

Chapter 2

The validity of the Dutch K10 and EK10 screening scales for depressive and anxiety disorders

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Abstract

The aim of this study was to validate the Dutch version of the Kessler-10 (K10) as well as an extended version (EK10) in screening for depressive and anxiety disorders in primary care. Data are from 1,607 participants (18 through 65 years, 68.8% female) of the Netherlands Study of Depression and Anxiety (NESDA), recruited from 65 general practitioners. Participants completed the K10, extended with five additional questions focussing on core anxiety symptoms, and underwent the WHO Composite International Diagnostic Interview (CIDI life time version 2.1) to assess DSM-IV-disorders (major depressive disorder, dysthymia, generalized anxiety disorder, social phobia, panic disorder, agoraphobia). Reliability (Cronbach's α) of the Dutch K10 was 0.94. Based on Receiver Operating Characteristics (ROC) analysis, the area under the curve (AUC) for the K10 for any depressive and/or anxiety disorder was found to be 0.87. The extended questions on the EK10 significantly improved the detection of anxiety disorders in particular. With a cut-off point of 20, the K10 reached a sensitivity of 0.80 and a specificity of 0.81 for any depressive and/or anxiety disorder. For the EK10, a cut-off point of 20 and/or at least one positive answer on the additional questions provided a sensitivity of 0.90 and a specificity of 0.75 for detecting any depressive and/or anxiety disorder. The Dutch version of the K10 is appropriate for screening depressive disorders in primary care, while the EK10 is preferred in screening for both depressive and anxiety disorders.

Key words: screening questionnaire; Depression; Anxiety; Sensitivity; Specificity

1. Introduction

Depressive and anxiety disorders are frequently seen in clinical practice, especially in primary care settings (Ellen et al., 1997; Howland and Thase 2005; Sartorius et al., 1996). The lifetime prevalence of both depressive and anxiety disorders among adults in the Dutch community is around 19.0% (Bijl et al., 1998). These disorders are responsible for personal suffering and, due to economic loss of productivity, high societal costs (Smit et al., 2006). Despite their prevalence, depressive and anxiety disorders often remain unrecognized (Ellen et al., 1997; Gilbody et al., 2001; Olfson et al., 2000; Sartorius et al., 1996). Therefore, a good screening procedure is important for clinical practice. To be acceptable in practice, instruments must be valid, reliable, brief and easy to use (Street et al., 1994). Most existing screening instruments are either brief but measure only one disorder, or are taking much time to complete when they screen for several disorders. The Kessler-10 (K10; Kessler and Mroczek, 1994) is one of the few screening instruments being short (10 questions and 2-3 min to complete) and screening for psychological distress (e.g. anxiety and depressive disorders). The advantages of the K10 over some other screening instruments are its strong psychometric properties and its ability to discriminate DSM-IV disorders from non-cases (Kessler et al., 2002). The K10 was developed based on extensive psychometric analyses in large population samples using item response theory methods and has a strong overall discriminatory power to detect DSM-IV cases from non-cases (Kessler et al., 2002). The K10 is a useful diagnostic screening instrument in general population samples (Furukawa et al., 2003; Kessler et al., 2005), as well as primary care samples (Kessler et al., 2002) and has been shown to be without substantial bias with respect to sex and education level (Baillie, 2005). Several studies reported good psychometric properties in screening for psychological distress and depressive disorders (*AUC* 0.77 to 0.93 [Baggaly et al., 2007; Cairney et al., 2007; Furukawa et al., 2003; Kessler et al., 2003]). It is still unknown whether the K10 screens as good for anxiety disorders as it does for depressive disorders, since most studies to date have focused on screening characteristics for severe mental illness (Kessler et al., 2003), psychological distress (Furukawa et al., 2003; Kessler et al., 2002), the combined group of depressive and anxiety disorders (Furukawa, 2008) or depressive disorders alone (Baggaly et al., 2007; Cairney et al., 2003). Since the K10 mainly consists of symptoms of depressive disorder, we wondered whether adding some more specific anxiety questions would improve the screening-properties of the K10 in the detection of anxiety disorders. Therefore we have extended the K10 (EK10) with five additional questions on core anxiety symptoms and on use of medication, (see supplementary file 1 at the website of the journal).

