Chapter 3

A Brief Web Screening Questionnaire
for Common Mental Disorders:
Development and Validation

Abstract

The advent of Internet-based self-help systems for common mental disorders has generated a need for quick ways to triage would-be users to systems appropriate for their disorders. This need can be met by using brief online screening questionnaires, which can also be quickly used to screen patients prior to consultation with a GP. Our objective is to test and enhance the validity of the Web Screening Questionnaire (WSQ) to screen for: depressive disorder, alcohol abuse/dependence, GAD, PTSD, social phobia, panic disorder, agoraphobia, specific phobia, and OCD. A total of 502 subjects (aged 18 - 80) answered the WSQ and 9 other questionnaires on the Internet. Of these 502, 157 were assessed for DSM-IV-disorders by phone in a WHO Composite International Diagnostic Interview with a CIDI-trained interviewer. Positive WSQ "diagnosis" had significantly ($P < .001$) higher means on the corresponding validating questionnaire than negative WSQ "diagnosis". WSQ sensitivity was 0.72 -1.00 and specificity was 0.44 - 0.77 after replacing three items (GAD, OCD, and panic) and adding one question for specific phobia. The Areas Under the Curve (AUCs) of the WSQ's items with scaled responses were comparable to AUCs of longer questionnaires.The WSQ screens appropriately for common mental disorders. While the WSQ screens out negatives well, it also yields a high number of false positives.

1. Introduction

The thriving development of Internet-based self-help aids (Marks et al., 2007) for particular mental disorders (Andersson et al., 2007; Carlbring et al., 2005) has generated a need for quick ways to triage would-be users to systems appropriate for their disorders. Many sufferers do not easily recognize their particular mental problem (Angermeyer and Dietrich, 2006) and could be guided by a Web-screening questionnaire to a self-help system appropriate for their problem. This could reduce the likelihood of their becoming disenchanted with using a self-help system not intended for their disorder. Such a questionnaire would preferably be conducted via the Internet, as it offers quick and easy access to large numbers of users at a low cost (Austin et al., 2006; Buchanan, 2003). This kind of questionnaire could also assist professionals such as general practitioners (GPs) in screening their patients prior to consultation.

The screening must be brief, as subjects will undergo screening more readily if it is short, quick (Cuijpers et al., 2009), and easy to read. A few brief online screening questionnaires (Farvolden et al., 2003; Gega et al., 2005; Lin et al., 2007) appear to be reliable and valid. The Internet-based Self-assessment Program for Depression (ISP-D; Lin et al., 2007), for example, reported sensitivity, specificity, positive predictive values (PPV), and negative predictive values (NPV) for major depressive disorder of 0.82, 0.73, 0.67, and 0.86, respectively (Lin et al., 2007). Sensitivity of another online test, the Web-Based Depression and Anxiety Test (WB-DAT; Farvolden et al., 2003), ranged from 0.71 to 0.95, while specificity ranged from 0.87 to 0.97 for major depressive disorder (MDD), obsessive compulsive disorder (OCD), post-traumatic stress disorder (PTSD), panic disorder with and without agoraphobia, and social phobia. Sensitivity for generalized anxiety disorder (GAD) was somewhat lower (0.63). However, existing online screening questionnaires do not assess all mental disorders for which self-help systems are now being created. To reduce this paucity, we developed a brief online screening questionnaire which screens for different mental disorders: the Web Screening Questionnaire for common mental disorders (WSQ), based on the Screening Questionnaire (SQ) of Marks and colleagues (Gega et al., 2005). The WSQ contains only 15 items and screens for depression, GAD, panic disorder with and without agoraphobia, social phobia, specific phobia, OCD, PTSD, and alcohol abuse/dependence. This paper reports optimization and validation of the WSQ.

2. Methods

2.1 Participants and Procedure

Participants were recruited (between May and December 2007) from the general Dutch population by using Internet banners (eg, Google and Dutch Internet sites on mental health issues). The advertisements linked to a Web page containing information about common mental disorders, Internet treatment and this study, an application form, and a link to the questionnaires. Subjects were asked to input their name and email address, so they could be identified and added to the data pool only once.

We specifically targeted adults (18 years of age or older) with Internet access and who felt anxious, depressed, or thought of themselves as drinking too much alcohol. We targeted a population with a high rate of common mental disorders as the kind likely to use the WSQ in the future. Since this population can only illuminate false negative and true positive rates, we needed controls to test those rates. Therefore, we also recruited 20 undergraduate psychology students who were not required to have symptoms, using banners at the VU University's students' Web page seeking participants for VU studies.

We excluded people reporting a high suicide risk (ie, a score of 3 on Q15 of the WSQ); they were advised to contact their GP. To raise the response rate, participants were told in advance that completers of the screening questionnaires would be offered a self-help book for common mental problems. Students received academic credit for participating. The study protocol was approved by the Medical Ethics Committee at the VU Medical Centre in Amsterdam, Netherlands.

