Symptom networks related to suicidal ideation in major depressive disorder and generalized anxiety disorder

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Abstract

Death by suicide a global health problem, often preceded with the experience of suicidal ideation. Both depression and anxiety increase the risk of experiencing suicidal ideation. However, the specific relations between symptoms of depression and anxiety on the one hand, and suicidal ideation on the other, remain unexplored. Therefore, we investigated these relations both at the cross-sectional (N = 2981) and the temporal level (N = 2596), with a follow-up time of 2 years. We included data from the NESDA study and controlled for the covariates age and gender. To do so, we used unregularized network models, each consisting of 21 nodes. In each network, 10 nodes represented depression items, 10 nodes represented anxiety items, and one node represented suicidal ideation. Results showed that the relation between suicidal ideation and depression was stronger than the relation between suicidal ideation and anxiety. This held true at the cross-sectional and temporal level. Overall, depression and anxiety symptoms at baseline explained about 15% of suicidal ideation at the cross-sectional level, and up to 13% at the temporal level. However, these percentages are not directly comparable, because only for the temporal analyses did we control for previous suicidal ideation. Results should be replicated and further investigated in order to be able to draw firm conclusions.

Keywords: suicidal ideation; major depressive disorder; generalized anxiety disorder; network analysis

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1. Introduction

Suicide is a global health problem causing an estimated 800,000 deaths per year (James et al., 2018). More than 1,800 of these deaths are in the Netherlands, accounting for 10.6 deaths per 100,000 residents in 2018 (CBS/Statistics Netherlands, 2019). Experiencing suicidal ideation increases the risk of attempting suicide (Large, Corderoy, & McHugh, 2020; Rogers, Ringer, & Joiner, 2018), with approximately 70% of patients who were admitted to the emergency department after a suicide attempt reported to have experienced suicidal ideation (Wei et al., 2018). Suffering from depression or anxiety increases the risk of experiencing suicidal ideation (De Beurs, Ten Have, Cuijpers, & De Graaf, 2019). Suicidal ideation includes passive thoughts of one's own death and active thoughts about harming or killing oneself (Posner, Oquendo, Gould, Stanley & Davies, 2007). Worldwide, over 250 million people are estimated to suffer from depressive disorders and a similar amount of people is estimated to suffer from anxiety disorders worldwide each year (James et al., 2018). In the Netherlands, one in five adults will experience a depressive episode or an anxiety disorder in their lifetime (De Graaf, Ten Have, Van Gool, & Van Dorsselaer, 2012) and approximately 8% of all adults will experience suicidal ideation at some point in their life (Ten Have, Van Dorsselaer, & de Graaf, 2013). Thus, feelings of depression and anxiety, but also thought about suicide are common and cooccurring psychological problems, which urgently require better understanding. It is important to further explore the mechanisms of depression and anxiety, their causes, and to find possible effective treatments, because this can contribute to increasing the quality of live for all people suffering from depressive or anxiety disorders and suicidal ideation.

1.1 Depression, anxiety, and suicidal ideation

Previous research has shown that both major depressive disorder (MDD) and generalized anxiety disorder (GAD) are related to an increased probability of experiencing

suicidal ideation (De Beurs et al., 2019; Balazs et al., 2013; Cougle, Keough, Riccardi, & Sachs-Ericsson, 2009). Furthermore, research has shown that suffering from a mood disorder increases the chance of developing an anxiety disorder, and vice versa, indicating high comorbidity (De Graaf, Ten Have, Tuithof, & Van Dorsselaer, 2013). De Beurs et al. (2019) found that the association between MDD and suicidal ideation was two times stronger than the association between GAD and suicidal ideation, and that a lifetime prevalence of MDD or GAD resulted in a persistent vulnerability of experiencing suicidal ideation. Additionally, patients with MDD are at a higher risk of experiencing suicidal ideation if they experience additional anxiety symptoms (Baek et al., 2015).

By investigating the relationship between MDD, GAD, and suicidal ideation, more knowledge can be gained about how the elevated risk of experiencing suicidal ideation is caused. Additionally, other influential factors are important to consider in order to get the most complete understanding of the interactions between symptoms, as mental disorders are considered to be multifactorial (Kendler, 2012).

