The PHQ2 as a Routine Mental Health Screening Tool for Tinnitus Patients

Background

“Mental health” (MH) specifically refers to the quality of emotional, psychological and social well-being that determines how well an individual copes with the stressors that define the human experience (US Dept of Health and Human Services, 2014).

Imaging studies reveal that there is significant overlap among brain centers responsible for mental health-related distress and tinnitus-related distress (Langguth & Landgrebe, 2011). It therefore is not surprising that many individuals with tinnitus have coexisting mental health disorders and that tinnitus patients with coexisting mental health disorders experience greater tinnitus-related disturbance than those without. (Benton, 2011). Because of the significant bi-directional relationship between mental health and tinnitus (Folmer et al, 2008), routine mental health screening of tinnitus patients has been recommended.

Progressive Tinnitus Management (PTM) is a five-level hierarchical process for the identification and provision of the least intensive tinnitus management sufficient to provide the patient adequate relief. Recent studies have indicated that as the need for more intensive tinnitus management services increases, the prevalence of mental health disorders also increases. In fact, one study has shown that only 40% of patients whose tinnitus-management needs were met by actions associated with PTM Level 2 (Audiological Assessment) had at least one co-existing mental health diagnosis compared to 85% of veterans who required the use of specific sound therapies for tinnitus management (PTM Level 5, Individualized Support). In the
same study, 33% of tinnitus patients who attended PTM Level 3 (Group Education) expressed suicidal ideation related to their tinnitus.

The Patient Health Questionnaire, or PHQ9 (Kroenke et al, 2001) is a concise, self-administered 9-item screening tool for depression designed to improve the recognition rate of depression, thus facilitating diagnosis and treatment. The PHQ9 specifically is recommended for use by non-mental health providers. PHQ9 scores of 8-11 or higher (out of a possible maximum score of 27) indicate need for MH referral (Manea et al, 2012), depending on the population. The PHQ9 includes a question about feelings of sadness/depression: “In the past two years, have you felt depressed or sad on most days, even if you felt okay sometimes?” A similar sadness question (“Do you often feel sad or depressed?”) demonstrated reasonable sensitivity and specificity to depression in both stroke patients and multiple sclerosis patients (Watkins et al, 2001; Avasarala et al, 2003). PHQ9 scores have demonstrated strong and significant correlations to both the Tinnitus Reaction Questionnaire, or TRQ (n = 82, \( r = .785 \) \( p < .001 \)), and the Tinnitus Functional Index, or TFI (n = 80, \( r = .699 \), \( p < .001 \)). PHQ9 scores also are strongly correlated to scores on the Self-Efficacy for Managing Reactions to Tinnitus (SMRT) questionnaire (n = 45, \( r = -.699 \), \( p < .001 \)).

The PHQ2 score, calculated from responses to the first two PHQ9 items, has demonstrated reliability and validity similar to the PHQ9 score (Kroenke et al, 2003). PHQ2 scores of 3 or higher indicate need for mental health care referral. Yano et al (2012) reported that the PHQ2 yielded 20.1% positive depression screens in a group of 10,929 US veterans.
Method

We examined whether the PHQ2 score and/or the single PHQ9 Sadness Question could be used for routine MH screening of tinnitus patients. PHQ9 scores, PHQ2 scores and PHQ9 Sadness Question responses were extracted from questionnaires completed by 212 tinnitus subjects. The questionnaires also included either the Tinnitus Reaction Questionnaire, TRQ (Wilson et al, 1991), or the Tinnitus Functional Index, TFI (Meikle et al, 2012). All subjects provided estimates of the percentage of waking hours that they were merely aware of the tinnitus (Awareness %) and the percentage of time they were aware of the tinnitus that it was disturbing (Disturbance %). We evaluated the relationships among the PHQ9, the PHQ2 and the above measures of tinnitus distress. We also calculated the sensitivity, specificity, and positive predictive values of the PHQ2 score, the PHQ9 Sadness Question and combinations of the two measures to the reference standard: PHQ9 scores of 11 or higher, the criterion for MH referral.

Results

Simple correlations were calculated between PHQ9 scores and both TRQ scores (n = 104, $r = 0.78, p < .001$) and TFI scores (n = 70, $r = 0.692, p < .001$). The strength and direction of these relationships are shown in Figure 1.
Figure 1. The strength and direction of relationships between PHQ9 scores and both TRQ and TFI scores.

