The Distressed (Type D) personality is independently associated with tinnitus adjusted for other personality characteristics: a case-control study

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Abstract.

Objective
Determination of personality characteristics associated with tinnitus in ENT patients compared to a control group of ENT patients without tinnitus.

Material and methods
We assessed adult chronic tinnitus sufferers (n = 265) and ENT patients without tinnitus (n = 265) participating in a cross-sectional study. Personality characteristics were evaluated using the DS14 (type-D [distressed] personality) questionnaire. The revised Eysenck Personality Questionnaire (EPQ-R) was used to assess neuroticism (EPQ-N) and extraversion (EPQ-E). Emotional stability was assessed on a subscale of the Five-Factor Personality Inventory (FFPI-ES).

Results
Compared to the controls, tinnitus patients had statistically significant and clinically relevant higher levels of neuroticism, negative affectivity and social inhibition, as well as lower levels of extraversion and emotional stability. Tinnitus patients were more likely to have a type-D personality.
Confirmative factor analysis was used to test the validity of the type-D construct in our population; the hypothesized model showed a good fit to the data.
In multivariate analysis, the personality traits neuroticism (OR: 1.08; 95% CI: 1.00–1.17), emotional stability (OR: 1.02; 95% CI: 1.00–1.04), and extraversion (OR: 0.89; 95% CI: 0.83–0.96) were associated with tinnitus but the odds ratios were difficult to interpret. The odds ratio of tinnitus increased twofold when type-D personality was entered as the last step of the model and as indicated by the -2 log-likelihood function, the level of prediction of the model improved with type-D personality in the final step of the model ($\chi^2 = 5.066 \, [df = 1], \, p = 0.02$).

Conclusions
Neuroticism, reduced extraversion and reduced emotional stability are associated with tinnitus, but the prediction level of the model improved with the addition of type-D personality to the single traits. This might indicate that personality characteristics, and type-D personality in particular, are associated with having tinnitus and might contribute to its perceived severity.
Introduction

Subjective tinnitus is an auditory perception of phantom sound in the absence of an acoustic stimulus. As a consequence of a reduced afferent input, neural plastic processes generate tinnitus in the central parts of the auditory system. Tinnitus is a common and disturbing condition reported by 10-20% of the general population (1;2). In a sample of 1275 subjects across 11 countries, the overall prevalence of tinnitus was 11%, with a higher prevalence in patients with somatization disorder (42%) or hypochondrial disorder (27%) (3). Tinnitus is more prevalent in males than females and its occurrence seems to increase with advancing age (1;2;4). Perceived tinnitus severity affects patients’ quality of life, including physical, emotional and social functioning, and induces psychological distress, such as anxiety and depression (3;5-11). However, not all patients with tinnitus experience the same levels of distress and the same impairments to quality of life as personality characteristics are likely to play an important mediating role.

Personality factors, including neuroticism and extraversion, assessed prior to the onset of tinnitus have been shown to predict the development of perceived tinnitus (9). Personality characteristics previously described to be associated with tinnitus include hysteria and hypochondriasis (5;7;12), neuroticism (9;13;14), lower levels of extraversion (9;13;14), withdrawal (5;15), emotional isolation (15), and psychasthenia (16;17). Psychasthenia refers to feelings of low self-esteem, anxiety, heightened sensitivity, moodiness and the inability to resist undesired maladaptive behaviours. In addition, the use of particular cognitive strategies, such as catastrophic and dysfunctional thinking, that increase patients’ emotional distress and perceived tinnitus severity may also be attributed to personality factors (6;18). Although the role of personality factors in tinnitus has been examined extensively, these studies have focused on single traits rather than a combination of traits.

In order to investigate which personality characteristics distinguish help-seeking tinnitus sufferers from general ear, nose and throat (ENT) patients without tinnitus, we examined the following personality traits: neuroticism, extraversion, emotional stability and type-D personality. Type-D patients tend to experience increased negative emotions and generally feel sad and have a gloomy view of life. This is paired with the tendency not to share these emotions with others due to fears of how others may react (19). Consequently, type-D patients have fewer personal ties in general and hence often lack social support (19;20). The type-D construct was developed in patients with ischemic heart disease and was validated across groups with cardiovascular disease. However, there is increasing evidence that patients with this personality taxonomy are high-risk patients as type-D has been associated with a wide range of emotional distress (e.g. anxiety, depression and post-traumatic stress disorder), impaired quality of life and health status, lower level of social support and increased risk of mortality and morbidity, all independent of demographic and clinical risk factors, including disease severity (21-23). In other words, type-D personality seems to play a modulating role in health-related functional status, quality of life and clinical, patient-based outcomes. The influence of type-D
personality on health outcomes cannot be attributed to these patients being more severely ill (24-26). This may also extend beyond cardiovascular disease to other chronic conditions, such as tinnitus.