1.2 Risk factors

There are numerous factors that can influence the risk of experiencing MDD, GAD, and suicidal ideation. One of these factors is gender, with women being more likely to experience depression and anxiety than men (De Graaf et al., 2013; Kessler et al., 1994). Women are also more likely to experience suicidal ideation (Bostwick, Pabbati, Geske, & McKean, 2016) and experience suicidal ideation earlier in life than men (Ten Have et al, 2013). However, males are approximately twice as likely to die after a suicide attempt (Bostwick et al., 2016). This difference between sexes develops over time with a start at adolescence (Kessler et al., 1994), and tends to decrease in old age (Fiske, Wetherell, & Gatz, 2009). Age is thus another factor that influences depression and anxiety. Young adults are more likely to experience depression and anxiety than older adults (De Graaf et al, 2013;

Fiske et al., 2009). The mean age of experiencing suicidal ideation for the first time is around 26 years of age (Ten Have et al, 2013), with young people being more likely to experience suicidal ideation, increasing the risk of a suicide attempt (Baek et al., 2015). Although there are multiple other factors influencing depression, anxiety, and suicidal ideation, such as comorbid disorders, socioeconomic status (Eikelenboom, Beekman, Penningx, & Smith, 2019; Ju et al., 2016), being persistently unemployed, experiencing life events (Zhang, Yip, Chang, Wong, & Law, 2015), marital status (Inder et al., 2014), and having chronic physical disorders (Scott et al., 2010), in this study the primary focus will be on age and gender.

1.3.1 Common cause vs network perspective

Before more effective treatments can be developed, a better understanding of the relationship between depression, anxiety, and suicide must be gained. One important step is to increase our knowledge about how individual symptoms of depression and anxiety are related to suicidal ideation. This is because there are likely direct causal relations among these problems, which we explain in more detail in the following section.

Previously conducted research has investigated the relationships between MDD, GAD, and suicidal ideation mainly based on the traditional common cause perspective, which assumes one or more causes to be responsible for the development of symptoms of depression and anxiety, as well as their comorbidity (Caspi & Moffit, 2018). However, it has also been suggested that symptoms can interact and influence the development of other symptoms (Schmitmann et al., 2013). These influences have sometimes been ignored when taking the common cause perspective, which may conceal important relationships between symptoms and disorders that could improve prevention and intervention strategies.

A theory that incorporates more than one cause and takes interaction between symptoms into account is the network theory. This notion supposes that symptoms can directly cause other symptoms to develop (Borsboom & Cramer, 2013). This theory can help

to gain insights into the underlying structures of disorders. Thus, the biggest difference between the common cause perspective and the network view is that the first explains the relation among symptoms by a common cause, the latter explains the same relations by mutual interaction.

The network approach to psychopathology has been used to investigate a wide range of disorders, usually by using statistical models from the family of network psychometrics (Fried et al., 2016). Examples of the mental disorders that have been studied are posttraumatic stress disorder (Fried et al., 2018; Armour, Fried, Deserno, Tsai, & Pietrzak, 2017; MacNally et al., 2015), psychotic disorders (Murphy, McBride, Fried & Shevlin, 2018; Isvoranu et al., 2017; Isvoranu, Borsboom, Van Os, & Guloksuz, 2016), anxiety (Beard et al., 2016; Heeren & McNally, 2016), depression (Aalbers, McNally, Heeren, De Wit, & Fried, 2019; Santos, Kossakowski, Schwartz, Beeber, & Fried, 2018; Van Loo et al., 2018; Wichers & Groot, 2016; Beard et al., 2016), suicidal behaviors (De Beurs et al., 2019; De Beurs, Van Borkulo, & O'Connor, 2017[a]), and substance abuse and dependence (Rhemtulla et al., 2016). Additionally, the network approach has been used to investigate early warning sings as indicators for mental disorders, and the predictability of the course of a disorder (Wichers & Groot, 2016; Van de Leemput et al., 2014). Moreover, multiple studies found that MDD and GAD are highly intertwined, providing more evidence for the comorbidity of both disorders (Cramer, Waldorp, Van der Maas, & Borsboom, 2010; Beard et al., 2016). Boschloo, Van Borkulo, Rhemtulla, Keyes, and Borsboom (2015) found that there are specific symptoms that connect disorders and influence the comorbidity between specific disorders. In sum, the network approach has provided valuable insights into the connections and influence of symptoms of various disorders, and provided an alternative explanation for the relations among symptoms within and across traditional psychiatric disorders. However, the network

approach has only rarely been used to understand suicidal behaviors (De Beurs, 2017[b]), and specifically how MDD and GAD are related to suicidal ideation.

1.3.2 Prior network research on MDD, GAD, and suicidal ideation

The network approach seeks to explain relations between symptoms by estimating networks, which consist of nodes and edges. A node represents a variable and an edge represents the partial correlation between these entities (Epskamp, Borsboom, & Fried., 2018). The edges in a network have varying strengths, depending on the direct connection of the node to other nodes in the network (Epskamp et al., 2018). Furthermore, edges between nodes can be both positive and negative, indicating a positive correlation and a negative correlation between the nodes, respectively (Robinaugh, Millner, & McNally; 2016).

