitus and quality of life ratings.

In chronic pain research, the mediating role of fearful reactions has been investigated and established (Gheldof et al., 2006; Goubert et al., 2004). It was found that in the association between pain severity and functional and social disability, fear of painful movement had an important mediating effect. The theoretical concept of mediators in the maintenance of tinnitus distress have been previously proposed (Andersson & Westin, 2008). First it was brought to attention that the tinnitus receives its negative connotation through classical conditioning (Jastreboff & Jastreboff, 2006). It was furthermore theorized that aversive responses towards the tinnitus sound might act as mediators and be the prime cause of maintained tinnitus distress in the long run. The current findings corroborate these assumptions in that aversive responses, like catastrophizing and fear might be the key factors in the maintenance of chronic tinnitus distress with an important mediating role of tinnitus specific fear in this process.

This study has a number of limitations. *First*, it is important to note that the current investigation was carried out using measures initially developed for chronic pain research. Correlations between the TQ and the new measures were significant; indicating a high convergent validity. Divergent validity was indicated by the significant negative correlation between the SF36 and the tinnitus measures. Future research is needed to examine the psychometric properties of these instruments in larger samples of patients with tinnitus.

Second, for reasons described below we used results on the TQ for descriptive purposes only. Guidelines for the grading of tinnitus severity have been described by Mc Combe et al. (McCombe et al., 2001). They concluded that the grading of tinnitus severity is almost synonymous with grading psychological distress. Since tinnitus severity is largely determined by psychological factors, the instruments developed for this purpose, like the TQ, comprise items which are quite similar to those of more specific measures to assess level of catastrophizing, hypervigilance and tinnitus related fear. For this reason it was considered inappropriate in the current investigation to use the TQ as a reference for disability caused by the tinnitus or tinnitus severity, since this would compromise analyses. Severity of tinnitus should be otherwise specified when used for researching cognitive models, possibly within the realm of a biopsychosocial framework. Another option would be to include Visual Analogue Scales (VAS) in the future to establish tinnitus severity or impact on daily life. *Third*, these results concern cross-sectional data. Therefore, causality cannot be inferred from current data. *Fourth*, another risk worth mentioning is that shared method variance might be causing an artificial inflation of correlations in the current analyses (Nicholls, Licht, & Pearl, 1982). *Last*, audiological measurements, such as level and lateralisation of hearing loss, tinnitus localisation and pitch match frequency and intensity, maskability, and uncomfortable loudness levels (UCL) to assess for decreased sound tolerance were not available for analyses. In future studies it would be of interest to see whether these measures could predict interpretation, fear and attentional bias towards the tinnitus. It might also be important to investigate whether these psychological mechanisms affect tinnitus measures like maskability or subjective loudness (intensity) and sound tolerance.

In sum, the present study indicates important parallels between chronic pain and chronic subjective tinnitus. Important new insights regarding the role of cognitive misinterpretations and fear in the maintenance of chronic tinnitus and the mediating role of these fearful

reactions towards the tinnitus have been presented. Important to note is that next to several parallels there are differences as well between chronic tinnitus and chronic pain disorder. For example, ineffective safety behaviours are assumed to play an important role in the maintenance of chronic tinnitus complaints. These safety behaviours are expected to be different from those observed in chronic pain patients, research efforts should be undertaken to further investigate the exact nature, occurrence, and consequences of these safety behaviours in tinnitus patients.

Results show that adopting a biopsychosocial approach, in studying development, maintenance, assessment and treatment approaches in chronic tinnitus might offer new venues for research and management of chronic tinnitus (Martinez Devesa et al., 2007). Future efforts should focus on development and validation of appropriate measures, experimental studies in which value of tinnitus sounds are manipulated, and replication of results using larger samples employing a longitudinal design.

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538 **Appendix 1**

539 ***Tinnitus Catastrophizing Scale (TCS)***

540 We are interested in your thoughts en feelings when experiencing tinnitus. With this
541 questionnaire we want to investigate what influence tinnitus has on you; on your mood, your
542 behaviour, your attitude. Below you can find 13 statements describing different thoughts and
543 feelings which might be related to your tinnitus. Please try to indicate to what extent these
544 thought or feelings apply to you by using the following rating scale: *0 = Not at all; 1 = to a*
545 *small extent; 2 = to some extent; 3 = to a large extent; 4 = Always*

546 ***If I experience Tinnitus ...***

547 ☐... I worry all the time about whether the tinnitus will end

548 ☐... I feel I can't go on

549 ☐... It's terrible and I think it's never going to get any better

550 ☐... It's awful and I feel it overwhelms me

551 ☐... I feel I can't stand it anymore

552 ☐... I become afraid the tinnitus will get worse

553 ☐... I keep thinking about other times I experienced tinnitus

554 ☐...I anxiously want the tinnitus to go away

555 ☐... I can't seem to keep it out of my mind

556 ☐... I keep thinking about how strong my tinnitus is

557 ☐... I keep thinking about how badly I want the tinnitus to stop

558 ☐... There is nothing I can do to reduce the intensity of the tinnitus

559 ☐... I wonder whether something serious may happen

Fear of Tinnitus Questionnaire (FTQ)

This questionnaire will help us understand how you think and feel about your tinnitus condition. It enables us to examine how tinnitus affects you, what effect it has on your mood, your behaviour, your attitude. Below you will find 17 statements. Please check the box next to each statement that you think applies to your current situation.

