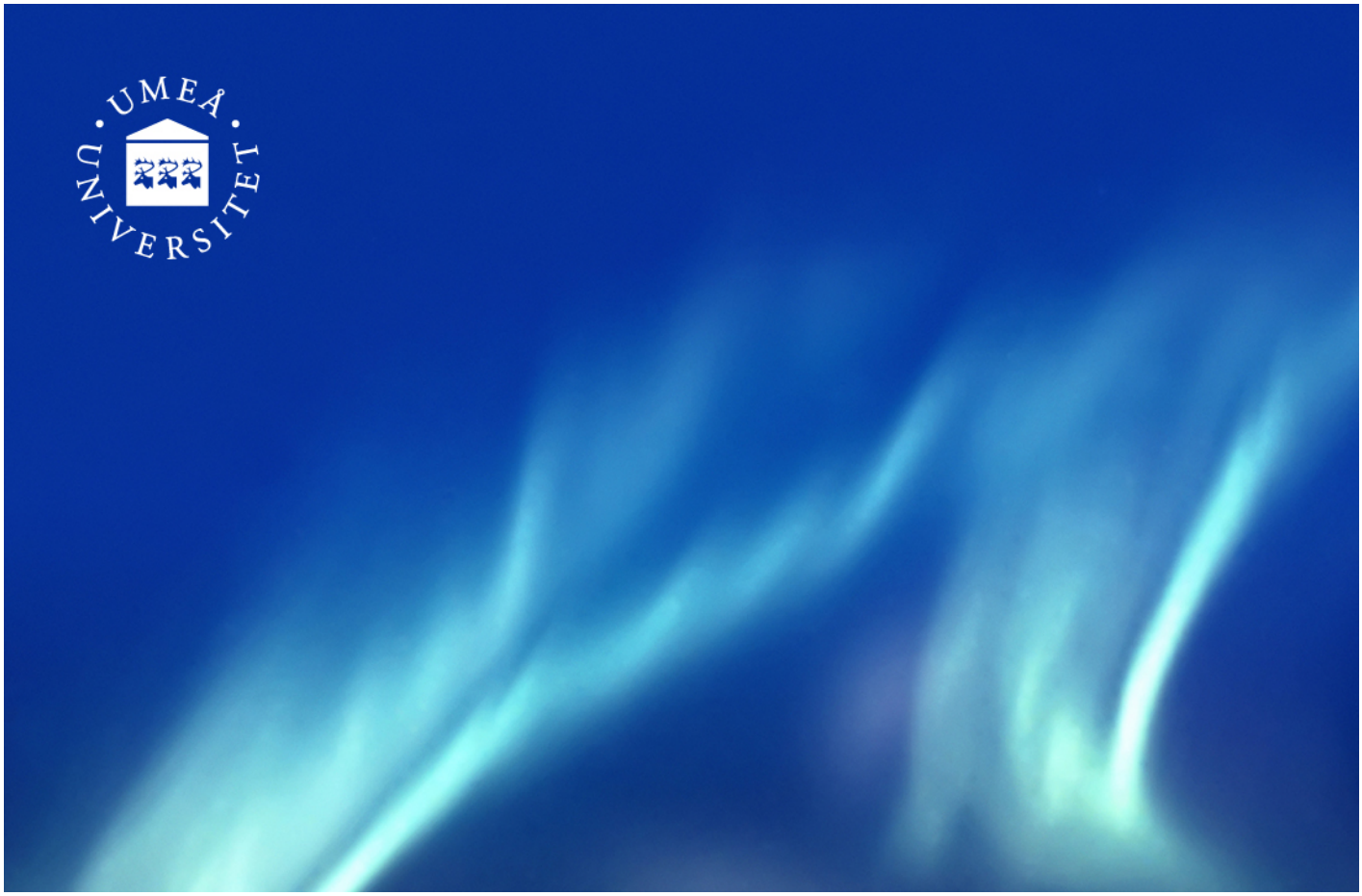

Validation of the Edinburgh Gotland Depression Scale for Swedish fathers

Niklas Svenlin

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Supervisor: Anna E Sundström

VALIDATION OF THE EDINBURGH GOTLAND DEPRESSION SCALE FOR SWEDISH FATHERS

Niklas Svenlin

Paternal postnatal depression has begun to receive attention during the last decade. Studies have shown that the consequences of paternal and maternal postnatal depression are equally serious. There are currently no validated instrument for screening of paternal postnatal depression. In this cross-sectional study a self-report questionnaire, the Edinburgh Gotland Depression Scale (EGDS) is validated against the clinical interview SCID-CV as gold standard, and is further developed. A convenience sample of Swedish fathers (N = 95) who had children in the past year, answered an online questionnaire and a subsample (n = 52) of them were later interviewed with the SCID-CV. The revised EGDS showed improved criterion-related validity, sensitivity and specificity. The scale has problems disciminating between mildly and non-depressed fathers. A cut-off score of ≥8 on the revised EGDS results in sensitivity of 91.7 per cent and specificity of 85.0 per cent. This study should be replicated and cross-validated to provide further evidence of validity.

Postnatal depression hos fäder har börjat uppmärksammas under det senaste decenniet. Studier har visat att konsekvenserna av postnatal depression hos fäder och mödrar är lika allvarliga. Det finns för närvarande inga validerade instrument för screening av postnatal depression hos fäder. I denna tvärsnittsstudie har självskattningsformuläret, Edinburgh Gotland Depression Scale (EGDS) valideras mot den kliniska intervjun SCID-CV som gold standard, och vidareutvecklas. Ett bekvämlighetsurval av svenska fäder (N = 95) som fått barn under det senaste året, besvarade en webbenkät och en undergrupp (n = 52) av dem blev senare intervjuade med SCID-CV. Det reviderade EGDS visade förbättrad kriteriumrelaterad validitet, sensitivitet och specificitet. Skalan har problem med att diskriminera mellan milt och icke-deprimerade pappor. En cut-off poäng ≥8 för den reviderade EGDS resulterar i sensitivitet på 91,7 procent och specificitet på 85,0 procent. Denna studie bör replikeras och korsvalideras för att ge ytterligare belägg för validiteten.

Depression is one of our major diseases and at least 25 per cent of all Swedish women and 15 per cent of all Swedish men will suffer from depression at some time during their lifetime (Socialstyrelsen, 2010). On an international level, depression has been reported as the leading cause of disability if measured by years lived with the disease (Mathers, Boerma, & Ma Fat, 2008). Depression leads to high costs for society in the form of long-term sick leave, reduced productivity and increased health care costs, while the costs for the individual are more difficult to quantify (Socialstyrelsen, 2010).

Postnatal depression

It is common that new mothers experience periods of the so-called "maternity blues" during a few days within the first two weeks after delivery (Henshaw, 2003). Common symptoms of the "blues" are tearfulness, emotional lability, confusion, anxiety, distractibility, elation and irritability. For some mothers, however, these periods are more difficult and longer, resulting in postnatal depression (i.e. major depression within the first year after delivery). The prevalence of depressive symptoms are higher among new mothers compared to women in general; approximately ranging from 10 to 15 per cent (Gavin et al., 2005; O'Hara & Swain, 1996; Rubertsson, Waldenstrom, Wickberg, Radestad, & Hildningsson, 2005; Wickberg & Hwang, 1997). Despite higher prevalence of symptoms, the prevalence of major depression is not higher among new mothers, ranging from one to six percent (Cox, Murray, & Chapman, 1993; Eberhard-Gran, Eskild, Tambs, Samuelsen, & Opjordmoen, 2002; O'Hara, Neunaber, & Zekoski, 1985). Known factors associated with maternal postnatal depression are: a history of depression before or during pregnancy, experiencing stressful life events during pregnancy, poor marital relationship and low social support (Rubertsson et al., 2005).

Postnatal depression has been regarded as an almost exclusively female phenomenon until about 10 years ago. Since then, numerous studies have looked in to the subject and found that fathers also suffer from postnatal depression (for a review, see e.g. Edward, Castle, Mills, Davis, & Casey, 2015). Several studies have found that the main factors associated with depression among fathers during the postnatal period are: reduced satisfaction with the relationship to the mother (Deater-Deckard et al., 1998; Figueiredo et al., 2008; Giallo, D'Esposito, Cooklin, et al., 2012; Ramchandani et al., 2011; Wee, Skouteris, Pier, Richardson, & Milgrom, 2011) and the mother being depressed or reporting a high degree of depressive symptoms (Giallo, D'Esposito, Cooklin, et al., 2012; Matthey, Barnett, Kavanagh, & Howie, 2001; Pinheiro et al., 2006; Ramchandani et al., 2008; Schumacher, Zubaran, & White, 2008; Wee et al. 2011). Deater-Deckard et al. (1998) also found, in an American sample, that lack of support from family and friends was associated with a higher risk for paternal postnatal depression. These results have been confirmed in a Swedish study by Massoudi, Hwang and Wickberg (2013a).

Postnatal depression among mothers and fathers has severe consequences for the entire family. Milgrom and McCloud (1996) found that mothers with high levels of depressive symptoms rated themselves as less competent parents, and less emotionally involved in the child compared to non-depressed mothers. They also

found that depressed mothers described both the relationship to the father and to the child in more negative terms than non-depressed mothers. In a study by Murray, Fiori-Cowley, Hooper and Cooper (1996) depressed mothers showed impaired ability to respond to their child's social cues and emotional needs, being more emotionally discordant than non-depressed. Several studies have found that children to depressed mothers have a higher risk of developing insecure attachment styles (mainly avoidant or disorganised attachment), and suffer negative effects on socio-emotional (e.g. conduct problems and externalising behaviour) and cognitive development (Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Martins & Gaffan, 2000; McMahon, Barnett, Kowalenko, & Tennant, 2005; Murray & Cooper, 1996). Depression in mothers is also related to impaired growth in the child (Rahman, Iqbal, Bunn, Lovel, & Harrington, 2004).

