CHAPTER 3

THE PERFORMANCE OF THE ALCOHOL USE DISORDER IDENTIFICATION TEST (AUDIT) IN DETECTING ALCOHOL ABUSE AND DEPENDENCE IN A POPULATION OF DEPRESSED OR ANXIOUS PERSONS
ABSTRACT

Background | Alcohol use disorders are highly prevalent but often remain unrecognized among depressed and/or anxious persons. This study examines the performance of the Alcohol Use Disorder Identification Test (AUDIT) in detecting alcohol abuse and dependence in this high-risk group and compares it to that in healthy controls.

Methods | Data from the Netherlands Study of Depression and Anxiety (NESDA) were used, including 1,756 persons with a past-year depressive and/or anxiety disorder and 648 persons without a lifetime depressive and anxiety disorder. The performance of the AUDIT was compared against the gold standard of a CIDI-based diagnosis of past-year alcohol abuse or dependence by means of sensitivity, specificity and areas under receiver operating characteristic curves (AUCs).

Results | The AUDIT accurately detected alcohol dependence in depressed and/or anxious men (AUC=0.89) and women (AUC=0.88), with detected cut-off points of ≥9 and ≥6, respectively, comparable to that in healthy controls (men: AUC=0.89; women: AUC=0.94). However, the overall accuracy in detecting alcohol abuse was limited in depressed/anxious men (AUC=0.74) and women (AUC=0.78) and no adequate cut-off points with both acceptable sensitivity and specificity could be identified.

Limitations | Persons with a primary diagnosis of an addiction disorder were excluded and therefore the sample may not be fully representative of the most severely addicted patients.

Conclusions | These findings confirm the accuracy of the AUDIT in detecting alcohol dependence, but not alcohol abuse, in depressed and/or anxious persons. Screening for alcohol dependence in this high-risk group could improve identification of persons suffering from this impairing comorbid condition.

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INTRODUCTION

Alcohol use disorders (AUDs; alcohol abuse [AA] or alcohol dependence [AD]) tend to worsen the course of depressive and anxiety disorders and may severely impede treatment (Barkow et al., 2003; Bijl and Ravelli 2000; Bruce et al., 2005; Buckner et al., 2008; McDermut et al., 2000; Vuorilehto et al., 2009). Although AUDs are highly prevalent in the general population, and especially among persons with depressive and/or anxiety disorders (Boschloo et al., submitted for publication; Burns and Teesson 2002; de Graaf et al., 2003; Hasin et al., 2007; Merikangas et al., 1998; Pirkola et al., 2005), AUDs often remain unrecognized (Cleary et al., 1988; Rydon et al., 1992). Adequate screening for AUDs may help to identify those depressed and/or anxious patients suffering from this impairing comorbid condition and, consequently, could improve effectiveness of health care.

The Composite International Diagnostic Interview (CIDI) (World Health Organization 1997) is a widely-used diagnostic instrument for the assessment of AUDs in both clinical and research settings. As a time-efficient screening instrument, the Alcohol Use Disorder Identification Test (AUDIT) (Babor et al., 1992) has been developed to detect hazardous and harmful alcohol use. A growing body of research evidence supports the validity of the AUDIT in screening for AUDs in various settings and in diverse populations (Allen et al., 1997; Reinert and Allen, 2002; Reinert and Allen, 2007), but empirical evidence regarding the diagnostic accuracy in depressed or anxious patients is lacking. Most studies also fail to distinguish between the performances of the AUDIT in detecting AA versus AD.

Since test performances often vary across populations (Ransohoff and Feinstein, 1978), the AUDIT may be less accurate in depressed and/or anxious persons due to social desirable answering or symptom overlap. Therefore, we examined and compared the performance of the AUDIT against the gold standard of a CIDI-based diagnosis of past-year AA or AD in a large sample of persons with a past-year depressive and/or anxiety disorder versus persons without a lifetime depressive and anxiety disorder.

METHODS

Study sample

Baseline data of the Netherlands Study of Depression and Anxiety (NESDA) were used, comprising 2,981 adults (18-65 years). Of that number, 19% were recruited from the community, 54% from primary care settings and 27% from specialized outpatient mental health care settings. Exclusion criteria were insufficient command of the Dutch language and a known primary clinical diagnosis of bipolar disorder, obsessive compulsive disorder, addiction disorder or psychotic disorder. A detailed description of the NESDA study design and sampling procedures can be found elsewhere (Penninx et al., 2008). The research protocol was approved by the Ethical Committee of participating universities and all participants provided written informed consent. In order to compare the performance of the AUDIT among two clearly distinct groups, we selected persons with a valid AUDIT-
Assessment

Psychiatric diagnoses: Diagnoses of psychiatric disorders were established with the CIDI, version 2.1 (World Health Organization, 1997), which classifies diagnoses according to DSM-IV criteria (American Psychiatric Association, 2001). The following diagnoses were assessed: past-year depressive (major depressive disorder or dysthymia), anxiety (generalized anxiety disorder, social phobia, panic disorder or agoraphobia) and alcohol use (alcohol abuse [AA] and dependence [AD]) disorders. CIDI hierarchical criteria exclude an AA diagnosis in the presence of a lifetime AD diagnosis.