Since psychometric properties among different populations can vary, the present study examined the validity of the Dutch version of the K10 in detecting depressive and anxiety disorders in particular. Furthermore, this paper examined whether the EK10 has better screening-properties than the original K10 in identifying depressive and in particular anxiety disorders. Finally, we examined the optimal cut-off score of the K10 and EK10 for identifying those who are at risk of an anxiety and/or a depressive disorder.

2. Methods

2.1 Participants

Data are from the Netherlands Study of Depression and Anxiety (NESDA), an ongoing 8-year prospective longitudinal cohort study set up to examine the long-term prognosis of depressive and anxiety disorders. NESDA is designed to be representative of persons with a depressive and/or an anxiety disorder in different health care settings. For the present study, only primary care participants were included since in this population we conducted a screening approach to identify persons with psychopathology. Diagnoses were assessed using DSM-IV diagnosis (American Psychiatric Association) of Major Depression Disorder (MDD), Dysthymia (Dyth), Generalized Anxiety Disorder (GAD), Panic Disorder (PD), Social Phobia (SP) or Agoraphobia (AG). Participants were recruited from General practitioners (GPs) in Amsterdam, Groningen and Leiden, the Netherlands who consulted their GPs in the past four months regardless of their reason for consultation. Participants aged 18 through 65 years who (i) screened positive on the EK10 and (ii) on a short telephone screen interview consisting of the Composite International Diagnostic Interview short form (CIDI-SF; (Kessler et al. 1998) depression or anxiety disorder sections were seen at the NESDA clinic site for an interview using the CIDI lifetime (WHO version 2.1). In addition, a random selection of the screen-negatives was also invited to participate (Penninx et al., 2008). Excluded from participation were patients who were not fluent in Dutch, and those with other severe primary psychiatric conditions that will largely impact on the course of depression and anxiety disorders, while not being the main focus of the NESDA study. Consequently, those with a primary diagnosis of an Organic Psychiatric Disorder, Psychotic Disorder, OCD, Bipolar Disorder or severe Addiction Disorder and were treated in a mental health organization, were excluded from participation.