In a prospective study, Ramchandani et al. (2005) found that paternal depression was associated with adverse emotional and behavioural outcomes in the children, and an increased risk of conduct problems in boys specifically, at age three and a half years. These results remained after adjusting for maternal and paternal depression outside of the postnatal period. During the last decade several studies have found similar results, such as detrimental effects on emotional, behavioural and cognitive development (Gutierrez-Galve, Stein, Hanington, Heron, & Ramchandani, 2015; Ramchandani et al., 2008; Wilson & Durbin, 2010; se also Edward et al., 2015 for a comprehensive review). Mezulis, Hyde and Clark (2004) found that fathers to some extent are able to compensate for the effects of the maternal postnatal depression as long as the father is not depressed himself. Their results also show that depression in both parents is a negative predictor for the mental health outcome in the child. Due to this, screening of paternal postnatal depression should be considered important.

Screening with Edinburgh Postnatal Depression Scale

In 2010 the Swedish National Board of Health and Welfare recommended all Swedish child health centres to offer screening for postnatal depression to all mothers between six and eight weeks after delivery (Socialstyrelsen, 2010). The child health services of the Swedish county's recommends the use of the Edinburgh Postnatal Depression Scale (EPDS) as an instrument in the screening process (Wickberg, 2015). The scale is not intended as a diagnostic tool but rather as an indicator of possible depressive mood and it is recommended that the results from the scale are followed up with an interview by the administrative district nurse (Cox & Holden, 2003; Matthey, 2010). The scale is the most widely used screening instrument for postnatal depression among mothers, and has been validated in at least 25 countries (Gibson, McKenzie-McHarg, Shakespeare, Price, & Gray, 2009). The specificity and sensitivity of the EPDS have been examined in a number of studies. Specificity refers to an instruments ability to correctly identify individuals with a disease, whereas sensitivity corresponds to the instruments ability to correctly identify individuals who do not have the disease. The results have indicated varying levels of sensitivity and specificity over studies and settings, ranging from 0.34 to 1.00 and 0.44 to 1.00 respectively (Gibson et al., 2009). In their systematic review the Swedish Agency for Health Technology Assessment and Assessment of Social Services found that the EPDS correctly

identifies about two thirds of all depressed mothers (Statens beredning för medicinsk utvärdering, 2012).

Several studies (Matthey et al., 2001; Edmonson, Psychogiou, Vlachos, Netsi, & Ramchandani, 2010; Lai, Tang, Lee, Yip, & Chung, 2010; Tran, Tran, & Fischer, 2012; Massoudi, Hwang, & Wickberg, 2013b) have tried to validate the EPDS for screening of paternal postnatal depression, however with non-conclusive results as sensitivity and specificity over all studies ranges from 0.55 to 1.0 and 0.77 to 0.97 respectively resulting in recommended cut off score ranging from ≥5 to ≥12 points. The point prevalence of postnatal depression among fathers at three months postpartum has been estimated to 6.1 percent, using the EPDS with a cut off score of 12 for minor and major depression; 1.3 percent major depression alone in a recent Swedish study (Massoudi et al., 2013b). This is similar to other international findings (Figueiredo & Conde, 2011; Madsen & Juhl, 2007; Ramchandani et al., 2005). These results go in line with a well-established female-to-male ratio of 2:1 for depression in population-based studies (Alonso et al., 2004).

It has been suggested that the recurring finding that depression is twice as common in women as in men is the result from men being under-diagnosed due to expression of atypical symptoms such as aggressiveness and irritability rather than depressive mood (Rutz, 1996). Following a study by Rutz (1996), several scales for assessing male depression have been developed (see e.g. Magovcevic & Addis, 2008; Martin, Neighbors, & Griffith, 2013; Rice, 2011), however at the start of the present study none of them have been validated for screening of paternal depression. The Gotland Male Depression Scale (GMDS) was developed by Wålinder and Rutz (2001) to measure the atypical symptoms of depression, and the scale has been validated in several studies (Chu et al., 2014; Sigurdsson, Palsson, Aevarsson, Olafsdottir, & Johannsson, 2015; Zierau, Bille, Rutz, & Bech, 2002), however not for paternal depression. Evidence for convergent validity has been found as the GMDS was positively related to the gold standard screening tool Beck Depression inventory-Second edition (BDI-II; Beck, Steer, & Brown, 1996).

There are several known instruments for assessing maternal postnatal depression, the EPDS being the most widely used. There are also several scales trying to capture the so-called male depression, with the GMDS being the only validated scale so far. However, to our knowledge there are no validated instruments for assessing postnatal depression among fathers.

The Edinburgh Gotland Depression Scale

Recently, a research team at the University of Lund did an attempt to construct a scale for assessing paternal postnatal depression. Agebjörn and Linder (2015) administered the EPDS, GMDS and BDI-II to 447 fathers. The factor structure and internal consistency of all items from the EPDS and GMDS were investigated to form a new scale, the Edinburgh Gotland Depression Scale (EGDS), consisting of 11 items – five items from the EPDS and six items from the GMDS. The new scale showed improved sensitivity (0.88), specificity (0.84) and internal consistency (*Cronbach's $\alpha = 0.89$*) compared to the EPDS in their sample, using the BDI-II (cut

off ≥14) as gold standard, hence indicating improved convergent validity of the EGDS. Neither the EPDS nor the GMDS has any item concerning the depression criterion of weight loss/gain or changes in appetite or the criterion of reduced interest. Agebjörn and Linder (2015) included one item concerning weight in their study but excluded it from the EGDS due to low factor loading. Including items related to these criterions could result in a lower inter-item reliability of the scale but might improve the content and/or criterion-related validity as such due to better construct representation.

Although the scale showed improved characteristics compared to the EPDS, it has not yet been validated against a clinical diagnosis of depression. Although the BDI-II has showed high convergence with clinical diagnosis, no self-report instrument can be used for actual diagnosing (Statens beredning för medicinsk utvärdering, 2012). It is a well known fact that self-report questionnaires have several limitations, such as that the researcher does not know how the participant have understood the questions or the response alternatives, that the response alternatives are not able to capture all possible experiences of the participants, as well as that the diagnostic criterion may be too technical and comprehensive to be clarified in an understandable and accessible way for the layperson (Statens beredning för medicinsk utvärdering, 2012). The semi-structured clinical interview allows for a more thorough examination of the participant's experience, while enabling clarifying follow-up questions, for the clinician to use their professional competence and understanding of the diagnostic criteria for diagnosis. At the same time the interview enables the clinician to verify his/her understanding of the participant's response with the participant (Statens beredning för medicinsk utvärdering, 2012). Hence, although the EGDS appears to measure depressive symptoms, it cannot be concluded that the scale is capturing the full range diagnosis of depression before a criterion-related validity study has been conducted. Validating the EGDS against a semi-structured clinical interview would provide valuable information on the scales criterion-related validity.

In the current study the EGDS is compared to the Structured Clinical Interview for DSM-IV Axis I Disorders, Clinician Version (SCID-CV; First, Spitzer, Gibbon, & Williams, 1996). While there is no objective golden standard of psychiatric diagnosis to compare to, the SCID-CV is often used as the golden standard for clinical diagnosis in concordance with the text revised fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; DSM–IV-TR; American Psychiatric Association, 2000). Structured and semi-structured clinical interviews have shown higher inter-rater reliability and criterion-related validity than unstructured clinical interview (First et al., 2014; Miller, Dasher, Collins, Griffiths, & Brown, 2001; Shear et al., 2000). The conclusion of a systematic review on diagnostics related to mood disorders was that the SCID-I is one of two diagnostic tools with high enough sensitivity and specificity for use in clinical diagnostic work. Another conclusion was that unstructured clinical interviews do not produce high enough sensitivity (Statens beredning för medicinsk utvärdering, 2012).

The aim of the current study was to examine if the EGDS could be improved by adding items related to either the criterions of major depression as defined by the DSM-5 or known risk factors for paternal depression. Moreover, the aim of this study was to examine the psychometric properties, dimensionality and criterion-related validity of the revised EGDS for screening of postnatal depression. Criterion-related validity, in terms of sensitivity and specificity, was examined by comparing EGDS rating to the SCID-CV as gold standard.

Method

Participants
A total of 104 fathers answered the online questionnaire. Of these, 95 fathers met the inclusion criteria of the study, being a Swedish-speaking father who has had a child within the last 12 months. Of the 95 participants, 52 were also interviewed with the SCID-CV. The mean age of the respondents was 33 (SD = 4.3) years. A majority (59%, n = 56,) of the fathers were first-time fathers, 30 (32%) had two children and 9 (10%) had three. The average age interval of the youngest child was three to four months with children between 1 and 8 months being within one standard deviation from the mean. Of the responding fathers 79 (83%) had never been treated for depression, 14 (15%) had been treated prior to the study and two (2%) were in treatment when answering the questionnaire. All respondents were living together with the mother and the child. There were no significant differences in these background variables between those interviewed and those who were not.