The objectives of this study were to investigate (1) whether the personality characteristics of neuroticism, extraversion, emotional stability and type-D personality were more or less prevalent in patients with tinnitus, as compared to ENT patients without tinnitus, and (2) whether type-D personality could be a discriminating factor between tinnitus and ENT patients, adjusting for neuroticism, extraversion and emotional stability. Since the type-D construct was developed and validated only in groups with cardiovascular disease, it was necessary to test the measurement model of this personality trait among tinnitus patients and controls prior to multivariate comparisons. In order to confirm the assessment of the hypothesized dimensions of the type-D personality trait among tinnitus sufferers, we further tested the hypothesis that (3) there is support for the separation of negative affectivity and social inhibition, subjecting the items from the type-D questionnaire (DS14) to confirmatory factor analysis.

Material and methods

Patients and design

Consecutive chronic subjective tinnitus sufferers (n = 265) and consecutive ENT patients without tinnitus (n = 265) seen at the Department of Otorhinolaryngology of the University Medical Center Groningen, the Netherlands, were included in the current study. Tinnitus sufferers aged ≥ 20 years were included, provided that they were consulting our clinic because of their tinnitus. They were all suffering from chronic tinnitus, defined as duration longer than three months. Tinnitus patients were excluded if tinnitus was not the main reason for consulting our clinic, or if they had objective tinnitus (determined by means of a diagnostic protocol for tinnitus) or chronic disease co-morbidity.

The controls were selected from patients aged ≥ 20 years visiting the otorhinolaryngologist. Eligible patients were subjects with non-severe or mild illnesses (e.g. mild hearing loss, sinusitis, gastrointestinal reflux, laryngitis, mild vertigo, hoarseness, etc.) or subjects with acute minor health complaints (e.g. small traumata, acute ear or sinus infections, nose bleeds, etc.). Subjects with a co-morbidity of any chronic disease affecting health-related functioning were excluded in order to select a sample that approximated the normal population. After examination by the otorhinolaryngologist, patients were excluded if they had a chronic disease (e.g. diabetes mellitus, chronic heart failure, rheumatoid arthritis, multiple sclerosis, Parkinson’s disease or COPD) or any clinical sign indicating the presence of subjective or objective tinnitus.

The study protocol was approved by the local medical ethics committee and all patients provided written informed consent.
Measures

Demographic variables
Age and gender were used as reported by patients in the questionnaire. Marital status or living arrangement was defined as: (1) living with a partner, (2) living alone. Educational status was defined as: (1) elementary schooling, (2) lower secondary schooling, (3) upper secondary schooling, (4) higher professional training, and (5) college/university education. Work status was defined as: (1) working and (2) not working (housewives were classified as working; retired persons were classified as not working).

Measures of personality traits
Personality traits were measured by means of self-rating questionnaires filled in by the subjects in private. We chose self-rating questionnaires to avoid the information bias (e.g. socially desirable responses) that might occur during personal interviews conducted by the otorhinolaryngologist in charge of the subject’s medical examination and treatment (unfortunately, the ENT clinic does not employ a health psychologist). We asked subjects to answer the questionnaire at home and, in order to comply with the informed consent condition of protecting the patient’s privacy, we also asked subjects to return their sealed questionnaires to the trial centre and not the outpatient clinic.

Neuroticism and extraversion
The neuroticism (EPQ-N) and extraversion (EPQ-E) scales were selected from the revised Eysenck Personality Questionnaire (EPQ-R) (27), using the certified Dutch translation of this questionnaire (28). Both the EPQ-N and the EPQ-E scales consisted of 12 items with a response scale of 1 (yes) and 0 (no). Scores are summed to yield a total score, which for the EPQ-N and EPQ-E ranges from 0-12. Higher scores indicate a higher degree of neuroticism or extraversion. The neuroticism scale of the Eysenck Personality Questionnaire (EPQ-N) assesses the general tendency to over-responsiveness or over-reactivity (neuroticism) with high values predisposing individuals to high levels of negative affect, such as worrying, moodiness, depression and anxiety. The low EPQ-N individual may be called “stable” and is usually even-tempered and controlled. High values on the EPQ-E scale predispose to high levels of sociability, positive affect and need for external stimulation. The person tending to be extrovert is carefree, easygoing and usually quite optimistic, whereas the person with introvert characteristics appears reserved and cautious. The EPQ-N and EPQ-E were assessed in seven Dutch studies (28) and showed on average strong levels of internal consistency with Cronbach’s alpha = 0.84 and 0.81, respectively.