2.2 Procedure

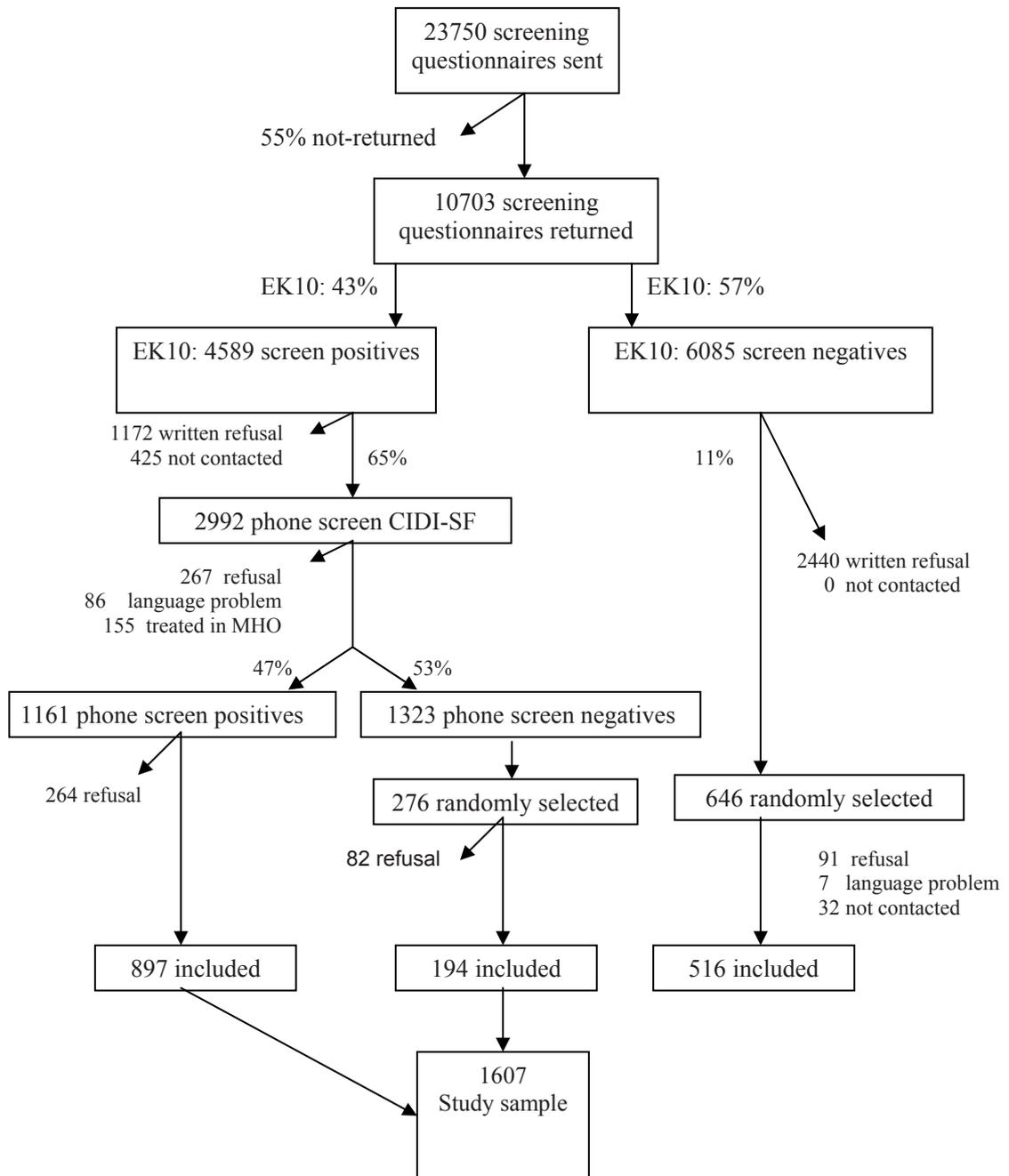
Sampling procedures and response have been described in detail elsewhere (Penninx et al., 2008). In short, a three-stage screening procedure was used. 65 General practitioners (GPs) in Amsterdam, Groningen and Leiden, the Netherlands, sent the extended K10 (EK10) to a random sample of 23,750 patients. They were asked to complete this questionnaire and return it to the research staff. The response rate after one written reminder was 45.0% (10,703 respondents, see Figure 1). Non-response analyses suggested no differences in psychopathology between responders and non-responders (Van der Veen, et al. submitted). Those returning the screening questionnaire were more likely to be female (59.3% versus 50.0%, $P < .001$) and older (44.4 versus 39.0 years. $p < 0.001$) compared to those not returning the screening questionnaire (Penninx et al., 2008). The 4,589 respondents (43.0%) who were screened positive (a [from previously studies] validated K-10 score of ≥ 20 (Furukawa et al., 2003) or a positive score on one of the five additional questions) were contacted for a short telephone screen interview consisting of the Composite International Diagnostic Interview short form (CIDI-SF; Kessler et al., 1998) sections (MDD, Dyth, GAD, PD, SP, AG) to assess the probability of anxiety or depressive disorders. This phone screen interview was

added to be able to screen a large group of participants in an economical way in terms of cost and time. Those who gave verbal consent and scored positive on the CIDI short-form criteria for a depressive or anxiety disorder (897 participants) by telephone, were seen at the NESDA clinic site for an interview using the CIDI lifetime (WHO version 2.1). In addition, a random selection of the screen-negatives (516 participants who scored negative on the written screening questionnaire and 194 participants who scored negative on the phone-screen) was also invited to participate (Penninx et al., 2008) Power analysis indicated that at least 400 screen-negative subjects were necessary to be compared with screen-positives. Excluded patients were identified during the phone screen. The result is our present sample of 1,607 respondents. See Figure 1 for the recruitment flow of participants.