Alcohol Use Disorder Identification Test: The AUDIT was developed by the World Health Organization as a self-report screening instrument for hazardous and harmful alcohol use in the past year (Saunders et al., 1993). The AUDIT has shown to be reliable and valid in screening for AUDs (Allen et al., 1997; Reinert and Allen 2002; Reinert and Allen 2007) and includes three items on alcohol consumption, three items on dependence symptoms and four items on problems related to alcohol use. Each item is scored from 0 to 4, generally based on frequency of occurrence, resulting in a total score of 0–40. The last two items inquire about alcohol-related problems and accord a higher weight for occurrence in the past year (4) and a lower weight for occurrence ever (2).

Descriptive statistics: Information on gender, age, years of education, partner status, and current smoking were obtained during the interview.

Potential effect-modifiers AUDIT: Severity of depressive symptoms (28-item self-report Inventory of Depressive Symptoms [IDS]) (Rush et al., 1996) and anxiety symptoms (21-item self-report Beck Anxiety Inventory [BAI]) (Beck et al., 1988) were assessed as well as care setting (secondary specialized mental health care versus primary care) to test the robustness of the AUDIT among depressed and/or anxious persons.

Statistical analysis

The diagnostic accuracy of the AUDIT was tested against the gold standard of a CIDI-based diagnosis of AA and AD, respectively. Based on sensitivity and specificity ratings Receiver Operating Characteristic (ROC) curves were processed and corresponding areas under the ROC curves (AUCs) were calculated by fitting logistic models. Equality of AUCs of non-depressed/non-anxious versus depressed/anxious persons was tested using chi-square tests, according to a method described in detail by Cleves (2002). Sensitivity and specificity were used to determine whether standard cut-off points (men: 8; women: 5 or 6) (Reinert and Allen, 2007) were adequate in detecting both AA and AD among depressed/anxious persons. Optimal cut-off points were identified based on the highest combined values of sensitivity and specificity with a minimal combined value of 1.60 and a sensitivity of at least 0.80. Multinomial logistic regression analyses with AUD status as the outcome assessed possible interaction effects of depression or anxiety severity and care setting with AUDIT performance. All analyses were stratified for gender since the...
performance and standard cut-off points of the AUDIT are different for men and women (Babor et al., 1992; Reinert and Allen, 2007).

RESULTS

Sample characteristics
Mean age was 41.3 (SD=13.0) years and 65.8% were women. In the past year 4.4% had AA and 7.5% AD. Table 1 presents gender-stratified sample characteristics comparing non-depressed/non-anxious versus depressed and/or anxious persons.

Screening characteristics of the AUDIT
Based on the sensitivity and specificity across the full range of cut-off points, Receiver Operating Characteristic (ROC) curves for the AUDIT in detecting AA (grey lines) and AD (black lines) are presented in Figure 1. Separate lines are shown for men and women with and without depressive/anxiety disorders. The corresponding AUCs and sensitivity and specificity ratings are presented in Table 2.

Screening for AA among men: the overall performance of the AUDIT in detecting AA was poor among non-depressed/non-anxious (AUC=0.66, 95% CI=0.54-0.77) as well as among depressed/anxious men (AUC=0.74, 95% CI=0.66-0.83) with no significant difference between these two groups (p=0.23). With a sensitivity of 0.56 and a specificity of 0.76, the standard cut-off point of 8 was not adequate in detecting AA among depressed/anxious men. No alternative cut-off point with both acceptable sensitivity and specificity could be identified for detecting AA among depressed and/or anxious men.

Screening for AD among men: in the detection of AD, the AUDIT was highly accurate in both non-depressed/non-anxious (AUC=0.89, 95% CI=0.79-0.99) and depressed/anxious men (AUC=0.89, 95% CI=0.84-0.93). The performance did not differ between men with a depressive/anxiety disorder versus healthy controls (p=0.98). In depressed/anxious men, the AUDIT had a sensitivity of 0.88 and a specificity of 0.76 at the standard cut-off point of 8. At the more optimal cut-off point of 9, the AUDIT had the same sensitivity but was slightly more specific (0.81).