Type-D personality
Type-D personality was assessed with the Type-D Scale (DS14) (19). The scale consists of 14 items that are answered on a five-point Likert scale from 0 (false) to 4
Personality characteristics

Type-D personality characterizes those who tend to experience increased negative emotions and who do not express these emotions in social interactions. The DS14 consists of the subscales negative affectivity (NA: seven items; e.g., “I often feel unhappy”) and social inhibition (SI: seven items; e.g., “I am a ‘closed’ person”). A standardized cut-off at ≥ 10 on both subscales indicates the case of type-D personality (29). The DS14 has adequate reliability with Cronbach’s alpha = 0.89 / 0.88 and three-month test-retest reliability of \( r = 0.72/0.82 \) for the DS14-NA and the DS14-SI subscales, respectively (19).

**Emotional Stability (FFPI-ES)**

Emotional Stability (FFPI-ES) was assessed with a subscale of the Five-Factor Personality Inventory (FFPI) (30-32). The ES scale consists of 20 items, with ten items each representing either the positive pole or the negative pole of this personality trait. Negative/positive items are reversed, such that lower scores indicate a higher level of stability. Patients indicated per item the extent to which the trait was applicable to them on a five-point Likert scale from 1 (not at all applicable) to 5 (entirely applicable). Emotionally stable people can take their minds off their problems, readily overcome setbacks, tend always to be in the same mood, do not invent problems for themselves and are not often overwhelmed by emotions (31). To avoid any response bias which may have arisen from experiencing tinnitus, for subjects diagnosed as having tinnitus, the general instruction was preceded by a situation-specific instruction: “Please do not let your answers be influenced by your current condition resulting from your illness or by any other reason for having been referred to the hospital.” The reliability and construct validity of this instrument has been well established (32-34). In previous studies the FFPI emotional stability scale showed satisfactory levels of internal consistency with Cronbach’s alpha ranging from 0.81 to 0.85. (31;32;35).

**Statistical analysis**

Discrete variables were compared using the chi-square test (Fisher’s exact test when appropriate, the difference of proportions test (36)) and are presented as numbers and percentages. Continuous variables were normally distributed (Shapiro Wilk, \( p > 0.05 \)), and were therefore compared with the Student t-test and are presented as means ± SD. In the case of multiple comparisons, we used the Bonferroni correction. Effect sizes (ES) were calculated only for the statistically significant results, since differences between groups that are due to sample fluctuation have no clinical relevance. Cohen’s ES “d” for unrelated samples was used to estimate the magnitude of the difference between two groups (mean difference score/the pooled standard deviation). According to Cohen’s thresholds, an ES of \(< 0.20\) indicates a trivial difference, an ES of \(≥ 0.20 \) to \(< 0.50\) a small difference, an ES of \(≥ 0.50 \) to \(< 0.80\) a moderate difference and ES \(≥ 0.80\) a substantial difference (37). For differences in proportions, Cohen’s effect size statistic “w” was used with threshold of \(< 0.10\) for trivial, \(> 0.10\) to \(< 0.30\) for small, \(> 0.30\) to \(< 0.50\) for medium and \(> .50\) for large differences. All statistical tests were two-tailed. A value of \( p < 0.05 \)
was used for all tests to indicate statistical significance. All statistical analyses were performed using SPSS 13.0.1 for Windows.

Since the DS14 was being used for the first time in tinnitus patients, confirmative factor analysis (CFA) was applied to test the construct validity of the NA and SI subscales. Previous studies investigating the factor structure of the DS14 have used exploratory factor analysis (EFA) rather than CFA (19;38;39). Confirmation of the hypothesized factor structure of NA and SI components is most adequately established by using CFA, which is a special type of structural-equation modelling (e.g., Bentler, 1989; Joreskog & Sorbom, 1989) (40;41). In CFA, the factor structure is explicitly hypothesized and is tested for its fit with the observed covariance structure of the measured variables. CFA can be used to compare the equivalence of factor structures in different samples (42;43). As such, CFA is more appropriate than EFA for assessing the replicability of the DS14 two-factor model across different samples. CFA also offers a wide variety of statistical tests and indices designed to assess the “goodness-of-fit” of identified models; thus, it provides a straightforward evaluation of the proposed factor/theoretical structure of the DS14. Model fit was assessed using multiple criteria as suggested by Bentler and Bonett (44): (a) non-significant $\chi^2$ indicating that a non-significant amount of variance in the data remains unexplained; however, a statistically significant $\chi^2$ can often be produced as an artifact of sample size and of small variations in the data (45), (b) normed fit index (NFI), (c) non-normed fit index (NNFI), (d) comparative fit index (CFI), and (e) the root mean square error of approximation (RMSEA). The NFI, NNFI and CFI fit indices indicate the extent to which the results fit the model that is being explored, with a value $> 0.9$ conventionally being adopted as evidence for a satisfactory fit (46;47). An RMSEA with values of less than 0.08 indicates a good fit to the data (48), while values greater than 0.10 suggest strongly that the model fit is unsatisfactory (49;50). The CFI and RMSEA were used because it has been argued that they provide more stable and accurate estimates than several of the other fit indices (49;50).