In the total study population (N=1,607), there were three subgroups based upon the three-stage screening procedure: (1) participants with a negative EK10-screen; (2) participants with a positive EK10 screen and a positive phone-screen; and (3) participants with a positive EK10-screen and a negative phone screen. For those three subgroups weight factors were needed to recalculate the studied population back to baseline population (in detail described below), as stratification influences sensitivity and specificity rather heavily.

The participants were offered a gift card of €15 and reimbursement of travelling expenses after completing the interview. All participants gave written informed consent and the study has been approved by the Medical Ethics Committee of the VU University Medical Center.

Figure 1. Flowchart of participants (K10 and EK10)



Note: Figure 1. Recruitment flow of NESDA respondents in the primary care setting (Penninx *et al.*, 2008, in press); MHO= Mental Health organization

2.3 Measurements

The 10-item Kessler psychological distress scale (K10; Kessler and Mroczek) is a measure of non-specific psychological distress in the anxiety-depression spectrum. Item responses are on a five-point Likert scale (5= "all of the time" to 1= "none of the time"), total score ranges from 10 (no distress) to 50 (severe distress) (Andrews and Slade 494-97). Several studies reported good psychometric properties in screening for combined depressive and anxiety disorders (Cairney et al., 2007; Furukawa et al., 2003; Kessler et al., 2003), some have been less promising (Baggaley et al., 2007).

The K10 was translated into Dutch, according to the World Health Organisation (WHO) translation protocol applied for the European Study of Epidemiology in Mental Disorders (ESEMED; Alonso et al., 2004). There were no wording changes in the Dutch K10, except for questions 7 and 10, in which commonly used Dutch synonyms were added for depression ("somberheid" [sadness]) and worthless ("afkeurenswaardig" [reprehensible] and "minderwaardig" [inferior]) respectively. In NESDA, the K10 was extended with four self report core anxiety questions; one additional question for each of the core anxiety symptoms (panic, social phobia, agoraphobia and GAD) following the text of the CIDI-SF core anxiety questions, and one question regarding the possible use of antidepressants or anxiolytics. The extended questions are included in the present study. The EK10 is shown in supplementary file 1 at the website of the journal. The EK 10 is designed to assess non PTSD/OCD anxiety disorders. Response options of these five questions are: 'yes' and 'no', item-scores range from 0 to 5. A positive score on the EK10 is a score ≥ 20 and/or a positive score on one of the five additional questions. A negative score on the EK10 is a score < 20 and a negative score on the four self report core anxiety questions and the medication question. It takes about three minutes for the participant to complete. The decision of making one positive item on the 5 extended questions counting as a positive EK10 score was based upon the fact that the 5 extended questions each measure a different anxiety disorder or use of medication.

The Life Time version 2.1 of the Composite International Diagnostic Interview (World Health Organization, 1997), Dutch version (Janca et al., 1994; Smeets and Dingemans, 1993) and fully structured interview, was used as gold standard to assess DSM-IV disorders (MDD, Dysth, GAD, PD, SP, AG). Good reliability and validity have been reported for this version of the CIDI (Andrews and Peters, 1998; Wittchen, 1994). The assessment typically takes 30-75 minutes depending on the mental state of the respondents (Jordanova et al., 2004). Diagnoses within the last six months were used in the analyses.

CIDI interviewers mainly consisted of psychologists, nurses or residents in psychiatry. They received one week of training by a certified CIDI trainer. After approval of audiotapes of at least two complete interviews they were certified to conduct the interview. A random selection of 10% of all taped interviews was reviewed in order to monitor interviewers' behaviour (Penninx et al., 2008). The inter-rater reliability for the depression and anxiety disorders have been explicitly tested by Wittchen et al. (Wittchen et al., 1984) and has shown to be high. The CIDI-trained interviewers were blind to the subject's classification on the EK10.

2.4 Statistical analyses

Because of the stratified selection (see Figure 1) the study sample was weighted back to the composition of the original sample using appropriate weights. EK10 negative subjects received the weight factor of $(6085/516) \times (1607/10703) = 1.77$; EK10 phone positive subjects received the weight factor of $(1161/897) \times (4589/2484) \times (1607/10703) = 0.36$, while EK10 phone negative subjects received the weight factor $(1323/194) \times (4589/2484) \times (1607/10703) = 1.89$.