Procedure
In this study, which had a cross-sectional design, a convenience sample of fathers answered a self-report questionnaire. For a sub-sample of participants, the self-reports were compared with results from a gold standard structured clinical interview. Participants were recruited either through the child health centres of the Umeå region (i.e. the municipalities of Umeå, Nordmaling, Bjurholm, Vännäs, Vindeln and Robertsfors) and Skellefteå municipality or through an invitation spread on the social network site Facebook. No data was collected concerning were the participants had received information about the study. At the child health centres an invitation letter was handed over to fathers participating in the so called "fathers appointment" when the child was between nine and ten months. An invitation was also handed over to mothers participating in the EPDS-screening when the child was three months, asking them to take the invitation home to the child's father.

The invitation letter, which was also spread on Facebook, contained information about the aim and procedure of the study, that the participation is voluntary, that participants can withdraw their consent at any point without explanation, that all data will be treated with confidentiality, and that the data will only be used for research purposes. In the letter was also a web-address to the online version of the questionnaire. At the end of the questionnaire the fathers were asked if they were willing to participate in a short structured interview to assess the quality of the questionnaire. Those who were willing, provided their contact information at the end of the questionnaire. The contact information to the fathers was kept separated from the scores on the questionnaire prior to the interview and was deleted afterwards.

Those who agreed to participate in the interview and who were not familiar with me, were interviewed using the depression section of the SCID-CV via telephone. Specific considerations were given to issues, which could be misinterpreted due to ordinary postnatal effects (e.g. sleep disturbance). Participants that were found to have a clinical depression diagnosis were recommended to contact their local

health care centre with respect to their symptoms. Diagnostic terms (e.g. Major depression, dysthymia) were not used during the interview, and none of the participants received an official diagnosis by the interviewer.

Although there are indications that paternal postnatal depression is a stable state over time (Giallo, D'Esposito, Christiansen, et al., 2012; Matthey, Barnett, Kavanagh, & Howie, 2000), this study sought to conduct interviews within two weeks of answering the questionnaire to minimise any possible time-effects. In the cases this could not be done the respondents were asked to answer the questionnaire again. However, all interviews that were conducted within three weeks of the survey were included in the study as both the interview and survey overlapped in time. Despite this, one interview was excluded as the response time exceeded the three-week limit.

Due to a type error in the information letter several fathers (n = 9) answered the questionnaire even though their children were older than 12 months. These fathers were excluded from the study.

Instruments

Self-reports of depression

The Edinburgh Gotland Depression Scale, EGDS (measuring paternal postnatal depression) is an 11-item self-report scale based on the EPDS (measuring maternal postnatal depression) and the Gotland Male Depression Scale, GMDS (measuring male depressive symptoms). All of these instruments are scored on four-point likert scales (0-3) (Agebjörn & Linder, 2015; Cox, Holden, & Sagovsky, 1987; Zierau et al., 2002). The EPDS consists of 10 items and is designed for use in primary health care. A total score of 13 or more indicates a probable major depression (Cox et al., 1987). The GMDS consists of 13 items divided on two subscales focusing either depression or distress (Zierau et al., 2002). The first nine items of the EGDS are phrased as assertions while the final two items are phrased as questions (see Appendix A for the full questionnaire).

In accordance with Hinkin (1998) it could be argued that the GMDS could be improved by a revision of the questionnaire items, as several of the items address a multitude of concepts (e.g. "More irritable, restless and frustrated" or "More aggressive, outward-reacting, difficulties keeping self-control"). By rephrasing the items of the scale in such a way that each item only addresses a single behaviour the validity could possibly increase. In the present study, this was done by dividing phrases that contained more than one behaviour into several items, e.g. one item addressing both irritability and restlessness was divided into two items; one item concerning irritability and one item concerning restlessness. In addition, two more items were constructed to capture the DSM-5 criterions that were not apparently addressed in any of the items in EGDS or GMDS (i.e. weight loss/gain and loss of interest/pleasure) and three items concerning known risk factors for paternal depression (i.e. maternal depression, reduced partner relation satisfaction and lack of social support from friends and family). These questions were added to improve the construct-representation, and hence the criterion-related validity.

The final online questionnaire consisted of a total of 28 items divided over three subscales; 11 items from the EGDS (subscale "EGDS"), 12 revised items based on the GMDS (subscale "GMDS") and five self-produced items based on criteria from the DSM-5 and risk-factors of paternal postnatal depression (subscale "DSM"). During statistical analysis a new revised scale was created by adding, or replacing items.

The items used in this study was formulated as assertions (e.g. I'm more easily stressed than before; see Appendix A for the full questionnaire) and the respondent was to choice between "Not correct at all", "Partly correct", "Fairly correct" or "Entirely correct".

The online questionnaire also included questions asking for background information concerning their age, total number of children, the age of the youngest child (given as intervals of months), whether or not they live together with the mother and the child, and whether they have been or are being treated for depression.

Semi-structured interview

The SCID-CV is a semi-structured interview to be used as a diagnostic tool by trained clinicians. It offers a broad diagnostic base for the most common diagnoses seen in clinical settings. Alongside structured questions for each diagnosis the specific criterion from the DSM-IV-TR is provided so that the clinician can verify whether or not the respondent fills the criterion (First et al., 1996). The SCID-CV has showed an inter-rater kappa range of 0.60 – 0.83 (adequate to excellent; Lobbestael, Leurgans, & Arntz, 2011) and a test-retest kappa range of 0.35 – 0.78 (inadequate to good; Zanarini et al., 2000).

Since 2013 the DSM-IV-TR has been replaced by the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM–5; American Psychiatric Association, 2013), however, at the start of this study the new Structured Clinical Interview for DSM-5 (SCID-5; American Psychiatric Association Publishing, n.d.) was not yet available, why the SCID-CV was used. The differences between the two versions of the DSM regarding major depression mainly consists of the abolishment of the bereavement exclusion criterion, which has been taken into consideration in this study. In DSM-5 (American Psychiatric Association, 2013) the symptoms of major depression are depressed mood, loss of interest or pleasure, significant weight loss or gain, fatigue, feelings of worthlessness, disturbed sleep, psychomotor agitation or retardation, diminished ability to think or concentrate and ideas or acts of self-harm and suicide. Specific considerations were given to issues, which could be misinterpreted due to ordinary postnatal effects (e.g. sleep disturbance).

In the current study only the depression section of the SCID-CV was used. This section covers all criterions and relevant differential diagnostics for the major depression diagnosis. All participants that filled the criterions for major depression were categorised as having major depression. No differentiation between severities of the depression was noted. All participants that showed

clinical significant depressive symptoms but did not fill the criterions of major depression were categorised as having depression not otherwise specified (NOS).

Statistical analysis

The data was analysed using IBM SPSS statistical software (Version 22). Internal consistency of the EGDS was calculated using Cronbach's α. The psychometric properties of the individual items were examined using item analysis consisting of calculations of item means, standard deviations, inter-item correlations, and corrected item-total correlations. Endorsement rates of the individual items for depressed and non-depressed fathers, based on the SCID-CV interview, were calculated and examined for independence using Pearson's χ^2. Based on the results from these analyses, the new revised scale was developed. Differences between diagnosis groups means on the original as well as the revised EGDS were explored using one-way ANOVA with Bonferroni post-hoc test.

The factor structure of the EGDS and the revised EGDS was investigated using the principal axis factoring method with the scree test, eigenvalue >1 and simple structure as extraction criteria and direct oblimin rotation, as recommended by Osborne and Costello (2009) for non-normally distributed data. The respondent-to-item ratio for both scales was just below the well-established recommended ratio of 10:1 but above the lowest acceptable ratio of 5:1; 9:1 for the EGDS and 8:1 for the revised EGDS.

The criterion-related validity of the scale was explored through bivariate Pearson correlations between the SCID-CV and the EGDS and the revised EGDS respectively. Although data from self-report questionnaires measuring depression seldom show normal distribution, due to relatively low prevalence in non-clinical samples and hence most participants will score low, the Pearson r is a robust parametric test that is known to give reliable results in bivariate analyses even for data that violates the assumption of normal distribution at an extreme level (Fowler, 1987).

To examine sensitivity and specificity of the instrument, receiver operating characteristics (ROC) were calculated for the original EGDS and revised EGDS scores, respectively, in comparison to SCID-CV depressive disorder diagnoses. In addition to sensitivity and specificity, positive predictive values (the percentage of all those scoring above the cut-off that was correctly diagnosed as depressed) and negative predictive values (the percentage of all those that scored below the cut-off that were correctly identified as not having a depression diagnosis) were reported for the EGDS using a range of cut-off values.

Results

This section begins with results from the psychometric analyses (item analysis and reliability) on the EGDS and the revised EGDS. This is followed by the exploration of the factor structure of the two scales. Finally, data concerning validity (i.e. convergent validity, sensitivity and specificity) of both scales are reported.

Psychometric analysis

The item analysis consists of item means, standard deviations, inter-item correlations, corrected item-total correlations, Cronbach's alpha, and endorsement rates, which is a measure of an item's ability to discriminate between depressed and non-depressed. All items had means below 1, which was expected. Standard deviations ranged from 0.25 to 0.85. Inter-item correlations ranged from 0.08 to 0.67 with 40 out of 55 correlations being in the "very weak" to "weak" range ($r < 0.4$), 12 correlations were considered moderate ($r = 0.40 – 0.59$) and three, between items 6, 7 and 8, were recognised as strong ($r = 0.60 – 0.79$) (Evans, 1996). EGDS items 10 and 11 showed only very weak to weak inter-item correlations. EGDS items 1, 5, 9, 10 and 11 all had corrected item total correlations below 0.5 however all were above 0.3. Internal consistency was good for the EGDS (*Cronbach's $\alpha = 0.84$*)(European Federation of National Psychologists Associations, 2013). Internal consistency could not be improved by removing any of the items. Endorsement rates, the percentage of all interviewed fathers that scored above 0 on a particular item, were significantly higher for the depressed than for the non-depressed fathers on all EGDS items except item 7 (addressing increased aggressiveness, externalizing behaviour and reduced impulse control).