Initial analyses showed that the model fit would be improved if a correlation between the latent variables was allowed, and so all analyses presented allow for this correlation. CFA was performed using LISREL (40).

The reliability of all scales was examined with Cronbach’s alpha ($\geq 0.70$ was considered sufficient) (51;52). However, since Cronbach’s alpha is dependent on the number of items in the scale, one can achieve a high reliability estimate by having either many items or highly inter-correlated items (or a combination of the two) (53). Thus, Cronbach’s alpha is essentially a function of two parameters: the number of scale items and the mean inter-item correlation (MIIC) among the items (54). The degree of inter-item correlation is a straightforward indicator of internal consistency, while the number of items is entirely irrelevant. According to the guidelines by Briggs and Cheek (55), the MIIC should fall in an optimal range between 0.20 and 0.50, but should not be less than 0.15 (53;56). Therefore, taking the upper value of the range, an MIIC $\geq 0.25$ seems reasonable. When estimating the internal consistency of the scales, the following criteria were used: Cronbach’s alpha.
coefficient $\geq 0.70$ and $\leq 0.90$; MIIC $\geq 0.25$. Scales with an alpha $< 0.70$ and a MIIC $< 0.25$ were removed.

With tinnitus and non-tinnitus as the binary dependent variables, all demographic characteristics and personality traits were entered as independent variables into a forward-directed, step-wise multiple logistic regression analysis to define those personality traits that were assumed to be independently associated with tinnitus (as compared to non-tinnitus) and that would allow us to correctly separate both groups. A p-value of 0.05 was used as the cut-off for sequentially entering and removing each variable.

In the first step we entered age, education, gender, marital status (partner vs no partner), work status (working vs not working), neuroticism, extraversion and emotional stability into a multivariate model. In the second step of the analysis we investigated with the -2 log-likelihood statistic (-2LL) whether adding the type-D personality indicator to the model would improve the predictive power of the model. We report the odds ratios (ORs) with 95% confidence intervals (CIs) and applied the Hosmer-Lemeshow test to evaluate the model calibration.

Results

Patient characteristics
Sociodemographic characteristics, stratified by tinnitus group vs. control group, are presented in Table 1. Tinnitus patients were statistically significantly older but this difference was small in size (ES = 0.38) and comprised more males (69.8% vs. 50.6%) than in the control group, which was a small difference in proportion (ES = 0.20). In addition, tinnitus patients were more likely to be married or have a partner (88.3% vs. 78.1%), but were less likely to be working (52.1% vs. 75.0%) than the controls. These differences in proportions were also small in magnitude. The proportion of subjects with primary schooling was higher among tinnitus patients than the controls, 38.1% vs. 27.4% (95% CI: 2.5–18.8%). In contrast, the proportion of patients with lower schooling was statistically significantly over-represented among the controls compared to the tinnitus population (34.4% vs. 25.9%; 95% CI: 16.4–0.04%). A comparison of gender and age distributions between the control group and the Dutch population showed no statistically significant differences to figures published by Statistics Netherlands.

The response to the invitation to fill in the questionnaire was 97% in the tinnitus group and 93% in the control group. Non-responders did not deviate in age, gender, marital status, working status and education status in any statistically significant way from the patients in our sample groups.

Confirmatory factor analysis of the DS14
Results of the CFA indicated satisfactory separation of NA and SI for tinnitus and non-tinnitus, as indicated by the five a priori criteria (Table 2). In each sample, the chi-square goodness-of-fit test was not statistically significant and all indices,
including the CFI, NFI, NNFI (> 0.9) and RMSEA (< 0.06), indicated a good fit for
the model in our study population. This suggests that the DS14 consists of two one-
dimensional subscales, which was confirmed in both tinnitus patients and controls.