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No dep/anx (n=250)</td>
<td>Dep/anx (n=573)</td>
</tr>
<tr>
<td>Age in years, mean (sd)</td>
<td>42.1 (15.0) 43.5 (11.5)</td>
<td>0.19</td>
</tr>
<tr>
<td>Education in years, mean (sd)</td>
<td>12.9 (3.2) 11.8 (3.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Partner, n (%)b</td>
<td>184 (73.6%) 375 (65.4%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Smoking, n (%)b</td>
<td>78 (31.2%) 260 (45.4%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Alcohol abuse, n (%)b</td>
<td>23 (9.2%) 34 (5.9%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Alcohol dependence, n (%)b</td>
<td>10 (4.0%) 74 (12.9%)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Table 1 Sample characteristics, stratified for gender.

* Based on independent t-tests; b Based on chi-square statistics.
Figure 1 ROC curves of the AUDIT in detecting alcohol abuse and dependence among non-depressed/non-anxious versus depressed/anxious men and women, respectively.
Table 2 Sensitivity, specificity and area under the ROC curve of the AUDIT in detecting alcohol abuse and dependence among non-depressed/anxious versus depressed/anxious men and women, respectively.

Sens: Sensitivity; Spec: Specificity; AUC: Area under the curve; 95% CI: 95% confidence interval.

<table>
<thead>
<tr>
<th>Cut-off</th>
<th>Alcohol abuse</th>
<th>Alcohol dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No dep/anx</td>
<td>Dep/anx</td>
</tr>
<tr>
<td></td>
<td>Sens</td>
<td>Spec</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥5</td>
<td>156</td>
<td>323</td>
</tr>
<tr>
<td>≥6</td>
<td>119</td>
<td>271</td>
</tr>
<tr>
<td>≥7</td>
<td>95</td>
<td>231</td>
</tr>
<tr>
<td>≥8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>74</td>
<td>194</td>
</tr>
<tr>
<td>≥9</td>
<td>56</td>
<td>174</td>
</tr>
<tr>
<td>≥10</td>
<td>44</td>
<td>158</td>
</tr>
<tr>
<td>≥11</td>
<td>34</td>
<td>138</td>
</tr>
<tr>
<td>≥12</td>
<td>23</td>
<td>114</td>
</tr>
</tbody>
</table>

Wome<sup>a</sup> 80<sup>b</sup> 125<sup>c</sup> 0.66 (0.54-0.77) 0.74 (0.66-0.83) p=.23 0.89 (0.79-0.99) 0.89 (0.84-0.93) p=.98

<table>
<thead>
<tr>
<th>Wome</th>
<th>no d/a</th>
<th>d/a</th>
<th>(n=392)</th>
<th>(n=1,092)</th>
<th>(n=381)</th>
<th>(n=1,152)</th>
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<tbody>
<tr>
<td>≥2</td>
<td>306</td>
<td>764</td>
<td>1.00</td>
<td>0.25</td>
<td>0.94</td>
<td>0.39</td>
</tr>
<tr>
<td>≥3</td>
<td>262</td>
<td>648</td>
<td>1.00</td>
<td>0.36</td>
<td>0.87</td>
<td>0.49</td>
</tr>
<tr>
<td>≥4</td>
<td>209</td>
<td>533</td>
<td>1.00</td>
<td>0.50</td>
<td>0.81</td>
<td>0.60</td>
</tr>
<tr>
<td>≥5&lt;sup&gt;c&lt;/sup&gt;</td>
<td>135</td>
<td>395</td>
<td>1.00</td>
<td>0.70</td>
<td>0.74</td>
<td>0.72</td>
</tr>
<tr>
<td>≥6&lt;sup&gt;c&lt;/sup&gt;</td>
<td>95</td>
<td>305</td>
<td>0.94</td>
<td>0.81</td>
<td>0.61</td>
<td>0.80</td>
</tr>
<tr>
<td>≥7</td>
<td>66</td>
<td>239</td>
<td>0.76</td>
<td>0.87</td>
<td>0.55</td>
<td>0.86</td>
</tr>
<tr>
<td>≥8</td>
<td>51</td>
<td>192</td>
<td>0.59</td>
<td>0.90</td>
<td>0.39</td>
<td>0.89</td>
</tr>
</tbody>
</table>

AUC (95% CI) 0.92 (0.88-0.96) 0.78 (0.70-0.86) p=.002 0.94 (0.90-0.98) 0.88 (0.84-0.93) p=.06

*a Number of non-depressed/non-anxious men and women with an AUDIT score higher than or equal to cut-off point.

*b Number of depressed/anxious men and women with an AUDIT score higher than or equal to cut-off point.