Item analyses on the entire questionnaire (subscales EGDS, GMDS and DSM) were performed as a basis for improvement of the EGDS. For all items of the questionnaire means were below 1.0 and standard deviations ranged from 0.25 to 0.96. Inter-item correlations for all questionnaire items ranged from -0.07 to 0.79. A vast majority (311 out of 378) of the correlations were found in the "very weak" to "weak" range (r ranging between 0.00 – 0.39), 48 correlations were considered moderate ($r = 0.40 – 0.59$) and 19 strong ($r = 0.60 – 0.79$) inter-item correlations were found (see Appendix B for full inter-item correlation matrix). The internal consistency for all items in the questionnaire was 0.91; no single item removal would raise the alpha. Corrected item-total correlations ranged from 0.19 to 0.78 with 11 correlations below 0.5. Out of these two had corrected item total correlations of less than 0.3 as well. Endorsement rates were significantly larger for the depressed than for the non-depressed fathers on all but 8 items; EGDS 7, GMDS 8, 9, 10 and 12, and DSM 3, 4 and 5. Table 1 displays item statistics for the entire online questionnaire and for the EGDS separately.

Table 1. *Item statistics for all questionnaire items and scale statistics for the EGDS. Higher scores indicates more depressive symptoms (n = 95). Endorsement rate (percentage of fathers scoring >0 on an item) for all interviewed fathers (n = 52).*

				All items (α = 0.91)		EGDS only (α = 0.84)		Endorsement rate (score >0)		
Subscale	#	Mean	Standard deviation	Corrected Item-Total Correlation	Cronbach's α if Item Deleted	Corrected Item-Total Correlation	Cronbach's α if Item Deleted	Non-depressed (%)	Depressed (%)	χ^2
EGDS	1	0.38	0.66	0.50	0.91	0.44	0.84	25.0	83.3	13.3***
	2	0.39	0.64	0.55	0.91	0.59	0.83	15.0	83.3	20.2***
	3	0.32	0.59	0.51	0.91	0.51	0.83	12.5	58.3	10.9**
	4	0.83	0.77	0.65	0.91	0.66	0.82	57.5	100.0	7.7**
	5	0.06	0.25	0.46	0.91	0.42	0.84	0.0	33.3	14.4***
	6	0.75	0.85	0.67	0.91	0.69	0.82	42.5	75.0	3.9*
	7	0.36	0.71	0.52	0.91	0.57	0.83	20.0	41.7	ns
	8	0.67	0.76	0.78	0.90	0.74	0.81	47.5	91.7	7.4**
	9	0.18	0.46	0.52	0.91	0.41	0.84	10.0	50.0	9.5**
	10	0.06	0.25	0.34	0.91	0.33	0.84	5.0	25.0	4.2*
	11	0.37	0.60	0.54	0.91	0.44	0.84	35.0	66.7	7.1**
GMDS	1	0.62	0.81	0.64	0.91			37.5	91.7	10.8**
	2	0.57	0.78	0.68	0.91			40.0	83.3	6.9**
	3	0.66	0.78	0.70	0.91			40.0	100.0	13.4***
	4	0.45	0.77	0.50	0.91			25.0	66.7	7.1**
	5	0.24	0.60	0.57	0.91			15.0	50.0	6.4*
	6	0.37	0.7	0.64	0.91			15.0	83.3	20.2***
	7	0.41	0.70	0.70	0.91			22.5	75.0	11.2**
	8	0.16	0.47	0.30	0.91			12.5	25.0	ns
	9	0.23	0.57	0.19	0.91			22.5	33.3	ns
	10	0.31	0.70	0.35	0.91			20.0	33.3	ns
	11	0.46	0.78	0.54	0.91			30.0	66.7	5.2*
	12	0.35	0.73	0.23	0.91			25.0	16.7	ns
DSM	1	0.36	0.58	0.48	0.91			20.0	58.3	6.6*
	2	0.72	0.81	0.36	0.91			42.5	83.3	6.2*
	3	0.45	0.76	0.40	0.91			32.5	58.3	ns
	4	0.67	0.83	0.32	0.91			47.5	66.7	ns
	5	0.74	0.96	0.47	0.91			50.0	50.0	ns

*p<0.05; **p<0.01; ***p<0.001

The items based on the GMDS were created in an attempt to improve the scale by either replacing EGDS items working poorly or by being added to the scale. Several of the GMDS items (i.e. 1, 2, 3, 4, 6 and 7) could be considered interchangeable with some EGDS items as these address the same concept. These interchangeable items had moderate to strong inter-item correlations. Table 2 shows inter-item correlations between the EGDS item and the item considered as a replacement, χ^2 test of independence for endorsement rates of each item, corrected item-total correlation and Cronbach's alpha if deleted, grouped depending on overall concept. For two of the concepts (Anger and Self-pity/complaint) the rephrased items of the GMDS subscale showed improved statistics (stronger corrected item-total correlations and larger discrimination between depressed and non-depressed as measured with endorsement rates and χ^2) as compared to the EGDS. Although no item of the EGDS did address the concept of weight loss or gain, two items, GMDS 11 and DSM 3, of the questionnaire were concerned with this concept. Of these two the GMDS 11 had higher corrected item-total correlation and item discrimination. The criterion concerning loss of interest was only addressed by DSM item 1, which had corrected item-total correlation 0.48 and significant discriminating ability (χ^2 *(1, N = 95) = 6.6, p = 0.01*). The remaining items (i.e. GMDS 5, 8, 9, 10, 12 and DSM 2,

3, 4 and 5) had all either poor discriminating ability or low corrected item-total correlation or both.

Table 2. *Item statistics for items intended to be interchangeble due to addressing the same concept (n = 95; n = 52 for χ2).*

Concept	Subscale	#	Inter-item correlation	χ^2	Corrected Item-Total Correlation	Cronbach's α if Item Deleted
Stress	EGDS	6		3.9*	0,67	0,91
	GMDS	1	0.72	10.8**	0.64	0.91
Anger	EGDS	7		ns	0.52	0.91
	GMDS	2	0.62	6.9**	0.68	0.91
Irritability/ restlessness	EGDS	8		7.4**	0.78	0.90
	GMDS	3	0.72	13.4***	0.70	0.91
	GMDS	4	0.51	7.1**	0.50	0.91
Self-pity/ complaint	EGDS	11		7.1**	0.54	0.91
	GMDS	6	0.49	20.2***	0.64	0.91
	GMDS	7	0.59	11.2**	0.70	0.91
Weight loss/gain	GMDS	11		5.2*	0.54	0.91
	DSM	3	0.61	ns	0.40	0.91

*p<0.05; **p<0.01; ***p<0.001

Based on the item analysis of the EGDS a new scale was created, the revised EGDS. This was done by replacing EGDS items 7 (addressing aggression, acting out and impulse control) and 11 (concerning self-pity and complaint) with GMDS items 2 (focusing irritability) and 6 (addressing self-pity), as these items had stronger discriminant ability and improved corrected item-total correlations. EGDS item 10 (addressing changes in behaviour) was removed, due to low inter-item correlations, low corrected item-total correlation and low endorsement rate among the depressed. The phrasing of the item was also considered problematic as it addresses several vague concepts in one. EGDS item 5 (addressing suicidal tendencies) were kept due to high clinical relevance. GMDS item 11 (concerning changes in appetite) and DSM item 1 (addressing loss of interest) were added to improve content validity as these items address diagnostic criterions omitted in the EGDS. Hence the revised EGDS consisted of 12 items, eight from the original EGDS, three from the GMDS subscale and one from the DSM subscale.

The revised EGDS

The revised scale had good internal consistency (*Cronbach's α = 0.87*), somewhat higher than the EGDS. Item statistics for the revised EGDS (Table 3) indicate an improvement as compared to the EGDS with fewer items having corrected item-total correlations lower than 0.5.

Table 3. *Corrected item-total correlation, cronbach's alpha if item deleted, endorsement rate and χ2 for the revised EGDS (n = 95).*

				Endorsement rate (score >0)		
Subscale	#	Corrected Item-Total Correlation	Cronbach's α if Item Deleted	Non-depressed (%)	Depressed (%)	χ^2
EGDS	1	0.48	0.87	25.0	83.3	13.3***
	2	0.59	0.86	15.0	83.3	20.2***
	3	0.54	0.86	12.5	58.3	10.9**
	4	0.66	0.86	57.5	100.0	7.7**
	5	0.46	0.87	0.0	33.3	14.4***
	6	0.66	0.86	42.5	75.0	3.9*
	8	0.74	0.85	47.5	91.7	7.4**
	9	0.47	0.87	10.0	50.0	9.5**
GMDS	2	0.66	0.86	40.0	83.3	6.9**
	6	0.58	0.86	15.0	83.3	20.2***
	11	0.53	0.87	30.0	66.7	5.2*
DSM	1	0.44	0.87	20.0	58.3	6.6*

There were significant differences in average scores between the diagnostic groups both for the EGDS ($F(2, 49) = 56.71$, $p < .000$) and the revised EGDS ($F(2, 49) = 57.77$, $p < .000$). For both scales the major depression group is entirely differentiated from the other groups while the depression NOS and non-depressed groups had some overlap concerning total score. Hence, both scales are good at discriminating between major depression and non-depression but have problems with identifying the fathers with depression NOS. Group means and standard deviations are displayed in Table 4. In Figure 1 and 2, the scores of the original EGDS and revised EGDS were plotted for depressed and non-depressed fathers. The results indicate that the fathers with major depression diagnosis were discrete groups while the non-depressed and the depression NOS fathers had overlapping score on both scales.