Our study tested the WSQ's validity and consisted of two parts (Figure 1):

1. Completion of 10 sets of questions: Internet demographic questions, the WSQ, and other questionnaires for common mental disorders: Center for Epidemiological Studies Depression scale (CES-D; Radloff, 1977), Generalized Anxiety Disorder scale (GAD-7; Spitzer et al., 2006), Fear Questionnaire (FQ; Marks and Mathews, 1979) plus a further question about eight kinds of specific phobia, Panic Disorder Severity Scale - Self Report (PDSS-SR [Shear et al., 2001; Houck et al., 2002]), Yale-Brown Obsessive Compulsive Scale (YBOCS [Goodman et al., 1989a; 1989b]), Impact of Events Scale (IES; Horowitz et al., 1979), Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993 [details below]),

2. A DSM-IV-diagnostic phone interview with a Composite International Diagnostic Interview (CIDI)-trained interviewer (CIDI lifetime, World Health Organization [WHO] version 2.1 [World Health Organization; 1997]) to assess the presence of a current (ie, within the last 6 months) DSM-IV diagnosis (American Psychiatric Association, 1994) of MDD, dysthymia (Dyst), minor depression (MinD), social phobia, GAD, panic disorder, agoraphobia, specific phobia, OCD, PTSD, and alcohol abuse/dependence. CIDI-interviewers were blind to the subjects' self-reports and the inclusion of control subjects (undergraduate psychology students).

In all, 687 people applied for the study, of whom 185 (27%) were excluded because they represented a high suicide risk (n = 5); there was no written informed consent (n = 22); or they refused to participate (n = 158). This left 502 participants, of whom 389 consented to a diagnostic phone interview, but 232 (60%) of those 389 either could not be contacted (n = 227) or refused (n = 5), leaving 157 participants who were phoned by a CIDI-trained interviewer within a mean of 13 days.

If participants had never experienced a traumatic event, they skipped the IES; if they had never drunk alcohol, they skipped the AUDIT; and if they had never suffered a panic attack, they skipped the PDSS-SR. Those who completed the screening questionnaires and gave informed consent entered the study.

Figure 1. Flowchart of participants (WSQ)
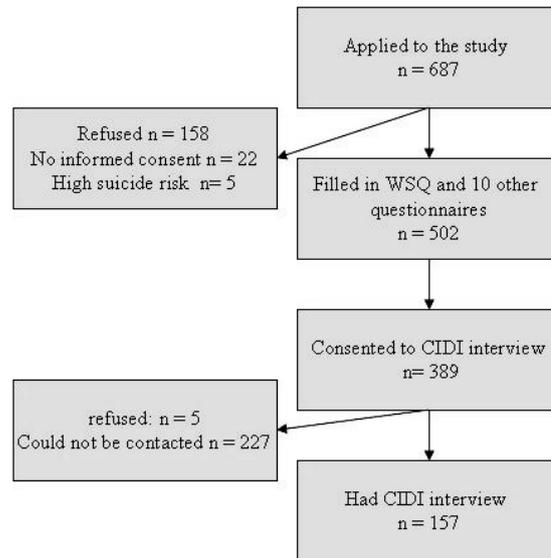
2.2 Measures

2.2.1 Development of the Web Screening Questionnaire for Common Mental Disorders (WSQ)

The WSQ for common mental disorders (http http://webscreeningquestionnaire.org/files/WSQ.pdf) has 15 self-rated questions based on the screening questionnaire (SQ) of Marks and colleagues (Gega et al., 2005) which screens for most common mental disorders. Of the SQ's original questions we used 6 unchanged (WSQ Q1, 3, 5, 6, 11, and 15) and added 8 questions from further reliable and valid instruments. These are:

- WSQ Q2 for depression, from CIDI (World Health Organization, 1997),
- WSQ Q4, 8, 9, 10, and 12 (for panic, social phobia, PTSD, and OCD from Mini-International Neuropsychiatric Interview (M.I.N.I. ; Sheehan et al., 1998), and

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- WSQ Q13 and 14 (for alcohol, from AUDIT; Saunders et al., 1993).

Three questions of the original WSQ reached either low specificity or low sensitivity. To enhance validity, we used logistic regression analysis to determine whether other items from appropriate questionnaires could replace these WSQ-items.We amended three questions using items for GAD (WSQ Q3, from GAD-7; Spitzer et al., 2006) for panic (WSQ Q4 from PDSS-SR; Houck et al., 2002), and for OCD (WSQ 12, from YBOCS; Goodman et al., 1989a; 1989b). We also added one question for the WSQ subscale specific phobia (WSQ Q7) which concerned further types of specific phobia. Each WSQ subscale has 1 - 2 items (for GAD, panic disorder, OCD, alcohol addiction, depression, agoraphobia, specific phobia, social phobia, and PTSD). Of the 15 WSQ questions, 8 had "yes" or "no" answers while the other 7 were Likert-type scales.