Table 1. Sociodemographic patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Tinnitus (n = 265)</th>
<th>Controls (n = 265)</th>
<th>P</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>55.38 ± 11.3</td>
<td>50.46 ± 14.42</td>
<td>.0001</td>
<td>d = 0.38</td>
</tr>
<tr>
<td>Males</td>
<td>185 (69.8%)</td>
<td>134 (50.6%)</td>
<td>.0001</td>
<td>w = 0.20</td>
</tr>
<tr>
<td>Females</td>
<td>80 (30.2%)</td>
<td>131(49.4%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/living with partner</td>
<td>234 (88.3%)</td>
<td>207(78.1%)</td>
<td>.001</td>
<td>w = 0.14</td>
</tr>
<tr>
<td>Unmarried, widowed, divorced</td>
<td>31 (11.7%)</td>
<td>58 (21.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Working status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>137 (52.1%)</td>
<td>198 (75.0%)</td>
<td>.0001</td>
<td>w = 0.24</td>
</tr>
<tr>
<td>Not working</td>
<td>126 (47.9%)</td>
<td>66 (25.0%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

95% Confidence Interval³

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Tinnitus (n=247)</th>
<th>Controls (n=259)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary schooling</td>
<td>94 (38.1%)</td>
<td>71 (27.4%)</td>
<td>2.5</td>
<td>18.8%</td>
</tr>
<tr>
<td>Lower schooling</td>
<td>64 (25.9%)</td>
<td>89 (34.4%)</td>
<td>-16.4</td>
<td>-.04%</td>
</tr>
<tr>
<td>Secondary schooling</td>
<td>68 (27.5%)</td>
<td>70 (27.0%)</td>
<td>-7.3</td>
<td>8.3%</td>
</tr>
<tr>
<td>Higher professional training</td>
<td>8 (3.2%)</td>
<td>9 (3.5%)</td>
<td>- 3.4</td>
<td>2.9%</td>
</tr>
<tr>
<td>College education/university</td>
<td>13 (5.3%)</td>
<td>20(7.7%)</td>
<td>- 6.7</td>
<td>1.8%</td>
</tr>
</tbody>
</table>

1. Student’s T-test; 2. Fisher exact test; 3. Difference of proportions test. d = effect size for mean differences; w = effect size for differences in proportions. A Bonferroni correction was applied to all tests to adjust for multiple comparisons, with P<.01 (0.05/4) indicating statistical significance.

Table 2. Confirmatory factor analysis for the DS14: negative affectivity and social inhibition as separate constructs

<table>
<thead>
<tr>
<th>Population</th>
<th>χ²</th>
<th>df</th>
<th>p</th>
<th>NFI</th>
<th>NNFI</th>
<th>CFI</th>
<th>RMSEA</th>
<th>90% CI for RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinnitus</td>
<td>62.19</td>
<td>48</td>
<td>0.08</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
<td>0.033</td>
<td>0.00 – 0.055</td>
</tr>
<tr>
<td>Non-tinnitus</td>
<td>57.08</td>
<td>48</td>
<td>0.17</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
<td>0.027</td>
<td>0.00 – 0.050</td>
</tr>
<tr>
<td>Total sample</td>
<td>52.46</td>
<td>48</td>
<td>0.31</td>
<td>0.99</td>
<td>1.00</td>
<td>1.00</td>
<td>0.013</td>
<td>0.00 – 0.032</td>
</tr>
</tbody>
</table>

NFI = normed fit index; NNFI = non-normed fit index; 3 = CFI = comparative fit index; RMSEA = root mean square error of approximation
Reliability of personality measures
In the current study, the NA and SI scales yielded Cronbach’s coefficient alphas of 0.90 and 0.87 in tinnitus patients and 0.82 and 0.87 in controls, respectively. In the total sample, the internal consistency estimates were 0.91 and 0.88 for NA and SI, respectively. The homogeneity of the NA and SI subscales was also confirmed by the mean inter-item correlations (MIIC): NA = 0.50 in the tinnitus sample and 0.41 in controls; SI = 0.49 in both tinnitus and controls. Within the total sample of tinnitus and controls, MIICs of 0.52 and 0.51 were found for the NA and SI subscales, respectively, all of which are within the optimal range of between 0.20 and 0.50.

The EPQ-N neuroticism scale yielded Cronbach’s alphas of 0.84 (MIIC = 0.32) and 0.86 (MIIC = 0.34) in the tinnitus and control group, respectively. The EPQ-E extraversion scale showed sufficient internal consistency with alphas of 0.87 (MIIC = 0.27) and 0.90 (MIIC = 0.35) in the tinnitus and control group, respectively. Emotional stability yielded Cronbach’s alphas of 0.93 (MIIC = 0.29) and 0.91 (MIIC = 0.29) in the tinnitus and control group, respectively.