Table 4. *Means and standard deviations for scores on the EGDS and the revised EGDS for all diagnostic groups.*

	EGDS		Revised EGDS	
	M	SD	M	SD
Non-depressed	3.13	2.70	3.90	3.34
Depression NOS	7.57	2.23	9.57	2.94
Major depression	16.00	2.65	20.00	3.16

Figure 1. *Distribution of scores on EGDS depending on diagnostic group (n = 52).*

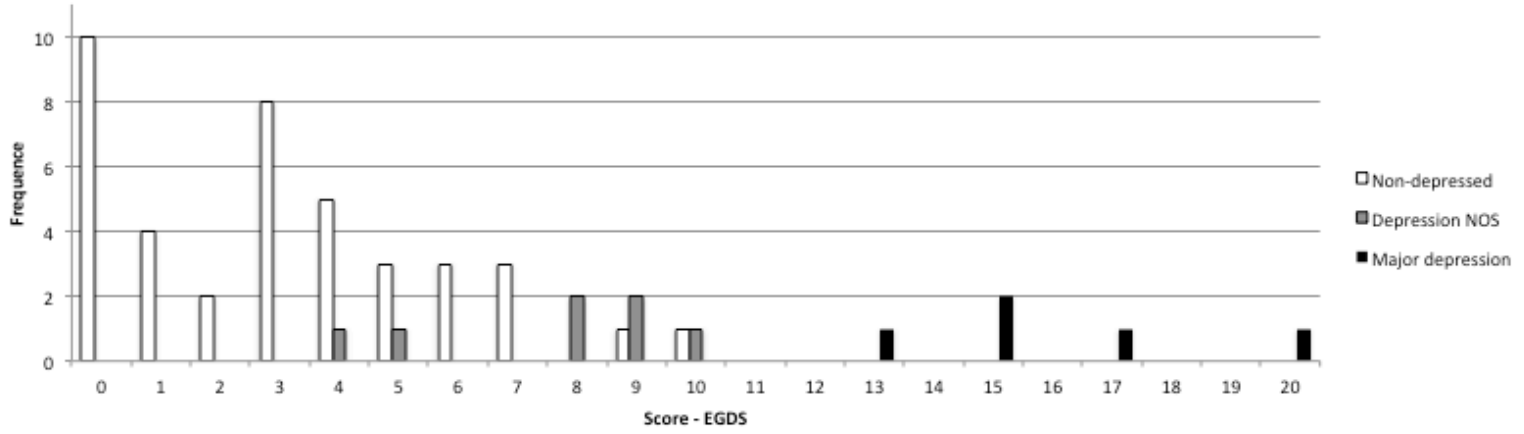
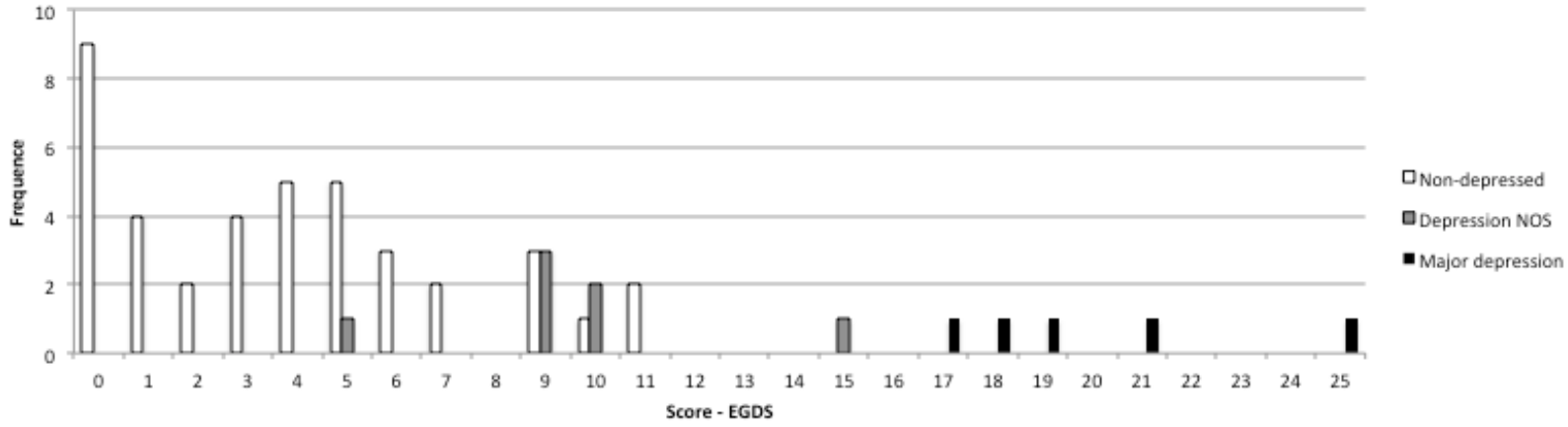


Figure 2. *Distribution of scores on revised EGDS depending on diagnostic group (n = 52).*



Exploratory factor analysis

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity indicated acceptable conditions for analysis of the EGDS (0.83; χ^2 (55) = 345.97, $p < 0.001$) and the revised EGDS (0.85; χ^2 (66) = 447.37, $p < 0.001$). For the EGDS, the inspection of eigenvalues showed that three factors had eigenvalues larger than one, however, the scree-plot indicated a single factor as the line flattens out already at factor two. As can be seen in Table 5, the difference in eigenvalues and amount of explained variance of each subsequent factor is low after the first factor, supporting the extraction of a single factor. Further on, the extraction of two or three factors did not provide a simple structure regarding to factor loadings of the items, as many items had relatively high loadings on more than one factor. Hence, only one factor was retained for the EGDS explaining 40% of the variance. For the revised EGDS the scree-plot was somewhat ambiguous concerning where the line flattens. The eigenvalues and explained variance (Table 4) do however support two factors and as both one and two factors provide equally simple structure two factors were retained, explaining 53% of the variance. Factor loadings for both scales are provided in Table 6 together with Cronbach's alpha for the two factors of the revised EGDS and the single factor solution for the revised EGDS for comparison. Based on the items with high loadings, factor one could be described as focusing somatic experiences while factor two seems to address more cognitive experiences.

Table 5. *Eigenvalues and explained variance for each potential factor of the EGDS and the revised EGDS.*

	EGDS		Revised EGDS	
Factor	Eigenvalue	% of variance	Eigenvalue	% of variance
1	4.40	40.00	5.10	42.51
2	1.19	10.80	1.26	10.53
3	1.02	9.25	1.03	8.58
4	0.91	8.25	0.88	7.33
5	0.74	6.72	0.77	6.41
6	0.69	6.30	0.64	5.32
7	0.65	5.86	0.60	5.02
8	0.53	4.78	0.54	4.51
9	0.35	3.15	0.38	3.20
10	0.29	2.65	0.30	2.52
11	0.25	2.25	0.26	2.18
12			0.23	1.88

Table 6. *Factor loadings for the EGDS and the revised EGDS (single and two factor solution) with Cronbach's alpha for each factor of the revised EGDS.*

			EGDS	Revised EGDS		
Subscale	#	Item	Single factor	Single factor	Factor 1 (α = .86)	Factor 2 (α = .76)
EGDS	1	Jag har kunnat se tillvaron från den ljusa sidan	0.47	0.55	-0.01	-0.73
	2	Jag har känt mig skrämd eller panikslagen utan speciell anledning	0.64	0.67	0.63	-0.03
	3	Jag har känt mig så ledsen och olycklig att jag har haft svårt att sova	0.56	0.62	0.74	0.17
	4	Jag har känt mig ledsen och nere	0.72	0.74	0.45	-0.38
	5	Tankar på att göra mig själv illa har förekommit	0.46	0.55	0.42	-0.19
	6	Jag/andra upplever att jag har mindre stresstolerans / mer än vanligt lättstressad	0.73	0.73	0.53	-0.26
	7	Jag/andra upplever att jag har ökad aggressivitet, utagerande, svårt med impulskontroll	0.61			
	8	Jag/andra upplever att jag är mer lättirriterad, rastlös, otillfredsställd	0.81	0.81	0.65	-0.23
	9	Jag upplever oro/ängslan/obehagskänsla framför allt på morgonen	0.46	0.56	0.58	-0.07
	10	Har du känt dig beteendeförändrad på ett sätt som gör att varken du eller andra känner igen dig / är omöjlig att ha att göra med?	0.36			
	11	Har du känt, eller andra noterat okända tendenser till självömkan, klagande, "ynklighet"?	0.49			
GMDS	2	Jag har "kortare stubin" och brusar lättare upp än vanligt.		0.74	0.63	-0.15
	6	Jag tycker synd om mig själv oftare än förut.		0.67	0.01	-0.80
	11	Jag äter mer, eller mindre än tidigare.		0.63	0.60	-0.01
DSM	1	Jag har tappat intresset eller lusten att göra sådant som jag brukar tycka om att göra.		0.52	0.53	0.06

Criterion-related validity, sensitivity and specificity

Both the EGDS and the Revised EGDS were very strongly correlated with depressive diagnosis as measured with the SCID-CV, r(50) = 0.83, $p < .001$, for the EGDS and r(50) = 0.83, p < .001for the Revised EGDS. Out of the 52 fathers interviewed, 12 (23%) met the criterion for a diagnosis whereof five had major depression and seven were categorised as having depression NOS.