2.2.2 Further Screening Questionnaires

2.2.2.1 Depressive Symptoms

The Dutch version of the CES-D (Radloff, 1977) has 20 self-rated items with each scored on a range of 0 - 3 and a total score of 0 - 60. The paper-pencil CES-D has good psychometric properties with a cut-off score of 16 (Beekman et al., 1997). The Internet CES-D is also reliable and valid with a cut-off score of 22 (Cronbach alpha: .93; sensitivity: 0.90; specificity: 0.74 [Cuijpers et al., 2008]).

2.2.2.2 GAD

We translated the GAD-7 (Spitzer et al., 2006) into Dutch for self-rating of generalized anxiety symptoms. Each of its 7 questions is rated 0 - 3 ("not at all" to "nearly every day"), and the total score range is 0 - 21. Reliability is excellent (Cronbach alpha = .92). With a cut-off point of ≥ 10, sensitivity is 0.89 and specificity is 0.82 among primary care participants (Spitzer et al., 2006). The GAD-7 was translated into Dutch by forward-translation (translated and discussed by two independent health professionals) and blind backward-translation (by an independent translator whose mother tongue is English). Since psychometric properties may differ among other populations, the Dutch version of the GAD-7 is validated in another study (TD, AVS, IMM, and PC, unpublished data, 2009).

2.2.2.3 Panic Disorder

The Dutch version of the PDSS (Shear et al., 2001) self-report SR form (Houck et al., 2002) asks 7 questions about 7 dimensions of panic disorder, each self-rated 0 - 4, with a total score range of 0 - 28. With a cut-off score of 8, sensitivity is 0.83 and specificity is 0.64 (Shear et al., 2001).

2.2.2.4 Phobias (Agoraphobia, Social Phobia, Specific Phobia)

The Dutch version of the FQ (Marks and Mathews, 1979) detects agoraphobia, social phobia, and blood-injury phobia. The FQ's total phobia scale contains 15

items; each self-rated 0 - 8, with a total score range of 0 - 120. Several studies support the validity of the FQ's social and agoraphobia subscales (Cox et al., 1996; Cox et al., 1991; Hoyer et al., 2002; Van Zuuren, 1988). To the FQ's 5 blood/injury questions we added a single self-rated question ("are you scared of …?") concerning further types of specific phobias, to be ticked as present or absent: animals (eg, dogs, cats), natural events (eg, earthquakes, storms, flooding), body fluids (eg, faeces, vomit, semen), materials (eg, cleaning products, medicine, poison), medical appointments (eg, dentist, hospital), items at home (eg, telephone, toilet, soap), specific situations (eg, driving, riding elevators, crossing bridges), and other (eg, vomiting, children). We omitted the FQ's 6 anxiety-depression items.

2.2.2.5 PTSD

The IES (Horowitz et al., 1979) assesses signs and symptoms of avoidance and intrusion after a serious or traumatic life event. It has 15 items, each self-rated 0 - 5, with a total score range of 0 - 75. People who score ≥ 26 are likely to have PTSD. The Dutch version is reliable and sensitive (van der Ploeg et al., 2004).

2.2.2.6 OCD

We used the Dutch 10-item severity subscale of the YBOCS (Goodman et al., 1989a; 1989b). Each self-rated item is rated 0 - 4, with a total score range of 0 - 40. Tests of internal consistency of the total scale (Dutch version) are .69 to .91 (Cronbach alpha) and compare well with several but not all measures often used to assess OCD (de Haan et al., 2006). A total score of 13 or more denotes clinically significant obsessive-compulsive symptoms (van Oppen et al., 2005).

2.2.2.7 Alcohol Abuse/Dependence

The Dutch version of WHO's self-rated AUDIT (Saunders et al., 1993) identifies people with hazardous alcohol consumption and dependence in primary care. Each of its 10 items is rated 0 - 4, with a total score range of 0 - 40. Cronbach alpha is .65 to .93: overall sensitivity is 0.92, and specificity is 0.94 (Saunders et al., 1993). A cut-off score of 8 is recommended for various endpoints (eg, alcohol-related social problems or medical problems; Conigrave et al., 1995).

2.2.2.8 Diagnoses

We used the Lifetime version 2.1 of the CIDI (World Health Organization, 1997) in its Dutch version (Janca et al., 1994; Smeets et al., 1993) as a "gold standard' to assess the presence of DSM-IV disorders in the last 6 months (GAD, panic disorder, OCD, alcohol abuse/dependence, MDD, Dyst, MinD, agoraphobia, specific phobia, social phobia, and PTSD). The CIDI is reliable and valid (Andrews and Peters, 1998; Wittchen 1994). The CIDI was administered by phone by trained CIDI interviewers who were psychologists or master's-level psychology students. The CIDI interviews used in this trial lasted 69 minutes on average.

2.3 Statistical analyses

To establish whether WSQ scores differed significantly between subjects with positive and with negative screen results, we conducted *t* tests on the mean and standard deviation of each screening instrument separately. In the sub-sample that had a diagnostic interview, we performed chi-square tests to ascertain whether WSQ scores differed between subjects with and without DSM-IV disorders.