Bivariate analysis of personality traits between tinnitus patients and controls
Table 3 describes the mean standard deviations, p-values and effect sizes of the different personality traits assessed in both groups. Compared to the controls, tinnitus patients had, on the one hand, statistically significant (p < 0.05) and clinically relevant (ES > 0.20) higher levels of neuroticism, negative affectivity and social inhibition, and, on the other hand, lower levels of extraversion and emotional stability. In addition, tinnitus patients were more likely to have a type-D personality than the controls (Fisher’s exact test, one degree of freedom; 35.5% vs 10.6%; p < 0.001).

Table 3. Differences in personality traits between tinnitus patients and controls

<table>
<thead>
<tr>
<th>Personality characteristic</th>
<th>Tinnitus</th>
<th>Control</th>
<th>p-value</th>
<th>Effect Size</th>
<th>95% CI for ES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>sd</td>
<td>Mean</td>
<td>sd</td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>5.83</td>
<td>3.50</td>
<td>8.14</td>
<td>3.12</td>
<td>.0001</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>50.93</td>
<td>13.26</td>
<td>42.75</td>
<td>12.06</td>
<td>.0001</td>
</tr>
<tr>
<td>Negative affectivity</td>
<td>13.18</td>
<td>7.32</td>
<td>6.20</td>
<td>4.85</td>
<td>.0001</td>
</tr>
<tr>
<td>Social inhibition</td>
<td>10.37</td>
<td>6.49</td>
<td>6.68</td>
<td>5.33</td>
<td>.0001</td>
</tr>
</tbody>
</table>

Type-D

<table>
<thead>
<tr>
<th>No type - D</th>
<th>Tinnitus</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>171 (64.5%)</td>
<td>237 (89.4%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type – D</th>
<th>Tinnitus</th>
<th>Control</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>94 (35.5%)</td>
<td>28 (10.6%)</td>
<td></td>
<td>0.001²</td>
</tr>
</tbody>
</table>

17.9% 31.6%
Bonferroni correction was applied to all tests to adjust for multiple comparisons, with $P<0.008$ (0.05/6) indicating statistical significance.

**Logistic regression analysis**

In the step-wise multiple logistic regression, four personality traits and five personal demographic characteristics were entered in the first step of the model to define those demographic and personality factors that are associated with tinnitus and may therefore contribute to a correct classification of patients with tinnitus. The results of this logistic regression analysis are summarized in Table 4.

Multivariable logistic regression was used to identify personality traits as determinants of tinnitus. Gender (male) showed the strongest association (odds ratio: 2.03, 95% CI: 1.32–3.13, $p = 0.001$), while working status and living with a partner both showed a significant association with tinnitus (odds ratio for working: 0.55, 95% CI: 0.34–0.89, $p = 0.01$; odds ratio for marital status: 0.47, 95% CI: 0.27–0.84, $p = 0.01$).

The personality traits neuroticism (OR: 1.08; 95% CI: 1.00–1.17), poor emotional stability (OR: 1.02; 95% CI: 1.00–1.04), and a low level of extraversion (OR: 0.89; 95% CI: 0.83–0.96) were associated with tinnitus. Note that the estimated odds ratios of these personality traits are very close to one, which is relatively hard to interpret. However, the odds of tinnitus increased twofold when type-D personality was entered in the last step of the model. Furthermore, we investigated whether adding type-D personality in the last step of our model, which also included demographic characteristics, neuroticism, extraversion and emotional stability, actually improved the level of prediction for tinnitus. All personality traits were associated with tinnitus, but as indicated by the -2 log-likelihood function, the level of prediction of the model improved significantly with the addition of type-D personality ($\chi^2 = 5.066$ [df = 1], $p = 0.02$). Comparison of the number of patients actually classified in each group with the number predicted for each group was evaluated with the Hosmer-Lemeshow statistic, producing a non-significant chi-square for each model. The Hosmer-Lemeshow statistic for the model was 7.79 ($p = 0.35$), indicating a good fit.
Table 4. Multivariate logistic regression analysis: predictors of tinnitus status