- ☐ **1** I am afraid that my tinnitus will deteriorate my hearing
- ☐ **2** I am afraid that my tinnitus will become worse
- ☐ **3** I fear that my tinnitus is the result of a tumour
- ☐ **4** Even though my tinnitus is getting worse, I do not think it points to a serious disease
- ☐ **5** I am afraid that my tinnitus will drive me crazy
- ☐ **6** The fact that I have tinnitus does not mean that my health is at risk
- ☐ **7** I am afraid my tinnitus will leave me deaf
- ☐ **8** I am afraid the moment will come that my head cannot withstand tinnitus anymore
- ☐ **9** My mental condition will become severely affected by my tinnitus
- ☐ **10** I am afraid that tinnitus will stop me from ever having a normal life again
- ☐ **11** I am afraid that I will never be able to experience silence again because of tinnitus
- ☐ **12** I am afraid that loud noises will aggravate my tinnitus
- ☐ **13** I am afraid I will not be able to do anything anymore because of my tinnitus
- ☐ **14** It worries me to think I may never be able to learn how to cope with this condition
- ☐ **15** It would be terrible if my tinnitus proved a life-long condition
- ☐ **16** I am concerned that tinnitus may be a risk to my physical health
- ☐ **17** I am afraid that tinnitus may be a preliminary sign of brain haemorrhage or similar

Tinnitus Vigilance and Awareness Questionnaire (TVAQ)

Below you find 18 sentences describing how people react on their tinnitus. . With this questionnaire we want to investigate what influence tinnitus has on you; on your mood, your behaviour, your attitude. Please indicate how often a statement applies to you by circling a number between 0 (never) and 5 (always).

	Never	Always				
1 I am very aware of changes in my tinnitus	0	1	2	3	4	5
2 I am quick to notice changes in the intensity of my tinnitus	0	1	2	3	4	5
3 I am quick to notice the effects of medication on my tinnitus	0	1	2	3	4	5
4 I am quick to notice changes in sound or intensity of my tinnitus	0	1	2	3	4	5
5 The tinnitus keeps me constantly occupied	0	1	2	3	4	5
6 I notice the tinnitus even if I am busy with another activity	0	1	2	3	4	5
7 I find it easy to ignore my tinnitus	0	1	2	3	4	5
8 I know immediately when my tinnitus starts or increases	0	1	2	3	4	5
9 When I do something that increases my tinnitus, the first thing I do is check to see how much my tinnitus was increased	0	1	2	3	4	5
10 I know immediately when my tinnitus decreases	0	1	2	3	4	5
11 I must attend to my tinnitus a lot	0	1	2	3	4	5
12 I carefully monitor how intense my tinnitus is	0	1	2	3	4	5
13 I become preoccupied with my tinnitus	0	1	2	3	4	5

14 I do not dwell on my tinnitus	0	1	2	3	4	5
15 Sometimes I'm able to ignore the tinnitus, even if it is present	0	1	2	3	4	5
16 I am aware of my tinnitus from the moment I get up till the moment I go to sleep	0	1	2	3	4	5
17 The tinnitus distracts me, no matter what I do	0	1	2	3	4	5
18 Often, my tinnitus is so bad that I cannot ignore it	0	1	2	3	4	5

565

TABLES

Table 1. *Demographic data: Age, Gender, Duration and Education*

Age (yrs)	%
> 35	5
35 < 50	33
50 < 65	33
65 <	28
Gender	%
Male	40
Female	60
Duration (yrs)	%
> 1	4
1 < 5	21
5 < 10	15
10 <	60
Education	%
Elementary	13
Junior high	20
High school	16
College education or University degree	51

Table 2. *Means. Standard Deviations. and Pearson correlation coefficients*

Variabels	Mean	SD	2	3	4	5	6
1. Tinnitus severity (TQ)	15	16.8	.74**	.70**	.57**	-.57**	-.01
2. Tinnitus Catastrophizing (TCS)	25.1	13.7	-	.70**	.62**	-.32*	.05
3. Fear of tinnitus (FTQ)	43.6	8.2	-	-	.42**	-.43**	.13
4. Increase attention towards the tinnitus (TVAQ)	49.6	15.4	-	-	-	-.31*	-.08
5. Quality of life (SF36)	53.3	8.4	-	-	-	-	-.03
6. Age	55.71	11.93	-	-	-	-	-

Note: *P < .05 (2-tailed); **P < .01 (2-tailed)