We calculated sensitivity and specificity, and positive and negative predictive values, for each WSQ subscale regarding its corresponding DSM-IV disorder (predictive validity). Sensitivity is the probability that a person who has a disorder is screen positive. Specificity is the probability that a person not suffering from a disorder is screen negative. There is no consensus of what levels of sensitivity and specificity are acceptable, as they depend on the test's aim, costs, and benefits (Smits et al., 2007). The WSQ aims to detect clinically-relevant mood, anxiety, and alcohol-related problems. Therefore, to minimize missed cases we set threshold levels of sensitivity at 0.70 or more, and of specificity at 0.40 or more. PPV is the probability of a positive diagnosis after a positive screening, and NPV is the probability of a negative diagnosis after a negative screening. PPV and NPV depend on prevalence (PPV increases when prevalence increases), so we did not set acceptable levels of these.

For WSQ questions which turned out to have unacceptable sensitivity or specificity, we replaced them with relevant items from the appropriate screening questionnaire. To find which items best predicted the chance of detecting a diagnosis, we used logistic regression analyses (Forward Likelihood Ratio method). We replaced items only if they improved validity. We calculated the Area Under the Curve (AUC) for the WSQ's scaled and dichotomous response options and its appropriate screening questionnaires. The AUC (the sum of sensitivity versus [1 –] specificity) measures a scale's accuracy; it equals the probability that a randomly chosen case will score higher than a randomly chosen non-case (Cairney et al., 2007). AUCs of 0.5 - 0.7 are said to reflect low accuracy, 0.7 - 0.9 moderate accuracy, and 0.9 - 1.0 high accuracy (Fischer et al., 2003). Furthermore, we performed *t* tests and χ² tests to examine differences in demographic and questionnaire results between subjects who had a CIDI diagnostic interview and those who did not, and tests to examine whether a student sub-sample's WSQ scores differed from the whole sample.

Our analyses used diagnoses reached within the last 6 months. MDD, Dyst, and MinD were combined into the category depressive disorder. For all analyses we used SPSS version 15.0 for Windows.

3. Results

3.1 Sample Characteristics

The total sample (N = 502) had a mean age of 43 years (SD 13, range 18 - 80), and 285 (57%) of the subjects were female. Of the 157 subjects who had a CIDI interview, the mean age was 43 (SD 15, range 18 - 80). Of these, 89 (57%) were female, and 107 (68%) subjects met DSM-IV criteria for any current (ie, within the past 6 months) depressive disorder, anxiety disorder, and/or alcohol

abuse/dependence. A total of 67 (43%) subjects had more than one diagnosis (Table 1).

Table 1. Demographic characteristics and prevalence of diagnosis

	N (%)	
	Complete sample	**CIDI sub-sample**
Completed all questionnaires on Internet	502 (100)	157
Gender, N (%)		
Male	217 (43)	68 (43)
Female	285 (57)	89 (57)
Age, Mean (SD)	43 (13)	43 (15)
(Range)	(18 - 80)	(18 - 80)
Education		
Low[a]	99 (20)	27 (17)
Medium[b]	217 (43)	73 (47)
High[c]	186 (37)	57 (36)
Country		
Netherlands	474 (94)	146 (94)
Other	28 (6)	11 (6)
Marital status		
Single	180 (36)	65 (41)
Married or cohabiting	241 (48)	67 (43)
Divorced/widowed	81 (16)	25 (16)
DSM-IV diagnosis within last 6 months, on CIDI phone interview	157	
Any depressive disorder	52 (33)	
Major depressive disorder	46 (29)	
Dysthymia	9 (6)	
Minor depression	8 (5)	
	94 (60)	
Any anxiety disorder		
Social phobia	32 (20)	
GAD	30 (19)	
Panic disorder	10 (6)	
Panic with agoraphobia	22 (14)	
Agoraphobia	10 (6)	
Specific phobia	40 (26)	
Obsessive-compulsive disorder	10 (6)	
PTSD	12 (8)	
Alcohol abuse/dependence	23 (15)	
Any disorder	107 (68)	
> one diagnosis	67 (43)	

[a]Low education: primary and lower general secondary education; [b]Medium education: Intermediate Vocational Training, school of higher general secondary education or pre university education; [c]High education: higher vocational education or university.

3.2 Comparisons of WSQ With Other Questionnaires

Table 2 shows that subjects who scored "Yes" for any particular WSQ "diagnosis" had significantly higher means ($P < .001$) on the corresponding validating questionnaire than those who scored "No" for that WSQ "diagnosis".