<table>
<thead>
<tr>
<th>Variable (in order of entry)</th>
<th>Regression coefficient B</th>
<th>Standard Error</th>
<th>Wald</th>
<th>p-value</th>
<th>OR</th>
<th>95 % CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>0.710</td>
<td>0.220</td>
<td>10.360</td>
<td>.001</td>
<td>2.03</td>
<td>1.32-3.13</td>
</tr>
<tr>
<td>Age</td>
<td>0.004</td>
<td>0.009</td>
<td>0.153</td>
<td>.70</td>
<td>1.00</td>
<td>0.99-1.02</td>
</tr>
<tr>
<td>Working</td>
<td>-0.606</td>
<td>0.248</td>
<td>5.981</td>
<td>.01</td>
<td>0.55</td>
<td>0.34-0.89</td>
</tr>
<tr>
<td>Higher education</td>
<td>0.010</td>
<td>0.053</td>
<td>0.040</td>
<td>.84</td>
<td>1.01</td>
<td>0.91-1.12</td>
</tr>
<tr>
<td>Married/having a partner</td>
<td>-0.743</td>
<td>0.292</td>
<td>6.468</td>
<td>.01</td>
<td>0.47</td>
<td>0.27-0.84</td>
</tr>
<tr>
<td>Personality traits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>0.079</td>
<td>0.039</td>
<td>4.071</td>
<td>.044</td>
<td>1.08</td>
<td>1.00-1.17</td>
</tr>
<tr>
<td>Extraversion</td>
<td>-0.114</td>
<td>0.035</td>
<td>10.713</td>
<td>.001</td>
<td>0.89</td>
<td>0.83-0.96</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>0.022</td>
<td>0.010</td>
<td>4.447</td>
<td>.035</td>
<td>1.02</td>
<td>1.00-1.04</td>
</tr>
<tr>
<td>Type-D personality</td>
<td>0.692</td>
<td>0.312</td>
<td>4.937</td>
<td>0.03</td>
<td>2.00</td>
<td>1.09-3.68</td>
</tr>
</tbody>
</table>

Discussion

The results of our study show that the traits of neuroticism, extraversion, emotional stability and type-D personality are factors capable of distinguishing help-seeking tinnitus patients from general ENT patients without tinnitus. Tinnitus patients had higher scores on all single traits and were more likely to have a type-D personality.

The results of the multivariate model showed that all personality traits were associated with tinnitus, but whilst the level of prediction of the model improved with the addition of type-D personality to the single traits of neuroticism, extraversion and emotional stability, the odds ratios of these personality traits are very close to one and therefore hard to interpret. The odds ratios of the tinnitus group increased twofold when type-D personality was entered into the model in the last step and, as indicated by the -2 log-likelihood function, the level of prediction of the model improved significantly with the addition of type-D personality.

It was not the purpose of this study to assess differences in personality traits among tinnitus patients stratified by disease duration or severity but to compare a convenient sample of help-seeking tinnitus patients with a control group that approximated the normal healthy population. The subjects in the control group consulted our outpatient clinic for non-severe, mild or acute illnesses but showed no sign of having tinnitus or any chronic disease affecting health-related functioning. In using these patients as controls, we tried to create a group comparable to the general population. The medical reasons why the controls visited our outpatient clinic may
arise in any healthy person (nose bleeds, acute ear infections or sinusitis, mild hearing loss, mild vertigo, etc).

Although we tried to employ group matching on age and gender, matching was not successful as tinnitus and controls differed in these characteristics. More reliable and valid results may have occurred if cases had been individually matched to controls. Matching on disease duration would lead to selection bias as controls were selected on having mild and acute symptoms in order to approximate a normal population. Nevertheless, the results of this study may be biased by an overrepresentation of those help-seeking subjects who suffer from tinnitus during many years. This is a weakness of this study. On the other hand, the higher prevalence of male subjects and older age among tinnitus patients compared to the general population, is in accordance with the results of other studies (1;57;58).

However, the p-value indicates the obtained probability of a Type I error in a test of statistical significance (and rejecting the null-hypothesis) which does not imply automatically that the difference regarding age, gender, marital status and working status between the samples of tinnitus patients and controls was important in any way. For example, in large samples, small or trivial differences are likely to become statistically significant and differences between tinnitus and control that are not due to sampling error were not very different but small according to standardized indices of differences between groups (effect sizes).

Comparable results were found by Holgers (11), who found that 22.8% had been absent from work due to their tinnitus. The negative influence of tinnitus on concentration, compounded by sleeplessness and fatigue, may explain this difference. Estimating the importance of these differences in the current study, we may conclude that differences between the tinnitus group and controls, not due to sampling error (p < 0.05), were not very different but small in size according to standardized indices of differences between groups (effect sizes). Comparing gender and age distributions in the control group with census data from the Dutch population (59), any differences to the figures published by Statistics Netherlands were not statistically significant. Therefore, external validity may not be seriously hampered by unacceptably large differences according to Cohen’s thresholds for differences in means and proportions (60). More reliable and valid results may have occurred if the subjects had been individually matched to controls.