Analyses were based on three main categories: any depressive disorder (MDD and Dysth), any anxiety disorder (GAD, PD, SP and/or AG) and any disorder (any depressive disorder and/or any anxiety disorder). First, internal consistency reliability (Cronbach's alpha) of the K10 was calculated. Then, Receiver Operating Characteristic (ROC) analyses were performed which calculated an Area under the Curve (AUC) for the K10. The AUC can be interpreted as the probability that a randomly chosen respondent with a disorder and a randomly chosen respondent without a disorder would be correctly distinguished based on their screening scores (Hanley and McNeil, 1983). Because the EK10 has a dichotomous outcome measure, we calculated sensitivity, specificity, positive predictive value and negative predictive value for different cut-off values of the K10 and EK10 in detecting depressive and/or anxiety disorders. Sensitivity is the probability that a person who suffers from a disorder is screen positive. Specificity is the probability that a person not suffering from a disorder is screen negative. Positive Predictive Value (PPV) is the probability of a positive diagnosis after a positive screening and Negative Predictive Value (NPV) is the probability of a negative diagnosis after a negative screening. In addition, we determined the optimal cut-off point. A common method for deriving the best cut-off score is set which generates the highest sum of sensitivity and specificity coefficients (Leentjens et al., 2000). However, there is no consensus on what levels of sensitivity and specificity are optimal, as they depend on the test's aim, costs and benefits (Smits et al., 2007). Since a screening questionnaire should also minimize the number of missed cases of clinically-relevant mood and anxiety problems, we also evaluated specifically the sensitivity of various cut-off points. Furthermore, we performed logistic regression analysis to test whether the additional questions of the EK10 statistically improved the prediction in detecting a depressive and/or anxiety disorder above K10 alone by testing model improvement using nested models. For this purpose the difference $(-2\log\text{Likelihood}(\text{model with K10 and extended question score}) - -2\log\text{Likelihood}(\text{model with K10 only}))$ was computed and compared with chi-square with 1 degree of freedom (Field and Wright, 2005). In addition, sensitivity, specificity, PPV and NPV analyses for K10 and EK10 in screening for different disorders (PAN, SF, GAD, MDD and Dysth) were calculated to examine whether the screening characteristics were different across types of diagnoses. Missing values on the K10 were only imputed (through replacing by individual mean item score) if respondents had answered at least 80% of the items on this questionnaire ($n=0.17\%$). All analyses were conducted in SPSS version 13.0 for Windows.

3. Results

In the total (weighted) sample, the average age was 46.40 years (SD 11.94, range 18-65), the majority of the subjects was female (67.3%). In total, 28.8% of the subjects met the DSM-IV criteria for any current (6-month recency) depressive and/or anxiety disorder. 16.9% of the subjects fulfilled the criteria of a depressive disorder and 22.4% of an anxiety disorder (see Table 1). The median time between the EK10 and CIDI interview was 21 days (n=110, SD: 13.8).

Table 1. Demographic characteristics and 6 month prevalence of DSM-IV depressive and anxiety disorders (N=1607), weighted analyses

	Total (%)
Gender (%)	
Male	(32.7)
Female	(67.3)
Age, mean (S.D.)	46.40 (11.94)
Range	[18–65]
Any depressive disorder	(16.9)
Major depressive disorder	(16.2)
Dysthymia	(4.1)
Any anxiety disorder	(22.4)
Social phobia	(10.8)
GAD	(6.7)
Panic and/or agoraphobia	(13.2)
Any disorder	(28.8)