When plotting the EGDS and the revised EGDS using the ROC-curve the scales had similar area under the curve (EGDS AUC: 0.94, SD = 0.04, 95%CI = 0.87 - 1.00, p < 0.001) (revised EGDS AUC; 0.93, SD = 0.04, 95%CI = 0.86 - 1.00, p < 0.001) indicating high overall sensitivity and specificity of both tests. A dichotomous diagnosis variable was used as state variable since each diagnosis group on its own was considered too small for reliable analysis. Table 6 displays the sensitivity, specificity, positive predictive value and negative predictive value for different cut-off scores for both scales. The Table is understood as such that for example a cut-off score of 8 on the revised EGDS would render a sensitivity of 91.7 per cent and a specificity of 85.0 per cent. This means that with a cut-off score of 8, 91.7 per cent of all depressed fathers screened would be recognised as depressed while 85.0 per cent of all on-depressed fathers screened would be recognised as non-depressed.

Table 7. *Specificity and sensitivity depending on cut-off score for the EGDS and the revised EGDS. Positive predictive value (PPV) and negative predicitive value (NPV) for the revised EGDS (n = 52)(values in per cent).*

	EGDS		Revised EGDS			
Cut-off	Sensitivity	Specificity	Sensitivity	Specificity	PPV	NPV
≥1	100	25.0	100	22.5	27.8	100
≥2	100	35.0	100	32.5	30.7	100
≥3	100	40.0	100	37.5	32.3	100
≥4	100	60.0	100	47.5	36.3	100
≥5	91.7	72.5	100	60.0	42.8	100
≥6	83.3	80.0	91.7	72.5	49.9	96.7
≥7	83.3	87.5	91.7	80.0	57.8	97.0
≥8	83.3	95.0	91.7	85.0	64.6	97.2
≥9	66.7	95.0				
≥10	50.0	97.5	66.7	92.5	72.7	90.3
≥11			50.0	95.0	74.9	86.4
≥12	41.7	100				
≥13			50.0	100	100	87.0
≥14	33.3	100				
≥16	16.7	100	41.7	100	100	85.2
≥18			33.3	100	100	83.4
≥19	0.08	100	25.0	100	100	81.7
≥20			16.7	100	100	80.1
≥23			8.3	100	100	78.5

Discussion

The aim of the present study was to examine if the Edinburgh Gotland Depression scale could be improved by adding items related to either the criterions of major depression as defined by the DSM-5 or known risk factors for paternal depression. A second aim was to examine the psychometric properties, dimensionality and criterion-related validity in terms of sensitivity and specificity.

Item analyses were performed in three steps. Initially the items of the original EGDS were investigated. Thereafter all items of the online questionnaire (i.e. subscales EGDS, GMDS and DSM) were analysed. Based on the results from these two steps a new version, the revised EGDS were created by merging items from all three subscales. The original EGDS had good internal consistency and removing any single item could not improve Cronbach's alpha. Item analysis showed that four of the items (5, 7, 10 and 11) could be improved as three of them had low corrected item-total correlation (5, 10 and 11), two (10 and 11) only displayed very weak to weak inter-item correlations and item 7 could not significantly discriminate between depressed and non-depressed. According to Clark and Watson (1995) inter-item correlations within a questionnaire should be moderate. Although the internal consistency of the original EGDS was similar as in the study by Agebjörn and Linder (2015), they did not investigate inter-item or corrected item-total correlations or discrimination between depressed and non-depressed. Hence, these results are difficult to compare.

Two more subscales were added to the questionnaire with the purpose of improving the original EGDS. The entire questionnaire had excellent internal consistency, which could not be raised by removing any particular item. Out of these 17 items, nine had too low discrimination ability and/or corrected item-total correlation to be added to the new revised EGDS. Of the remaining seven items, two were new items addressing omitted criterions in the original EGDS, and six were intended to replace existing items in the original EGDS, adressing the same concepts but with new phrasings. Two of these alternative phrasings showed improved item statistics concerning corrected item-total correlations and discriminant ability between depressed and non-depressed compared to the original items of the EGDS.

Based on the item analysis a new scale, the revised EGDS was formed by excluding EGDS item 10, but keeping EGDS 5 due to high clinical value, and replacing EGDS items 7 and 11 with the new phrased items, based on the recommendations by Hinkin (1998). Due to clearer formulations, these new items will likely enhance the reliability as well as the validity of the scale by making it clear what the respondent is responding on, as the questions only explores one concept at the time.

Also, two more items were added to improve construct representation as these items address diagnostic criterions omitted in the original EGDS. The revised EGDS had good and improved internal consistency and fewer items with low corrected item-total correlation, indicating that the items could better discriminate between

those scoring high and low on the total scale. These changes improved the validity of the instrument. The questions that were added have high diagnostic significance. In total there are nine criteria for depression of which a total of five shall be filled for a major depression diagnosis. Also, one of the first two criteria must be filled (American Psychiatric Association, 2013). When two of these nine, and also one of the two initial, criteria were omitted in original EGDS this was done because of low importance in the sample (Agebjörn & Linder, 2015), but at the expense of the construct representation. By including these criteria the scale should have better coherence with the overall diagnostic picture, although these items could be considered weak due to low or non-significant discrimination between depressed and non-depressed, low corrected item-total correlation and low factor loadings. However, on the basis of this study's sample size and generalizability there are good arguments for not entirely rely on statistics in choosing items. When the sample could be a less than perfect representation of the population from which it has been drawn, there is always a risk of overfitting a scale in such a way that it fits the sample perfectly but fits the population poorly. I argue that adding items that, although statistically weak, theoretically should be included the risks of overfitting could be reduced. This could also be the case of the original EGDS, as the study by Agebjörn and Linder (2015) also used a convenience sampling.

Both the EGDS and the revised EGDS were good at separating the fathers with major depression from the other fathers but could not entirely discriminate between the fathers with depression NOS and the non-depressed, although all group means were significantly different. In the study by Massoudi et al. (2013b) this was also the problem of the EPDS implying that there are still important improvements to be made. Although the difference in frequency between the two diagnostic groups in this study was small, other studies (Agebjörn & Linder, 2015; Massoudi et al., 2013a) have shown that mild depression is a more common state among new fathers. It could hence be argued that, although the consequences of major depression are worse, the mildly depressed due to sheer numbers are an important group to capture.

The results from the exploratory factor analysis were somewhat ambiguous. Based on the factor loadings of the items, simple structure, scree-plot and eigenvalues of the different factors it appears that the EGDS can be interpreted in terms of a single factor while the revised EGDS is best explained by a two-factor solution, factor one could be described as focusing somatic experiences while factor two seems to address more cognitive experiences. These results are however a matter of discussion as other solutions, such as a single factor or a two-factor model for both scales, could have been argued for. It is likely that the ambiguity concerning factor loadings and structure were due to the analysis being done on a too small sample. The respondent-to-item ratio for both scales was just below the well-established recommended ratio of 10:1 but above the lowest acceptable ratio of 5:1; 9:1 for the EGDS and 8:1 for the revised EGDS. Although this rule-of-thumb has been criticised for lacking scientific ground (Osborne & Costello, 2009), no a priori given ratio can guarantee that the risks of errors are low enough (Osborne & Costello, 2004) and as many studies as 41% perform factor analysis on data with

ratios < 5:1 (Osborne & Costello, 2009). The recommendations by Osborne and Costello (2004) are large samples of at least 200 respondents for any certainty in the analysis. Based on this small sample, however, the indication was that the revised EGDS was a somewhat more stable scale as explained variance was higher and non-significant loadings were fewer. Although there is no consensus on how to interpret factor loadings, Field (2005) argues that factor loadings of .60 is significant for any sample size while Hair, Tatham, Anderson and Black (1998) conclude that the loadings needed for significance depend on sample size. For the sample of this study (N = 95) Hair et al. count loadings > .55 as significant. Items with non-significant loadings could imply the need of retaining more factors or indicate that the item does not fit the scale and should be excluded. For the EGDS five items had loadings < .55. For the revised EGDS five items had loadings < .60 whereof four had loadings < .55. Because of the low power in the model, due to few respondents, the results from the factor analysis should be considered an indication and something that future studies can cross-validate with larger sample sizes.

Both the original and revised scale were very strongly correlated with depression diagnoses (r=0.83), as measured with the SCID-CV, that were used in this study. According to the European Federation of National Psychologists Associations (2013) criterion-related correlations above r=0.50 should be considered excellent. ROC-curve analysis, using a dichotomous diagnosis variable (depressed/non-depressed) as state variable showed similar AUC for the revised EGDS as compared to the EGDS, both scales being in the excellent range (Streiner & Cairney, 2007). Although these indicators point towards a very strong criterion-related validity, they are relatively crude measurements that most demonstrate that the relationship between the scales and the interview is clear. The quality of that relationship is better described by sensitivity and specificity.