Of the four personality characteristics investigated in our study, only neuroticism and extraversion have been assessed in previous studies of tinnitus patients. Other studies evaluating neuroticism in tinnitus sufferers also found a significant positive correlation between neuroticism and perceived tinnitus severity (9;13;14) except for Wilson et al. (61). Similarly, some (9;13) but not all studies (14) found significant inverse correlations between reduced extraversion and perceived tinnitus severity. To our knowledge, this is the first study to examine the role of emotional stability in tinnitus, whereas previous studies have predominantly described the personality trait of emotional stability as part of a personality profile, for example, the psychoticism component of the PSY-5 scale of the Minnesota
Multiphasic Personality Inventory (MMPI) (5;15). This psychoticism component of the MMPI also includes increased levels of social introversion, anxiety, internal conflict, withdrawal, emotional isolation and nonconformity; significantly elevated scores on this personality disposition were found in two studies (5;15).

Since the four scales of the EPQ-R are not subscales that need to be summed in order to constitute one composite scale, we can justify selecting only the scales of neuroticism and extraversion, and excluding psychoticism and social desirability. However, as the sequence of items listed in the questionnaire may have affected the responses to the items, differences with the outcomes of other studies may have occurred. To avoid this item-response bias, it might have been better to have used the brief version (EPQ-BV) (62) which involves only the two scales of neuroticism and extraversion. Furthermore, we also skipped four of the five FFPI scales), basing our decision to do so on the ethical principle of not wanting to place an unnecessary burden on patients by asking too many questions (FFPI, k = 100) about personality characteristics deemed less relevant to tinnitus (agreeableness, conscientiousness, openness or autonomy).

The results of the CFA in our study unambiguously confirmed that the type-D scale fits the hypothesized model, confirming the validity of the measure. This validity was previously evaluated only in patients with cardiovascular diseases. The results of our study show that the prevalence of type-D personality is significantly higher among our help-seeking tinnitus patients than in the control group.

Furthermore, since there is no consensus on whether personality traits are associated with tinnitus, a heterogeneous set of measures was used in previous studies, including the normal or short version of the MMPI (5;7;15;17;63-65), the EPQ (9;13;14;61), and the DSM-III-R or DSM-IV classifications for psychiatric disorders (7;10;66-69). This heterogeneity of measures makes comparisons between studies difficult and inhibits systematic review. We chose to apply self-rating questionnaires to avoid information bias arising in interviews conducted personally by the otorhinolaryngologist in charge of the subjects’ medical examination and treatment (subjects may have felt required to give socially desirable responses). A disadvantage of this assessment procedure may have been the time subjects needed to answer and return the questionnaire, which may have led to a longer response time compared to the immediate response to questions posed by an interviewer. Another bias may have been the opportunity to communicate about items with significant others such as the partner or close friends.

In this study we used both the Eysenck Neuroticism Scale and the FFPI Emotional Stability Scale to target and assess the same feature (emotional stability). However, we initially intended to explore the potential roles of the negative and positive poles of this personality trait, which was not appropriate according to the developers of these measures. Interestingly, our results do not confirm the overlap of these constructs, although this was not the major focus of this study.

Since the evaluation of personality characteristics, and the type-D personality profile in particular, might explain why some tinnitus sufferers may
experience more problems as compared to others, and why some patients seek help, examination of personality characteristics seems a relevant factor in taking the history of tinnitus patients. In combination with anxiety and depression assessment, measuring type-D personality could help ENT practitioners determine who should be referred for psychological assistance early on in the evaluation and treatment of tinnitus, instead of after years of suffering.

The cause and effect relationship between perceived tinnitus severity and personality characteristics remains interesting but unexplained. Two major difficulties arise in relation to this debate. First, in the current study, tinnitus was already present at the moment of consultation and it was difficult to take any pre-existing personality characteristics. Second, since our tinnitus patients were recruited because they had come to our clinic for their tinnitus, they were likely to be more distressed than the overall tinnitus population consisting of a mixture of help-seeking and non-help-seeking individuals. Therefore, our tinnitus study population may not represent the whole tinnitus population, indicating that the results of our study may be generalized only to the help-seeking tinnitus population.

In conclusion, this study found that help-seeking tinnitus patients had a tendency to be significantly more neurotic, less emotionally stable and less extravert than the general ENT population without tinnitus (comparable with the Dutch population in terms of age and gender), and these tinnitus patients had a significantly higher prevalence of the type-D (distressed) personality.
Reference List


Personality characteristics