The reliability (Cronbach's α) of the K10 in our sample was 0.94. Scale analysis showed that Cronbach's alpha did not improve when omitting one item of the K10-scale. The Area under the Curve (AUC) of the K10 for any depressive and/or anxiety disorder was 0.87 (95% C.I. 0.869-0.873) (see supplementary material file 2 at the website of the journal). For their screening properties in detecting any depressive and/or anxiety disorders, different cut-off scores for the K10 and EK10 were evaluated (Table 2, weighted analyses). The best cut-off score for both the K10 and EK10 was found to be 20 (K10: sensitivity: 0.79-0.90; specificity: 0.74-0.81; PPV: 0.41-0.63; NPV: 0.93-0.97, EK10: sensitivity: 0.89-0.95; specificity: 0.67-0.75; PPV: 0.37-0.60; NPV: 0.95-0.99). Especially for screening for anxiety disorders, the EK10's sensitivity performance appeared to be better than the K10 performance (EK10-20: sensitivity: 0.89; specificity: 0.70, K10-20: sensitivity: 0.79; specificity: 0.76).

Table 2. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for different cut off scores on the K10 and EK10, weighted analyses

	Sensitivity	Specificity	PPV	NPV
ANY DEPRESSIVE OR ANXIETY DISORDER				
K10-18	0.86	0.73	0.56	0.93
K10-20	0.80	0.81	0.63	0.91
K10-22	0.73	0.85	0.66	0.89
EK10-18	0.92	0.69	0.54	0.95
EK10-20	0.90	0.75	0.60	0.95
EK10-22	0.88	0.78	0.62	0.94
ANY DEPRESSIVE DISORDER				
K10-18	0.92	0.66	0.35	0.98
K10-20	0.90	0.74	0.41	0.97
K10-22	0.86	0.79	0.45	0.91
EK10-18	0.95	0.61	0.33	0.98
EK10-20	0.95	0.67	0.37	0.99
EK10-22	0.94	0.70	0.39	0.98
ANY ANXIETY DISORDER				
K10-18	0.86	0.68	0.43	0.94
K10-20	0.79	0.76	0.48	0.93
K10-22	0.72	0.80	0.51	0.91
EK10-18	0.92	0.64	0.42	0.97
EK10-20	0.89	0.70	0.46	0.96
EK10-22	0.88	0.72	0.48	0.95

Note: Negative K10 is a score < 18, 20 or 22 respectively; Positive K10 is a score ≥ 18, 20 or 22 respectively;

Negative EK10 is a score < 18, 20 or 22 respectively, and no positive answer on any of the 5 additional questions; Positive EK10 is a score ≥18, 20 or 22 respectively and/or at least one positive answer on one of the 5 additional questions.

Results of the logistic regression analyses are presented in Table 3. When compared to Model with only K10 cut-off score ≥20 (Model 1), the extension of the five additional questions on the EK10 (with a cut-off score of at least one positive score on one of the five additional questions, Model 2) significantly improved the prediction of detecting any depressive and/or anxiety disorder, as indicated by a highly significant Likelihood Ratio test ($P<0.001$). This was especially true for the detection of any anxiety disorder ($P<0.001$).

Table 3. Stepwise logistic regression analysis, weighted analyses

	OR (95% C.I.)		Model improvement	
			-2log likelihood	χ^2 ; df=1 P
<i>Any depressive or anxiety disorder</i>				
Model 1: K10b20 versus K10 \geq 20	17.03 (12.96–22.38)		1381.757	
Model 2: K10b20 versus K10 \geq 20	4.81 (3.39–6.81)			
Extended questions score ^a	7.25 (5.09–10.33)		1258.974	<0.001
<i>Any depressive disorder</i>				
Model 1: K10b20 versus K10 \geq 20	25.57 (16.85–38.81)		1040.843	
Model 2: K10b20 versus K10 \geq 20	9.02 (5.43–14.99)			
Extended questions score ^a	4.70 (2.90–7.59)		995.964	<0.001
<i>Any anxiety disorder</i>				
Model 1: K10b20 versus K10 \geq 20	11.94 (8.95–15.92)		1335.274	
Model 2: K10b20 versus K10 \geq 20	3.35 (2.29–4.89)			
Extended questions score ^a	6.75 (4.55–10.01)		1238.848	<0.001

Note: Results of stepwise logistic regression analysis to test model improvement in prediction of any depressive and/or anxiety disorder when model with K10 (Model 1) was extended with score on additional questions (Model 2).

^a Positive score on extended questions is at least one positive answer on any of the 5 additional (anxiety and medication) questions.