The sensitivity and specificity in this study is similar to the findings of Agebjörn and Linder (2015), using the BDI-II as gold standard and a cut-off score of ≥7. Although the original EGDS had a larger AUC, which can be seen as a rough estimate of the test's overall quality, than the revised EGDS, the latter had a higher overall sensitivity and more preferably distributed specificity than the original EGDS, resulting in more suitable statistics for screening. The most usable cut-off score for any screening tool is depending on what is most important – finding all those with a diagnosis or not to investigate anyone unnecessarily (i.e. keeping the costs down). According to this study a cut-off score of ≥8 (sensitivity: 91.7, specificity: 85.0) on the revised EGDS should be a good trade-off between high sensitivity and high specificity. A rough estimate, based on the approximation of one hundred thousand births in Sweden yearly (Statistiska centralbyrån, 2015-12-01) and a depression prevalence of 6.3 per cent in the population (Massoudi et al., 2013a) gives that a cut-off of ≥8 would result in about 180 missed diagnoses out of a total of 6300 depressed fathers and a total of about 2200 follow-up interviews not resulting in a diagnosis. For the original EGDS a “best” cut-off is not as easy to define. A cut-off score of ≥8 do give the highest combined sensitivity and specificity (83.3, 95.0) and could hence be argued as the best alternative. In line with the reasoning above, such a cut-off on the original EGDS would result in approximately

300 missed diagnoses and about 1600 excessive interviews. Likewise, a cut-off of ≥5 (sensitivity: 91.7, specificity: 72.5) on the original EGDS would result in some 180 missed cases but just above 3150 excessive interviews. Therefore, although the psychometric differences of the original EGDS and the revised EGDS are small the overall picture is that the revised EGDS is an improvement that would produce both fewer missed cases and excessive interviews. These recommended cut-offs are somewhat lower than most validation studies of the EPDS with most studies recommending cut-offs of ≥10 – 11. Massoudi et al. (2013b) found in a Swedish sample that a score of ≥9 was the best cut-off for finding fathers with either major or minor depression, however with low sensitivity (66.0%) and specificity (85.3%), making it unusable for screening. Likewise, the revised EGDS is good at differentiating the fathers with major depression from the other fathers but cannot fully separate the mildly depressed from the non-depressed. However, the result from this study show that the EGDS had higher sensitivity and specificity than what the EPDS have in most studies and hence is a preferable alternative in screening fathers for depression. It could be argued that these results are an indication of the need of a gender-specific screening instrument for paternal depression, as implied by Rutz (1995). As mentioned earlier, a reliable and valid instrument for the screening of paternal postnatal depression is both requested from the child health services of Sweden (Massoudi et al., 2013b), and justified on the basis of the clinical situation, where depression in fathers has proved equally serious for the child as maternal postnatal depression (e.g. Edward et al., 2015; Gutierrez-Galve, Stein, Hanington, Heron, & Ramchandani, 2015; Mezulis, Hyde, & Clark, 2004; Ramchandani et al., 2005; Ramchandani et al., 2008; Wilson & Durbin, 2010). This study is an important contribution for the creation of a paternal depression screening tool, especially due to the use of a structured clinical interview as gold standard, although more studies are needed.

Limitations

The sample size of this study is small and just under the generally considered limit for adequacy in the context of instrument validation (European Federation of National Psychologists Associations, 2013). This is especially problematic for statistical analysis such as factor analysis, as have been mentioned above. A sample size of more than 200 would have been a minimum for adequate reliability in the analysis of the factor structure. Further on, small samples with low population prevalence also provide a specific challenge in getting enough respondents with the investigated disease. Due to a very high prevalence within the sample of this study, this specific problem was avoided, however, at the cost of generalizability. The results of this study do however contribute to the overall knowledge on paternal depression screening due to a strong method with a large part of the sample interviewed using the gold standard. The results should be seen as a clear indication for future replications with larger samples.

The SCID-CV was designed to be used in an actual physical meeting between the interviewer and the respondent. In this study the interviews were carried out over telephone. It has been showed that interviews over the telephone have several limitations such as lower engagement in the interview and higher levels of social desirability and acquiescence in responses (Holbrook, Green, & Krosnick, 2003).

Although the data collection method might have put the reliability of the SCID-CV at risk, the tendency would then have been fewer fathers reporting depressive symptoms and hence making it difficult to examine the criterion-related validity of the scale.

Implications

In this study the prevalence of depressive disorders was 23 per cent. Although there are no official prevalence data for the Swedish population, other studies have found prevalences of 6.3 per cent nationally (Massoudi et al., 2013a) and internationally (e.g. Figueiredo & Conde, 2011; Ramchandani et al., 2005). Although this indicates a non-representative sample of the population it might also imply that the critic of the recurring finding of twice as high depression prevalence among women compared to men is relevant. During the interviews, several of the fathers tried to minimize the importance and extent of the depressive symptoms. It was also common that the fathers stressed that their low mood had not to do with the child. Several studies have reported that men are less likely to seek professional help for mental health issues (e.g. Fagerskiold, 2006) and that they focus on physical problems when they do (Smith, Braunack-Mayer, & Wittert, 2006). Hence, this overrepresentation of depressed fathers could be an indication of an actual larger prevalence in the population, in line with the theories on male depression. The discrepancy of prevalence between the study by Massoudi et al. (2013a) and this study could also have a base in the usage of different gold standards – the PRIME-MD and the SCID-CV. In their systematic review the Swedish Agency for Health Technology Assessment and Assessment of Social Services found that the PRIME-MD could not be recommended for diagnostic interviews concerning mood disorders due to low sensitivity (Statens beredning för medicinsk utvärdering, 2012). Hence, the prevalence of 6.3 per cent might be an underestimate, although the prevalence probably is not as high as the 23 per cent found in this study.

Further studies

As have been mentioned above, the results of the present study need to be cross-validated on larger samples. For the purpose of generalizability a population-based sample would be recommended.

The revised EGDS could be further developed as to better discriminate between non-depressed fathers and fathers suffering from depression NOS. This could be achieved by adding more items, as the groups have significantly separated means or preferably revising the items in such a way that differences between groups increase (e.g. increase the gap between low and high score on the likert scales).

Conclusions

The revised EGDS was developed to address shortcomings in the construct representation of the EGDS. By adding items concerned with omitted criterions for depression in the DSM-5 and by revising formulations or excluding existing items criterion-related validity was improved. Item analyses indicated good psychometric properties of the revised instrument. The revised EGDS was then validated in a small cross-sectional convenience sample (n = 52) of Swedish

fathers using the SCID-CV depressive mood section as gold standard. Based on this study a recommended cut-off score of ≥8 would produce high sensitivity (91.7 per cent) and specificity (85.0 per cent) for all depressive states. Due to the sampling used in this study and the sample size, these results need to be cross-validated with a larger sample, preferably population-based. The consequences of untreated paternal postnatal depression are known to be severe for both father and child. This study is an important contribution to the work of constructing a reliable and useful instrument for screening of fathers.

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Fäders psykiska hälsa

Din ålder:

Hur många barn har du?

Ungefärlig ålder på ditt yngsta barn?

- Under 1 mån
- 1 - 2 mån
- 3 - 4 mån
- 5 - 6 mån
- 7 - 8 mån
- 9 - 10 mån
- 11 - 12 mån
- Över 12 mån

Familjestatus

- Jag bor med mamman och barnet
- Jag bor med barnet (ej med mamman), halva tiden eller mer
- Jag bor med barnet (ej med mamman), mindre än halva tiden
- Jag bor varken med mamman eller barnet

Har du någon gång tidigare i ditt liv blivit behandlad för depression?

- Ja, behandlingen är avslutad.
- Ja, behandlingen pågår.
- Nej

Kommentar?

Var snäll och markera det svar som bäst stämmer överens med hur du känt dig under de sista två veckorna, inklusive idag.

Under de senaste två veckorna:

Jag har kunnat se tillvaron från den ljusa sidan

- lika bra som vanligt
- nästan lika bra som vanligt
- mycket mindre än vanligt
- inte alls

Jag har känt mig skrämd eller panikslagen utan speciell anledning

- ja, mycket ofta
- ja, ibland
- nej, ganska sällan
- nej, inte alls

Jag har känt mig så ledsen och olycklig att jag har haft svårt att sova

- ja, mesta tiden
- ja, ibland
- nej, sällan
- nej, aldrig

Jag har känt mig ledsen och nere

- ja, för det mesta
- ja, rätt ofta
- nej, sällan
- nej, aldrig

Tankar på att göra mig själv illa har förekommit

- ja, rätt så ofta
- ja, ganska ofta
- ja, då och då
- aldrig

Jag/andra upplever att jag har mindre stresstolerans / mer än vanligt lättstressad

- Inte alls
- I viss mån
- Stämmer rätt väl
- I hög grad

Appendix A: Questionnaire

Jag/andra upplever att jag har ökad aggressivitet, utagerande, svårt med impulskontroll

○ Inte alls ○ I viss mån ○ Stämmer rätt väl ○ I hög grad

Jag/andra upplever att jag är mer lättirriterad, rastlös, otillfredsställd

○ Inte alls ○ I viss mån ○ Stämmer rätt väl ○ I hög grad

Jag upplever oro/ängslan/obehagskänsla framför allt på morgonen

○ Inte alls ○ I viss mån ○ Stämmer rätt väl ○ I hög grad

Har du känt dig beteendeförändrad på ett sätt som gör att varken du eller andra känner igen dig / är omöjlig att ha att göra med?

○ Inte alls ○ I viss mån ○ Stämmer rätt väl ○ I hög grad

Har du känt, eller andra noterat okända tendenser till självömkan, klagande, "ynklighet"?