Table 2. WSQ and screening questionnaires: means, standard deviations (SDs) and prevalence (N = 502)

Other screening questionnaires:	"Diagnosis" on WSQ (Web Screening Questionnaire)				
	Yes		No		t (d.f. = 500)
	N (%)	M (SD)	N (%)	M (SD)	
	Any depressive disorder				
CES-D (score range 0 - 60)	296 (59.0)	32.2 (7.1)	206 (41.0)	18.1 (10.3)	15.2[a]
	Generalized anxiety disorder				
GAD-7 (score range 0 - 21)	320 (63.8)	13.6 (3.9)	182 (36.3)	5.5 (3.1)	24.3 [a]
	Panic disorder (without agoraphobia)				
PDSS-SR (score range 0 - 28)	278 (55.4)	9.3 (5.1)	224 (44.6)	0.6 (1.7)	24.2 [a]
	Panic with agoraphobia				
PDSS-SR	153 (30.5)	11.2 (5.1)	349 (69.5)	2.9 (4.1)	19.3 [a]
	Agoraphobia (without panic disorder)				
FQ-agoraphobia (score range 0 - 40)	205 (40.8)	12.7 (10.9)	297 (59.2)	2.9 (4.5)	14.0 [a]
	Social phobia				
FQ-social phobia (score range 0 - 40)	226 (45.0)	16.6 (8.7)	276 (55.0)	7.0 (6.0)	14.6 [a]
	Specific phobia				
FQ-specific phobia[b] (score range 0 - 40)	290 (57.8)	7.6 (7.7)	212 (42.2)	2.3 (3.5)	9.2 [a]
	Obsessive-compulsive disorder				
YBOCS (score range 0 - 40)	182 (36.3)	11.0 (6.3)	320 (63.8)	0.8 (2.3)	26.2 [a]
	Post-traumatic stress disorder				
IES (score range 0 - 75)	273 (54.4)	33.5 (20.1)	229 (45.6)	0.0[c]	25.3 [a]
	Alcohol abuse/dependence				
AUDIT (score range 0 - 40)	198 (39.4)	19.6 (6.2)	260 (60.6)	6.3 (5.5)	24.4 [a]

[a]Significant at $P < .001$.
[b]Additional specific phobia questions were dichotomous, so their means and standard deviations could not be calculated.
[c]If participants had never experienced a traumatic event then they skipped the IES.

3.3 Predictive Validity and Refinement of the WSQ

For the three WSQ subscales, GAD, OCD, and panic, validity was below threshold levels of 0.70 for sensitivity and 0.40 for specificity, so we replaced those (based on logistic regression analysis) with relevant items from the appropriate screening questionnaires (GAD-7, YBOCS, and PDSS-SR, respectively). This improved sensitivity or specificity. The WSQ subscale-specific phobia had an unacceptably low sensitivity (0.60), but we did not replace it with an item from the appropriate screening questionnaire as that did not improve sensitivity or specificity.

Based on the log-likelihood ratio statistic, using logistic regression analyses, we added three categories of the specific phobia question, "Are you scared of …?". These categories were (1) animals, (2) specific situations, and (3) medical issues, which improved the sensitivity of the WSQ subscale for specific phobia but not for specificity (sensitivity: from 0.60 to 0.80; specificity: from 0.77 to 0.47).

Table 3 shows that for all 10 CIDI DSM-IV diagnoses more subjects with a CIDI diagnosis scored positive on the corresponding WSQ questions than did subjects without that CIDI diagnosis. The differences were all significant at the $P <$ .001 level except for specific phobia (P = .003). Table 3 also shows that the WSQ's sensitivity ranged from 0.72 (social phobia) to 1.00 (agoraphobia). The WSQ's specificity ranged from 0.44 (panic disorder) to 0.77 (panic disorder with agoraphobia). PPV varied from 0.11 (PTSD) to 0.51 (any depressive disorder), and NPV varied from 0.87 (specific phobia) to 1.00 (agoraphobia).

Table 3. WSQ vs CIDI diagnoses: prevalence, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) (n = 157)

WSQ "Diagnosis"		CIDI DSM-IV Diagnosis						
		No	Yes	χ^2 (d.f. = 1)	Sensitivity	Specificity	PPV	NPV
		n	n					
Any depressive disorder								
WSQ-depression	No	62	8	26.8[a]	0.85	0.59	0.51	0.89
	Yes	43	44					
Generalized anxiety disorder								
WSQ-GAD	No	57	2	[b]	0.93	0.45	0.29	0.97
	Yes	70	28					
Social phobia								
WSQ-social phobia	No	91	9	22.0[a]	0.72	0.73	0.40	0.91
	Yes	34	23					
Panic disorder								
WSQ-panic	No	65	1	[b]	0.90	0.44	0.10	0.98
	Yes	82	9					
Panic with agoraphobia								
WSQ-panic+agoraphobia	No	104	3	[b]	0.86	0.77	0.38	0.97
	Yes	31	19					
Agoraphobia								
WSQ-agoraphobia	No	92	0	[b]	1.00	0.63	0.15	1.00
	Yes	55	10					
Specific phobia								
WSQ-specific phobia	No	55	8	9.1[c]	0.80	0.47	0.34	0.87
	Yes	62	32					
Obsessive-compulsive disorder								
WSQ-OCD	No	102	2	[b]	0.80	0.69	0.15	0.98
	Yes	45	8					
Post-traumatic stress disorder								
WSQ-PTSD	No	68	2	[b]	0.83	0.47	0.11	0.99
	Yes	77	10					
Alcohol abuse/dependence								
WSQ-alcohol	No	97	4	[b]	0.83	0.72	0.34	0.96
	Yes	37	19					

[a]Significant at $P < .001$; [b]Not able to calculate χ^2 due to small numbers (< 5) in cells; [c]Significant at $P = .003$.