PHQ2 scores then were compared to PHQ9 scores. Not surprisingly, there was a strong and significant correlation between PHQ2 scores and PHQ9 scores ($r = 0.87$, $p < .001$): PHQ9 scores increased as PHQ2 scores increased. As shown in Figure 2, a One-Way ANOVA revealed significant differences among mean PHQ9 scores associated with each PHQ2 score ($F = 11.634$, $p < .001$). Holm-Sidak comparisons revealed significant differences between all mean PHQ9 score pairs ($p < .01$) except for PHQ2=1 vs. PHQ2=2 ($p > .05$). Cohen’s $d$ indicated that the significant differences between adjacent PHQ9 means were large. In short, PHQ2 scores appear to adequately represent PHQ9 scores and to differentiate subjects by their PHQ9 scores. Furthermore, subjects with PHQ2 scores $\geq 3$ were far more likely to have PHQ9 scores $\geq 11$ than subjects with PHQ2 scores of $< 2$ (Odds Ratio = 45.4, $\chi^2 = 101.432$, $df = 1$, $p < .001$).
Figure 1. PHQ2 scores appear to adequately represent PHQ9 scores and to differentiate subjects by their PHQ9 scores.

We then evaluated whether PHQ2 scores might differentiate subjects on PHQ9 scores and various measures of perceived tinnitus severity distress. As shown in Figure 3, subjects with PHQ2 scores \( \geq 3 \) had significantly higher PHQ9 scores \((p < .001)\), TFI scores, TRQ scores \((p < .001)\), Awareness % \((p = .003)\) and Disturbance % \((p < .001)\) than those with PHQ2 scores \(< 2\). Cohen’s \(d\) indicated that the significant differences between all measures were large except ** which was medium.

Figure 3. Subjects with PHQ2 scores \( \geq 3 \) had significantly higher PHQ9 scores \((p < .001)\), TFI scores, TRQ scores \((p < .001)\), Awareness % \((p = .003)\) and Disturbance % \((p < .001)\) than those with PHQ2 scores \( \leq 2\).
We then evaluated relationships between the PHQ9 Sadness Question and measures of perceived tinnitus severity. As shown in Figure 4, subjects who responded YES to the PHQ9 Sadness Question had significantly higher PHQ2 scores \((p = .001)\), PHQ9 scores, TFI scores \((p = .001)\), TRQ scores \((p = .001)\), Awareness\% \((p = 0.26)\) and Disturbance\% \((p = .001)\) than those who responded NO. Cohen’s \(d\) indicated that the significant differences between all measures were small to medium, except ** which was large.

![Figure 4](image)

Figure 4. Subjects who responded YES to the PHQ9 Sadness Question had significantly higher PHQ2 scores \((p = .001)\), PHQ9 scores, TFI scores \((p = .001)\), TRQ scores \((p = .001)\), Awareness\% \((p = 0.26)\) and Disturbance\% \((p = .001)\) than those who responded NO. Cohen’s \(d\) indicated that the significant differences between all measures were small to medium, except ** which was large.

Finally, sensitivity, specificity and positive predictive value (PPV) were calculated for PHQ2 scores, the PHQ9 Sadness Question and for the two measures combined for comparison to the reference standard: PHQ9 score \(\geq 11\). The measure offering the best combination of sensitivity, specificity and positive predictive value was the single PHQ2 score \(\geq 3\) (Table 1).

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Table 1

<table>
<thead>
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<th>Measure</th>
<th>Yes (Sad = YES)</th>
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<td>PHQ2 Scores</td>
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<tr>
<td>PHQ9 Scores</td>
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<tr>
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<tr>
<td>TRQ</td>
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<tr>
<td>Awareness%</td>
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<tr>
<td>Disturbance%</td>
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<td>0.71</td>
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</table>
Table 1. The measure offering the best combination of sensitivity, specificity and positive predictive value was the single PHQ2 score ≥ 3.

Discussion

There were significant correlations between both PHQ9 and PHQ2 scores and scores on both the TRQ and the TFI. Subjects who scored ≥ 3 on the PHQ2 or who answered YES to the PHQ9 Sadness Question scored significantly higher on the PHQ9 and on various measures of perceived tinnitus severity (TFI scores, TRQ scores, Awareness % and Disturbance %) than those who scored < 2 on the PHQ2 or who answered NO to the PHQ9 Sadness Question.

The criteria of “PHQ2 score ≥ 3” and “PHQ9 Sadness Question = YES” demonstrated identically high sensitivity to the reference standard (PHQ9 score ≥ 11), but the specificity of “PHQ2 score ≥ 3” was substantially higher. The combination of “PHQ2 ≥ 3” and “PHQ9 Sadness Question = YES” failed to improve sensitivity and specificity sufficiently to warrant their combined use; the positive predictive values of “PHQ2 > 3 OR PHQ Sadness Question = YES” was barely better than that of “PHQ2 score ≥ 3” alone.

Results suggest that the single criterion “PHQ2 score ≥ 3” is an adequate substitution for the PHQ9 for identifying tinnitus patients who may benefit from MH referral.
References