TQ: Tinnitus questionnaire; TCS: Tinnitus catastrophizing scale; FTQ: Fear of tinnitus questionnaire; TVAQ:

Tinnitus vigilance and awareness questionnaire; SF36: Short form 36

Table 3. Statistics from regression equations: Tinnitus catastrophizing (TCS) as independent variable and Tinnitus-related fear (FTQ) as dependent variable

<i>Model</i>	<i>R² change(F)</i>	<i>Independents</i>	<i>B</i>	<i>Stand B</i>
1	0.04(0.77)	Age	0.08	0.11
		Gender	-1.92	-0.11
		Education	-0.62	-0.08
2	0.48(15.07)	Tinnitus Catastrophizing (TCS)	0.45 **	0.71 **

Note: *P < .05 (2-tailed); **P < .01 (2-tailed)

TCS: Tinnitus catastrophizing scale; FTQ: Fear of tinnitus questionnaire

Table 4. Statistics from regression equations: Tinnitus catastrophizing (TCS) and Tinnitus-related fear (FTQ) as independent variables and increased attention towards tinnitus (TVAQ) as dependent variable

<i>Model</i>	<i>R² change (F)</i>	<i>Independents</i>	<i>B</i>	<i>Stand B</i>
1	0.062(1.23)	Age	0.01	0.00
		Gender	-0.22	-0.01
		Education	3.37	0.25
2 a	0.37(10.54)	Tinnitus Catastrophizing (TCS)	0.70 **	0.62 **
2 b	0.22 (16.50)	Fear of tinnitus (FTQ)	0.84 **	0.48 **
3	0.02(8.35)	Tinnitus Catastrophizing (TCS)	0.65 **	0.57 **
		Fear of tinnitus (FTQ)	0.12	0.07

Note: *P < .05 (2-tailed); **P < .01 (2-tailed)

TCS: Tinnitus catastrophizing scale; FTQ: Fear of tinnitus questionnaire; TVAQ: Tinnitus vigilance and awareness questionnaire

Table 5. Statistics from regression equations: Tinnitus catastrophizing (TCS) and Tinnitus-related fear (FTQ) as independent variables and quality of life (SF36) as dependent variable

<i>Model</i>	<i>R² change (F)</i>	<i>Independents</i>	<i>B</i>	<i>Stand B</i>
1	0.05(0.88)	Age	-0.08	-0.10
		Gender	1.89	0.11
		Education	-1.73	-0.22
2	0.08(1.97)	Tinnitus Catastrophizing (TCS)	-0.19 **	-0.29 **
3	0.12(3.46)	Tinnitus Catastrophizing (TCS)	0.04	0.06
		Fear of tinnitus (FTQ)	-0.51 **	-0.50 **

Note: *P < .05 (2-tailed); **P < .01 (2-tailed)

TCS: Tinnitus catastrophizing scale; FTQ: Fear of tinnitus questionnaire; SF36: Short form 36

Table 6. *Partial effect of control variables on dependent variables and indirect, total and direct effects of the mediation model*

Control variables	Effects	Coefficients	Standard error	<i>p</i>
Age		-.04	.09	.66
Gender		1.08	2.20	.62
Education		-2.12	-2.02	.05
	Path a	.45	.06	.00*
	Path b	-.51	.18	.00*
	Path c	-.19	.08	.02*
	Path c'	.04	.11	.72

Note: a path, effect of tinnitus catastrophizing on tinnitus related fear; b path effect of tinnitus related fear on quality of life, controlled for catastrophizing; c path, total affect, of tinnitus catastrophizing on quality of life (*significant effect see also figure 3); c'path, direct affect, of tinnitus catastrophizing on quality of life controlled for the mediator, all path analyses controlled for age, gender and education.

Table 7. *Mediation of the effect of Tinnitus Catastrophizing on Quality of Life through Tinnitus Related Fear*

	Bootstrapping					
	Percentile 95% CI		BC 95% CI		Bca 95% CI	
	Lower	Upper	Lower	Upper	Lower	Upper
FTQ	-.3868	-.0690	-.4165	-.0662	-.4047	-.0710

Note: FTQ, Tinnitus related fear, BC, bias corrected; Bca bias corrected and accelerated;

2000 bootstrap samples, analyses controlled for age, gender and education

FIGURES

Figure 1: Predicted associations between Catastrophizing about tinnitus (TCS), Tinnitus-related fear (FTQ), Increased attention towards tinnitus (TVAQ) and Quality of life (SF36) and the mediating effect of Tinnitus-related fear (FTQ)

Figure 2. (a) Scores on the Tinnitus Questionnaire (TQ) and (b) Tinnitus location

Figure 3. The mediator model with Tinnitus related fear (FTQ) as the mediator in the association between catastrophising about tinnitus (TCS) and Quality of life (SF36). Standardized Beta's of individual paths, and the standardized Beta of the direct effect

Note: * $P < .05$ (2-tailed); ** $P < .01$ (2-tailed); *** $P < .001$