When examining the sensitivity and specificity of specific disorders (Table 4), we found good screening properties for the K10 on MDD, Dysth and GAD, PD and/or AG and SP (sensitivity: 0.78-1.00; specificity: 0.66-0.73). As expected, the sensitivity of the EK10 was high for all disorders, especially for anxiety disorders (sensitivity: 0.87-1.00), although, as a consequence, specificity of the EK10 was lower (specificity: 0.59-0.67). Negative predictive values for the K10 as well as the EK10 on all specific disorders were high (0.96-1.00), positive predictive values were low (0.09-0.39).

Table 4. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for different disorders on the K10 and EK10, weighted analyses

	Sensitivity	Specificity	PPV	NPV
Major Depressive Disorder				
K10-20	0.90	0.73	0.39	0.97
EK10-20	0.95	0.67	0.36	0.99
Dysthymia				
K10-20	1.00	0.66	0.11	1.00
EK10-20	1.00	0.59	0.09	1.00
Generalized Anxiety Disorder				
K10-20	0.94	0.67	0.17	0.99
EK10-20	0.95	0.61	0.15	0.99
Panic disorder and/or agoraphobia				
K10-20	0.81	0.70	0.29	0.96
EK10-20	0.92	0.64	0.28	0.98
Social phobia				
K10-20	0.78	0.68	0.23	0.96
EK10-20	0.87	0.62	0.22	0.97

Note: Negative K10 is a score < 20. Positive K10 is a score ≥20; Negative EK10 is a score < 20 and no positive answer on one of the 5 additional questions; Positive EK10 is a score ≥20 and/or at least one positive answer on any of the 5 additional questions.

4. Discussion

The current study evaluated the validity of the K10 and extended K10 (EK10) in the detection of depressive as well as anxiety disorders among primary care participants. The Dutch version of the K10, with a cut off score of ≥20, is appropriate for screening depressive disorders in primary care, while the EK10 is preferred in screening for both depressive and anxiety disorders and anxiety disorders alone. The increased ability of the EK10 to identify "depressive or anxiety disorders" is largely, but not completely, the result of the EK10's increased ability to identify anxiety disorders. The K10 proved to be reliable (Cronbach's α 0.94) and valid (*AUC* 0.87) in detecting diagnoses of any depressive and/or anxiety disorder, and is in line with previous studies (*AUC* 0.87 to 0.93 [Cairney et al., 2007; Furukawa et al., 2003; Kessler et al., 2002; Kessler et al., 2003]). As we have hypothesized, logistic regression analysis unequivocally showed that in our study population the addition of the five questions on the EK10 significantly improved the detection of any anxiety disorder in particular.

A recent study (Smits et al., 2007) suggests that the optimal cut off score is determined by the costs and benefits of correct and erroneous decisions depending on the context in which the mental health screening instrument is used. For a depressed person, a screening instrument with high sensitivity is important, as the depression will afflict his or her quality of life. For health care providers, the trade-off between the costs of a detected patient (cost of medical care, the use of the treatment and the diagnostic instrument) versus the costs of an undetected patient (with a potential higher risk of overall medical care costs and costs associated with loss of productivity) has to be made, which will probably result in another optimal cut-off point. For researchers, it will be costly to miss depressed people (e.g., high rate of false negatives) as this slows the recruitment of respondents. Therefore, a low cut-off score with, consequently, a high sensitivity and a low rate of false negatives, is preferable. It is, however, beyond the scope of this paper to calculate these costs. We found that the optimal cut-off score (where the sum of sensitivity and specificity reaches its maximum and taking high levels of sensitivity into account) based upon any depressive or any anxiety disorder for both the K10 and the EK10 seems to be 20 and/or at least one positive answer on one of the five extended questions. While previously studies found different cut-off scores (e.g. cut-off score of 14 [Baggaley et al., 2007]; cut-off score of 19 [Harvard School of Medicine, 2006]), our finding of a cut-off score of 20 or more is supported by other studies (Furukawa et al., 2003). Although differences between cut-off score of 20 or 22 on the EK10 are not large, using a cut-off score of 20 on the EK10 will minimize missed cases of people likely to have a depressive and/or anxiety disorder.