*c Standard cut-off point.
Screening for AA among women: in the detection of AA, a significant difference was found in the performance of the AUDIT in women with a depressive/anxiety disorder compared to those without a disorder (p=0.002). In non-depressed/non-anxious women the AUDIT was accurate (AUC=0.92, 95% CI=0.88-0.96), whereas the accuracy was lower in depressed/anxious women (AUC=0.78, 95% CI=0.70-0.86). At the standard cut-off point of 5, the AUDIT had a sensitivity of 0.74 and a specificity of 0.72 in depressed/anxious women. Identification of the highest cut-off point with an acceptable sensitivity of at least 0.80, resulted in a cut-off point of 4 with a specificity of only 0.60.

Screening for AD among women: although the AUDIT was highly accurate in detecting AD in non-depressed/non-anxious (AUC=0.94, 95% CI=0.90-0.98) women, the performance tended to be somewhat less in depressed/anxious women (p=0.06) but was still high (AUC=0.88, 95% CI=0.84-0.93). With a standard cut-off point of 5, the AUDIT had a sensitivity of 0.88 and a specificity of 0.72, whereas the (other) standard cut-off point of 6 resulted in a sensitivity of 0.85 and a specificity of 0.80 in depressed and/or anxious women.

Effect-modification of the AUDIT
Performance of the AUDIT for detecting AA or AD, in men and in women was not altered by severity of depressive or anxiety symptoms or health care setting (p of all interactions >.35).

DISCUSSION

The present study shows that the AUDIT accurately detects CIDI-based alcohol dependence in depressed/anxious men (AUC=0.89) and women (AUC=0.88), comparable to its performance in healthy controls. The standard cut-off point of 8 for men was adequate (sensitivity: 0.88; specificity: 0.76), but specificity could be further improved to 0.81 without losing sensitivity by choosing a cut-off point of 9. The identified optimal cut-off point of 6 with a sensitivity of 0.85 and a specificity of 0.80 for depressed/anxious women corresponds with the recommended cut-off points of 5 or 6 for women in the general population. However, the overall performance of the AUDIT in detecting alcohol abuse is limited among depressed/anxious men (AUC=0.74) and women (AUC=0.78) as no adequate cut-off points with both an acceptable sensitivity and specificity could be identified.

This study is the first in examining the diagnostic accuracy of the AUDIT among depressed/anxious persons. The results show that the AUDIT accurately detects AD in this high-risk group, regardless of the severity of depressive or anxiety symptoms and care setting. Administration of the AUDIT has the potential of improving health care service efficiency, since alcohol dependence is highly prevalent in depressed/anxious persons (Boschloo et al., submitted; Burns et al., 2002; De Graaf et al., 2003; Hasin et al., 2007; Merikangas et al., 1998) and often remains unrecognized (Bijl and Ravelli, 2000; Bruce et al., 2005; Buckner et al., 2008; McDermut et al., 2000). As adequate therapies such
as pharmacological and psychosocial interventions are available for alcohol problems (Bouza et al., 2004; Miller and Wilbourne 2002), recognition of AD gives the opportunity to offer more suitable therapy to those depressed and/or anxious persons suffering from this comorbid condition. Performance of the AUDIT in identifying depressed AA is limited as no adequate cut-off points could be identified. This is in line with previous studies and stresses the importance to consider AA and AD separately.

Methodological strengths of our study are that we analyzed a large sample of persons with a diagnosis of a depressive and/or anxiety disorder (n=1,756), including a large sample of women (n=1,581), which is unique in studies on the AUDIT. In addition, the performance of the AUDIT among depressed/anxious persons was directly compared with its performance among non-depressed/non-anxious persons and we differentiated between AA and AD. However, there are some limitations to be recognized. First, the sample may not have been fully representative of all depressed/anxious persons with an AUD, since persons with a primary diagnosis of an addiction disorder were initially excluded from this study. On the other hand, the sample may be quite similar to the potential target population as in clinical practice the AUDIT will not be administered among persons with a known primary diagnosis of an addiction disorder. Furthermore, the performance was tested against the gold standard of a CIDI-diagnosis of AA or AD. Although the CIDI is highly reliable and valid in detecting AA and, especially, AD (Üstün et al., 1997), this is not a completely objective method as it is based on self-report. However, this is a common and accepted method in research on the AUDIT.

In conclusion, the AUDIT accurately detects AD, but not AA, in depressed/anxious persons. A cut-off point of ≥9 for men and ≥6 for women is recommended. Screening with the highly accurate and time-efficient AUDIT will help to identify depressed or anxious persons suffering from AD, a highly prevalent condition that often remains unrecognized in clinical practice.
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