○ Inte alls ○ I viss mån ○ Stämmer rätt väl ○ I hög grad

Kommentar?

Om du tänker på den senaste månaden, hur väl stämmer dessa påståenden?

	Stämmer inte alls	Stämmer delvis	Stämmer ganska bra	Stämmer helt
Jag är mer lättstressad än tidigare.	○	○	○	○
Jag har "kortare stubin" och brusar lättare upp än vanligt.	○	○	○	○
Jag är mer lättirriterad än vad jag brukat vara.	○	○	○	○
Jag är mer rastlös än tidigare.	○	○	○	○
Jag har svårt att fatta även enkla vardagsbeslut.	○	○	○	○
Jag tycker synd om mig själv oftare än förut.	○	○	○	○
Jag klagar mer än vanligt.	○	○	○	○
Jag använder alkohol eller tabletter i lugnande och/eller avkopplande syfte.	○	○	○	○
Jag tränar mer och/eller hårdare än tidigare.	○	○	○	○
Jag arbetar mer än vanligt.	○	○	○	○
Jag äter mer, eller mindre än tidigare.	○	○	○	○
Jag har ett ökat behov av sex.	○	○	○	○

Kommentar?

Om du tänker på den senaste månaden, hur väl stämmer dessa påståenden?

	Inte alls	I liten grad	I hög grad	I mycket hög grad
Jag har tappat intresset eller lusten att göra sådant som jag brukar tycka om att göra.	○	○	○	○
Jag har upplevt att mamman till barnet verkat ledsen eller olycklig.	○	○	○	○
Jag har ökat, eller minskat i vikt, utan att försöka åstadkomma detta.	○	○	○	○
Jag känner att jag har bra stöd från familj och vänner.	○	○	○	○
Jag är lika nöjd med min och mammans relation nu som jag var under graviditeten?	○	○	○	○

Kommentar?

Kan du tänka dig att ställa upp på en kort intervju?

Jag är tacksam för att du tar dig tiden att besvara denna enkät och jag hoppas att du även kan tänka dig att ställa upp på en kortare intervju (ca 10 min). Alla som svarar på enkäten kommer inte att kontaktas för intervju. Intervjun är en viktig del i studien.

Dina kontaktuppgifter används endast för att genomföra intervjun. Dina svar är konfidentiella och kommer inte att kunna kopplas till dig som person. Den insamlade informationen kommer endast att användas i forskningssyfte och inga personuppgifter kommer att sparas efter att intervjun genomförts.

Namn:

Telefon:

E-post:

Appendix B: Inter-item correlation matrix

Appendix B. *Inter-item correlation matrix (pearson r) for all questionnaire items. *significant at α < .05; **significant at α < .01 (n = 95).*

Subscale	#		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
EGDS	1	Jag har kunnat se tillvaron från den ljusa sidan	1																											
	2	Jag har känt mig skrämd eller panikslagen utan speciell anledning	0.228*	1																										
	3	Jag har känt mig så ledsen och olycklig att jag har haft svårt att sova	0.183	0.432**	1																									
	4	Jag har känt mig ledsen och nere	0.488**	0.525**	0.496**	1																								
	5	Tankar på att göra mig själv illa har förekommit	0.115	0.317**	0.230*	0.341**	1																							
	6	Jag/andra upplever att jag har mindre stresstolerans / mer än vanligt lättstressad	0.441**	0.436**	0.374**	0.456**	0.282**	1																						
	7	Jag/andra upplever att jag har ökad aggressivitet, utagerande, svårt med impulskontroll	0.253*	0.413**	0.311**	0.325**	0.235*	0.642**	1																					
	8	Jag/andra upplever att jag är mer lättirriterad, rastlös, otillfredsställd	0.335*	0.480**	0.374**	0.504**	0.396**	0.674**	0.607**	1																				
	9	Jag upplever oro/ängslan/obehagskänsla framför allt på morgonen	0.161	0.338**	0.378**	0.297**	0.276**	0.307**	0.127	0.379**	1																			
	10	Har du känt dig beteendeförändrad på ett sätt som gör att varken du eller andra känner igen dig / är omöjlig att ha att göra med?	0.247*	0.181	0.230*	0.284**	0.288**	0.078	0.174	0.282**	0.182	1																		
	11	Har du känt, eller andra noterat okända tendenser till självömkan, klagande, "ynklighet"?	0.235*	0.258*	0.209*	0.389**	0.274**	0.288**	0.235*	0.426**	0.258*	0.346**	1																	
GMDS	12	Jag är mer lättstressad än tidigare.	0.292*	0.327**	0.386**	0.374**	0.282**	0.721**	0.566**	0.671**	0.494**	0.175	0.266**	1																
	13	Jag har "kortare stubin" och brusar lättare upp än vanligt.	0.302*	0.382**	0.416**	0.357**	0.423**	0.603**	0.624**	0.653**	0.365**	0.2	0.274**	0.627**	1															
	14	Jag är mer lättirriterad än vad jag brukat vara.	0.356*	0.414**	0.443**	0.349**	0.336**	0.640**	0.544**	0.724**	0.377**	0.168	0.335**	0.651**	0.789**	1														
	15	Jag är mer rastlös än tidigare.	0.332*	0.178	0.198	0.383**	0.186	0.323**	0.283**	0.508**	0.370**	0.242*	0.348**	0.379**	0.294**	0.292**	1													
	16	Jag har svårt att fatta även enkla vardagsbeslut.	0.144	0.391**	0.295**	0.299**	0.478**	0.332**	0.119	0.432**	0.654**	0.186	0.312**	0.388**	0.295**	0.360**	0.315**	1												
	17	Jag tycker synd om mig själv oftare än förut.	0.617**	0.327**	0.172	0.549**	0.405**	0.374**	0.316**	0.504**	0.276**	0.405**	0.486**	0.380**	0.431**	0.407**	0.420**	0.379**	1											
	18	Jag klagar mer än vanligt.	0.372**	0.395**	0.222*	0.482**	0.341**	0.440**	0.486**	0.605**	0.360**	0.402**	0.590**	0.513**	0.556**	0.600**	0.379**	0.367**	0.673**	1										
	19	Jag använder alkohol eller tabletter i lugnande och/eller avkopplande syfte.	0.15	0.147	0.087	0.134	0.191	0.181	-0.012	0.205*	0.410**	0.098	0.093	0.158	0.217*	0.176	0.213*	0.319**	0.139	0.220*	1									
	20	Jag tränar mer och/eller hårdare än tidigare.	0.047	0.157	0.128	0.065	0.122	0.099	0.029	0.126	0.204*	0.198	0.151	0.076	0.059	0.2	0.098	0.394**	0.15	0.078	0.1	1								
	21	Jag arbetar mer än vanligt.	0.232*	0.088	-0.03	0.235*	0.259*	0.256*	-0.008	0.208*	0.191	0.073	0.361**	0.205*	0.127	0.132	0.412**	0.356**	0.319**	0.260*	0.143	0.008	1							
	22	Jag äter mer, eller mindre än tidigare.	0.214*	0.358**	0.418**	0.397**	0.346**	0.369**	0.291**	0.486**	0.328**	0.235*	0.266**	0.312**	0.435**	0.467**	0.267**	0.441**	0.294**	0.383**	0.321**	0.185	0.069	1						
	23	Jag har ett ökat behov av sex.	0.056	0.186	0.239*	0.240*	-0.005	0.04	0.168	0.245*	0.035	-0.065	0.239*	0.171	0.192	0.152	0.192	0,000	0.077	0.217*	-0.007	-0.068	0.04	0.219*	1					
DSM	24	Jag har tappat intresset eller lusten att göra sådant som jag brukar tycka om att göra.	0.226*	0.393**	0.412**	0.279**	0.213*	0.249*	0.149	0.337**	0.393**	0.139	0.379**	0.244*	0.297**	0.292**	0.252*	0.391**	0.237*	0.234*	0.103	0.1	0.277**	0.239*	0.181	1				
	25	Jag har upplevt att mamman till barnet verkat ledsen eller olycklig.	0.467**	0.216*	0.213*	0.368**	0.092	0.266**	0.012	0.210*	0.167	0.092	0.108	0.158	0.259*	0.302**	0.107	0.233*	0.360**	0.318**	0.148	0.006	0.211*	0.16	0.17	0.173	1			
	26	Jag har ökat, eller minskat i vikt, utan att försöka åstadkomma detta.	0.015	0.292**	0.202*	0.262*	0.247*	0.230*	0.15	0.314**	0.285**	0.074	0.191	0.161	0.281**	0.189	0.230*	0.487**	0.293*	0.226*	0.428**	0.124	0.179	0.614**	0.157	0.281**	0.109	1		
	27	Jag känner att jag har bra stöd från familj och vänner.	0.210*	0.141	0.191	0.263**	0.155	0.213*	0.091	0.300**	0.099	0.05	0.349**	0.177	0.174	0.223*	0.034	0.183	0.2	0.176	0.052	0.093	0.246*	0.039	0.102	0.310**	0.114	0.018	1	
	28	Jag är lika nöjd med min och mammans relation nu som jag var under graviditeten?	0.397**	0.186	0.338**	0.373**	0.162	0.296**	0.264**	0.317**	0.252*	0.253*	0.372**	0.184	0.230*	0.236*	0.236*	0.224*	0.368**	0.334**	0.141	0.17	0.311**	0.122	0.01	0.361**	0.273**	0.122	0.505**	1