Compared to the corresponding CIDI DSM-IV diagnoses, the AUC for the WSQ subscales with scaled responses (WSQ subscales GAD, OCD, alcohol, and panic) were similar to the AUC of the longer questionnaires, ranging from an AUC of 0.76 for the WSQ subscale panic versus an AUC of 0.70 of the PDSS-SR, to an AUC of 0.81 for the WSQ subscale OCD versus an AUC of 0.85 for the YBOCS. The AUC for the dichotomous WSQ's subscales of panic with agoraphobia and agoraphobia were similar to the AUC of the longer, scaled questionnaires (PDSS: AUC of 0.79 versus WSQ panic with agoraphobia: AUC of 0.82; both WSQ and FQ subscale agoraphobia: AUC of 0.81), but not for the WSQ dichotomous subscales of depression, social phobia, and PTSD (ranging from WSQ subscale depression: AUC of 0.72 versus CES-D: AUC of 0.84 to WSQ subscale PTSD: AUC of 0.65 versus IES: AUC of 0.82) (Table 4).

Table 4. WSQ and screening questionnaires versus CIDI diagnoses: Area Under the Curve (AUC) and 95% CI for scaled and dichotomous response options

WSQ "Diagnosis"	CIDI DSM-IV Diagnosis	
	AUC	95% C.I.
Any depressive disorder		
WSQ-depression	0.72	0.64 - 0.80
CES-D	0.84	0.77 - 0.90
Generalized anxiety disorder		
WSQ-GAD	0.78	0.69 - 0.86
GAD-7	0.77	0.68 - 0.85
Social phobia		
WSQ-social phobia	0.72	0.62 - 0.82
FQ-social phobia	0.82	0.74 - 0.89
Panic disorder		
WSQ-panic	0.76	0.59 - 0.93
PDSS-SR	0.70	0.57 - 0.88
Panic with agoraphobia		
WSQ-panic+agoraphobia	0.82	0.72 - 0.91
PDSS-SR	0.79	0.69 - 0.89
Agoraphobia		
WSQ-agoraphobia	0.81	0.73 - 0.90
FQ-agoraphobia	0.81	0.70 - 0.91
Obsessive-compulsive disorder		
WSQ-OCD	0.81	0.65 - 0.97
YBOCS	0.86	0.72 - 0.99
Post-traumatic stress disorder		
WSQ-PTSD	0.65	0.51 - 0.80
IES	0.82	0.67 - 0.97
Alcohol abuse/dependence		
WSQ-alcohol	0.77	0.68 - 0.86
AUDIT	0.75	0.66 - 0.84

3.4 Differences Between Students and Non-students

As expected, students compared to non-students had significantly lower scores on the WSQ subscales for depression (P = .004), alcohol (P < .001), GAD (P < .001), OCD (P < .001), panic (P < .001), and panic with agoraphobia (P = .004).

3.5 Differences Between CIDI Interviewed and Non-interviewed Sub-samples

Demographic variables did not differ significantly between subjects who had a CIDI diagnostic interview and those who did not. However, those who had a CIDI interview scored significantly lower on one WSQ subscale (social phobia; P = .009), on the CES-D (P = .05), and on the FQ social-phobia subscale (P = .03).

4. Discussion

4.1 Principal Results

It takes about two minutes to complete the WSQ to detect common mental disorders. The WSQ quickly detects clinically-relevant mood, anxiety, and alcohol-related problems and so can guide Internet users to Internet-self-help modules appropriate for their problem, or quickly screen patients prior to consultation with a GP. This measure can also be used in more homogeneous samples to screen out people with co-morbid disorders. The WSQ turned out to be a valid screener for social phobia, panic disorder with agoraphobia, agoraphobia, OCD, and alcohol abuse/dependence (sensitivity: 0.72 - 1.00; specificity: 0.63 - 0.80), and appropriate for depressive disorder, GAD, PTSD, specific phobia, and panic disorder (without agoraphobia) (sensitivity: 0.80 - 0.93; specificity: 0.44 - 0.51) in our study population. Interestingly, the AUC's of the WSQ's scaled single items, and some of the dichotomous items, were comparable to the AUC's of the longer questionnaires, supporting our conclusion that short questionnaires, sometimes with just one item, can be as valid as longer ones. This is in line with previous studies (Cuijpers et al., 2009, Lim et al., 2000; McKenzie and Marks, 1999; Mitchell and Coyne, 2007).