The present study is afflicted with a few limitations. A first limitation is the high rate of non-response and refusals (higher among males than females) which may have resulted in selection bias. However, as non-response analyses suggested no effect on psychopathology between responders and non-responders (Van der Veen, et al., submitted) and additional analyses did not indicate differential effects in sensitivity and specificity analyses between males and females, there is no reason to believe refusals have contributed to selectivity. Furthermore, screening using a carefully prepared screening instrument (K10) which has been validated in many settings to determine optimum cut-off scores is given equal weight to each of the five questions on the EK10. Also, the usage of a phone screen vs. the in person interview introduced an additional layer in our recruitment strategy, but we adequately adjusted for this by applying weighing factors. Furthermore, there are several studies providing qualified justification for the use of telephone interviews to collect data of mental health disorders (Evans, et al., 2004; Rohde et al., 1997; Willemse et al., 2004). Finally, since our study focused on primary care participants, our results might not be completely generalizable to the general population. Furthermore, generalizability of the EK 10 as a measure of depression and anxiety may be further limited as individuals with OCD or PTSD as primary disorder were not included in this study. Besides the limitations, strong aspects of this study are the large number of participants, the close monitoring of trained CIDI-interviewers and the use of an extensive CIDI with depression and anxiety diagnoses.

In sum, our findings illustrate that the Dutch K10 is an appropriate screening instrument for depressive disorders in primary care. Extending the K10

with five additional questions improved the detection of especially anxiety disorders. The most appropriate cut-off score on the K10 appears to be 20.

Depression and anxiety disorders often unrecognized (Ellen et al., 1997; Olfson et al., 2000). There is a need for screening tools that will help physicians and other professionals in primary care recognize and adequately treat major depressive disorder and anxiety disorders (Farvolden et al., 2003). Better detection of disorders can eventually lead to less personal suffering and more adequate healthcare. Therefore, screening for these disorders is of important value for clinical practice as well as research reasons. Both K10 and EK10 are well-qualified to do so.

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Optional e-only supplementary files
Appendix 1. K10 and the five additional questions

The following questions are about your feelings in **the past 4 weeks**.

		All of the time	Most of the time	Some of the time	A little of the time	None of the time
1	About how often did you feel tired out for no good reason?	<input type="checkbox"/>				
2	About how often did you feel nervous?	<input type="checkbox"/>				
3	About how often did you feel so nervous that nothing could calm you down?	<input type="checkbox"/>				
4	About how often did you feel hopeless?	<input type="checkbox"/>				
5	About how often did you feel restless or fidgety?	<input type="checkbox"/>				
6	About how often did you feel so restless you could not sit still?	<input type="checkbox"/>				
7	About how often did you feel depressed?	<input type="checkbox"/>				
8	About how often did you feel that everything was an effort?	<input type="checkbox"/>				
9	About how often did you feel so sad that nothing could cheer you up?	<input type="checkbox"/>				
10	About how often did you feel worthless?	<input type="checkbox"/>				
					yes	no
11	In the past month, did you have a spell or attack when all of a sudden you felt frightened, anxious or very uneasy, or all of a sudden experienced physical symptoms?				<input type="checkbox"/>	<input type="checkbox"/>
12	In the past month, did you have an unreasonably strong fear of being in a crowd, leaving home alone, standing in a queue or traveling on buses, cars and trains?				<input type="checkbox"/>	<input type="checkbox"/>
13	In the past month, did you have a strong fear of doing things in front of others, like speaking in public, eating in public, writing while someone watches?				<input type="checkbox"/>	<input type="checkbox"/>
14	In the past month, have you felt most of the time worried and anxious?				<input type="checkbox"/>	<input type="checkbox"/>
15	Do you use medication for anxiety, depression, tension or stress at this moment?				<input type="checkbox"/>	<input type="checkbox"/>

Optional e-only supplementary files

Appendix 2. ROC-curve of Dutch K10 for any depressive and/or anxiety disorder

ROC Curve