Compared to psychometric properties of other online screening questionnaires (sensitivity: 0.63 - 0.95; specificity: 0.73 - 0.97), WSQ's sensitivity was similar (sensitivity: 0.72 - 1.00 [Farvolden et al., 2003; Lin et al., 2007]), but specificity was, for some disorders, considerably lower (specificity: 0.44 - 0.80). One explanation for this lower specificity might be that we have used 6-month prevalence rates rather than point prevalence rates, whereas the WSQ assesses current symptoms rather than symptoms during the previous 6 months. Therefore, specificity might be higher when the WSQ is validated against concurrent DSM-IV diagnoses. Although only one of the two symptoms is required for a diagnosis of MDD, the "WSQ depression diagnosis" is based on elevated mood and anhedonia. However, when only one of the two symptoms would give a positive "WSQ depression diagnosis", specificity was below the threshold level of 0.40. Therefore, both core depression symptoms are needed to fulfill the criteria of a positive "WSQ depression diagnosis". Although sensitivity, specificity, and NPV's were acceptable for most WSQ "diagnosis", PPV's were low (0.10 - 0.51), indicating that the WSQ misidentified many participants as (falsely) positive. NPV and PPV depend on prevalence. When prevalence is high, which might be the case in self-selected samples such as those in this study, "true" negatives will have a greater impact, and when prevalence is low, "true positives" have a higher impact on the NPV and PPV. When prevalence is low, a positive diagnosis from the WSQ should be regarded with caution. Subjects with a positive WSQ score can then undergo more in-depth screening with a longer questionnaire or CIDI with a higher specificity. However, the test successfully identified "true" negatives (high NPV), which is to say that subjects with no WSQ positive score ("diagnosis") of any kind are likely to have no relevant DSM-IV diagnosis when interviewed by CIDI. In brief, the WSQ screens out negatives well but yields many false positives.

Although WSQ's false positives do not have a diagnosis, they might have symptoms of depression, anxiety, or alcohol problems, since they have elevated scores on the relevant screening questionnaires.

4.2 Limitations

One limitation of our study is that the CIDI-diagnosis live phone interviews were not taped, so inter-rater reliability could not be calculated. Second, subjects always completed the WSQ on the Internet before the other screening questionnaires, so order effects could not be ruled out. Third, though sensitivity and specificity do not depend on prevalence of the disorders in the population, the PPV and NPV do; consequently, the values we found might not generalize to situations where prevalence is different. Fourth, it is not known how representative our self-recruited participants are of Internet self-help applicants. Fifth, subjects who had a CIDI interview had significantly less social phobia on that WSQ-subscale than those who did not, so the WSQ-social-phobia results might be less generalizable to other populations. Sixth, as described earlier, 6-month prevalence rates of DSM-IV diagnoses were used, whereas the WSQ assesses current symptoms. Ideally, the WSQ should be validated against concurrent DSM-IV diagnoses. Seventh, norms are unavailable for acceptable levels of sensitivity and specificity which depend on the test's aim, costs, and benefits (Smits et al., 2007). As the WSQ aims to detect clinically-relevant mood, anxiety, and alcohol-related problems in order to minimize missed cases, we chose thresholds of sensitivity at 0.70 or more and of specificity at 0.40 or more. Finally, the WSQ for common mental disorders could be further simplified (http://webscreeningquestionnaire.org/files/WSQ_simple_version.pdf). However, before using this simplified WSQ, psychometric properties have to be evaluated.

Despite its limitations, the WSQ is a useful and quick Internet screening tool to detect people likely to have common mental disorders.

4.3 Future Research

Many false positives were found for WSQ subscales GAD, panic, specific phobia, and PTSD, while far fewer false positives were found for alcohol abuse/dependence, social phobia, panic disorder with agoraphobia, and OCD. The high rate of false positives may, for some questions, be due to a lack of clarity or classification criteria. Future research which enhances clarity of questions and classification criteria is needed to improve the predictive power of the WSQ.

Acknowledgements

Conflicts of Interest

None declared.

Abbreviations

AUC: area under the curve
AUDIT: alcohol use disorders identification test
CES-D: Center for Epidemiological Studies Depression scale
CIDI: composite international diagnostic interview
Dyst: dysthymia
DSM-IV: Diagnostic Statistical Manual, 4th edition
FQ: fear questionnaire
GAD: generalized anxiety disorder
GAD-7: generalized anxiety disorder - 7
GPs: general practitioners
IES: impact of events scale
ISP-D: Internet-based self-assessment program for depression
M: mean
MinD: minor depression
MDD: major depressive disorder
MINI: mini-international neuropsychiatric interview
NPV: negative predictive value
OCD: obsessive compulsive disorder
PDSS-SR: panic disorder severity scale self-report
PPV: positive predictive value
PTSD: Post-Traumatic Stress Disorder
SD: standard deviation
SQ: screening questionnaire
VU: Vrije Universiteit
WB-DAT: Web-based depression and anxiety test
WHO: World Health Organization
WSQ: Web screening questionnaire
YBOCS: Yale-Brown Obsessive Compulsive Scale

Web Screening Questionnaire for Common Mental Disorders (WSQ)

Q	Web Screening Questionnaire for common mental disorders (WSQ)					Sub-scale	From
1	Circle a number from the scale below to show how much you are troubled by feeling miserable or depressed:					Depres.	SQ
	Hardly at all	Slightly disturbing/ not really disabling	Definitely disturbing/ disabling	Markedly disturbing/ disabling	Very severely disturbing/ disabling		
	(0) (1)	(2) (3)	(4) (5)	(6) (7)	(8)		
2	Do you experience a loss of interest and/or pleasure in most things, like work, hobbies and other things you usually enjoy?		Yes (1)	No (0)		Depres.	CIDI
3	During the past two weeks, how often have you been bothered by the following problem: Having trouble relaxing?					GAD	GAD-7
	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)			
4	A panic attack is a sudden rush of fear or discomfort accompanied by at least 4 of the symptoms listed below. In order to qualify as a sudden rush, the symptoms must peak within 10 minutes. Symptoms are: rapid or pounding heartbeat, sweating, trembling/shaking, breathlessness, feeling of choking, chest pain/discomfort, nausea, dizziness/faintness, feelings or unreality, numbness/tingling, chills or hot flashes, fear of losing control or going crazy, fear of dying. If you have had any panic attacks during the past week, how distressing (uncomfortable, frightening) were they while they were happening? If you did not have any panic attacks but did have limited symptoms attacks, answer for the limited symptom attacks.					Panic	PDSS-SR
	Not at all distressing, or no panic or limited symptom attacks during the past week	Mildly distressing (not too intense)	Moderately distressing (intense, but still manageable)	Severely distressing (very intense)	Extremely distressing (extreme distress during all attacks)		
	(0)	(1)	(2)	(3)	(4)		
5	Do you avoid public places from which a quick escape may be difficult or do you endure this with clear suffering or anxiety? (e.g. public transport, shops/town centers, queues, cinema, unfamiliar buildings, distance from home).		Yes (1)	No (0)		AGO	SQ
6	Are you either extremely anxious or do you avoid specific objects or situations?		Yes (1)	No (0)		Specific Phobia	SQ
7	Are you scared of: animals (e.g. dogs, spiders, snakes, cats, birds, mice, insects) or medical issues (e.g. blood, dentist, injection, surgery, hospital, doctor) or specific situations (e.g. bus, crowded shop, tunnel elevator, airplane, bridge or car driving)		Yes (1)	No (0)		Specific Phobia	VU
8	Have you avoided social situations for fear that attention might be on you?		Yes (1)	No (0)		Social Phobia	MINI
9	Are you fearful or embarrassed being watched, being the focus of attention, or fearful of being humiliated? (This includes situations like speaking in public, eating in public with others, writing while someone watches, or being in social situations).		Yes (1)	No (0)		Social Phobia	MINI
10	Did your symptoms start after having experienced, witnessed or had to deal with an extremely traumatic event that included actual or threatened death or serious injury to you or someone else? (e.g. serious accident, sexual or physical assault, a terrorist attack, being held hostage, kidnapping, hold-up, fire, discovering a body, unexpected death, war, natural disaster…)		Yes (1)	No (0)		PTSD	MINI
11	Have you ever experienced a traumatic event?		Yes (1)	No (0)		PTSD	SQ
12	Obsessions are recurrent thoughts, impulses or images that are unwanted, distasteful, inappropriate, intrusive or distressing (e.g. the idea of hurting your children although you know you never want to do that). How much time did you spend on obsessions in the past week?					OCD	ybocs
	0 hr/day or no obsessions (0)	0-1 hr/day (1)	1-3 hr/day (2)	3-8 hr/day (3)	>8 hr/day (4)		
13	How many drinks containing alcohol do you have on a typical day when you are drinking?					Alcohol	audit
	None (0)	1-2 (1)	3-4 (2)	5-6 (3)	7-9 (4)	10 or more (5)	
14	How often do you have six or more drinks on one occasion?					Alcohol	audit
	Never (0)	Less than monthly (1)	Monthly (2)	Weekly (3)	Daily or nearly daily (4)		
15	Has the idea of harming yourself or taking your own life, recently come into your mind?					Suicide	SQ
	Definitely not (0)	Has crossed my mind but I would not do it (1)	I seriously considered it but I stopped myself (2)	I would do it given the opportunity (3)			

*WSQ cut-off scores: Depression: Q1≥ 5 & Q2=1; GAD: Q3≥2; Panic: Q4 ≥1; Panic with Ago Q4 ≥1 & Q5=1; Ago: Q5=1; Specific phobia: Q6 or Q7=1; Social phobia: Q8=1 & Q9=1; PTSD: Q10=1 or Q11=1; OCD: Q12≥1; Alcohol Abuse/Dependence : Q13≥2 & Q14≥3 ; Suicide : Q15=3 (exclusion)