Other than the strengths of edges, a node with a high centrality has many connections with other nodes. This means that the node can influence other nodes in the network, but can also can be influenced by them (Rouquette et al., 2018). Finally, bridge centrality is used, which means that a symptom is related to one or more symptoms outside the disorder it belongs to. In this study, the bridge centrality between MDD, GAD, and suicidal ideation is used, which provides information about which symptoms are most strongly related to suicidal ideation.

Previous research using the network approach has shown that there is overlap between MDD and GAD symptoms based on the DSM-IV (Borsboom & Cramer, 2013). Despite these overlapping symptoms between MDD and GAD, it is not yet known which specific symptoms of these disorders are most strongly related to suicidal ideation. If specific symptoms would be identified to be high-risk symptoms in the relation to suicidal ideation, these symptoms could be targeted more actively during treatment, which could decrease the development of suicidal ideation. More knowledge about these relations could therefore contribute to better mental health care for those who are suffering from MDD or GAD.

1.4 The present study

To contribute knowledge about the correlations between MDD, GAD, and suicidal ideation, we use network psychometric models to test whether specific MDD and GAD symptoms are more strongly related to suicidal ideation than others than would be expected by chance, when controlled for age and gender. The dependent variable of interest was the sum of the edges from all MDD nodes to suicidal ideation, and the sum of edges of all GAD nodes to suicidal ideation. We utilized two waves of data from the NESDA study, namely Wave 1 and Wave 2, to answer the two research questions (RQs) in this paper, which are:

> RQ 1: How do MDD and GAD symptoms at Wave 1 relate to suicidal ideation at Wave 1, controlling for the covariates age and gender?
>
> RQ 2: How do MDD and GAD symptoms and suicidality at Wave 1 predict suicidal ideation at Wave 2, controlling for the covariates age and gender?

There were no set expectations about the outcomes of the research questions due to the exploratory design of the study – we see this project as hypothesis generation rather than hypothesis testing research. Further research can then explore more in-depth how the risk symptoms are related to suicidal ideation, and how screening and treatment might be altered based on this information.

To answer the research questions, we used data from the Netherlands Study of Depression and Anxiety (NESDA) (www.nesda.nl). NESDA provides a longitudinal dataset of 2981 participants who have completed a variety of questionnaires, including questionnaires about depression, anxiety, and suicide. Specifically, we used the Inventory of Depressive Symptoms (IDS) (Rush et al., 1986) to measure mood, the Beck Anxiety Index (BAI) (Beck, Rush, Shaw, & Emery, 1979) to measure anxiety, and the Beck Scale for Suicidal Ideation (BSS) (Beck et al., 1979) to determine suicidal ideation. The nodes in the networks represent

symptoms of MDD, GAD, and suicidal ideation. We included 10 items per disorder. Furthermore, based on previous research, the covariates age and gender were included in the analyses to control for them.

Before the data was seen and the analyses were conducted, the project was preregistered at AsPredicted.org (https://aspredicted.org/blind.php?x=y7yc2q). We hoped to increase scientific rigor by specifying research questions and hypotheses before looking at the data, ensuring that we tested our initial predictions and did not alter our expectations based on the data (Nosek, Ebersole, DeHaven, & Mellor, 2018).

2. Method

2.1 Participants

We analyzed data from the Netherlands Study of Depression and Anxiety (NESDA) (www.nesda.nl) at two different timepoints in the study. The NESDA study is a national study conducted in the Netherlands that includes Dutch participants aged 18 to 65 years old at baseline. Participants both with and without symptoms of MDD and GAD were included. Participants were recruited from primary care practices in the Netherlands in the provinces Groningen, Friesland, Drenthe, Leiden, and Amsterdam. Baseline data was collected from 2004 until 2007, while follow-up data was collected two years after baseline, from 2006 until 2009. Participants filled out self-report questionnaires and some questionnaires were conducted by trained interviewers. All participants filled out the same set of questionnaires. At baseline (Wave 1), a total of 2981 participants participated in the study, and at follow-up 2 (Wave 3; hereafter Wave 2), a total of 2596 participants participated in the study.

2.2 Measures

To determine the relations between MDD and GAD symptoms and how these are related to suicidal ideation, we selected specific items from MDD and GAD scales included in NESDA,

based on the following criteria: Firstly, it was preferred that we could use the same questionnaires for all measures, so the included questionnaires had to be present at both timepoints included in the analyses. Secondly, it was preferred that all the included items were selected from within one questionnaire, instead of a combination of items from different scales. Thirdly, we wanted to avoid the skip-out effect, which could result from questionnaires with hierarchical questions (only X if answer Y). No outliers were expected because of the restricted response rate of the questionnaires.

2.2.1 Mood

Depressive symptoms were assessed in the NESDA study with the CIDI and the Inventory of Depressive Symptoms (IDS) (Rush et al., 1986). The CIDI questionnaire has skip-items, and it was therefore decided to use the IDS, a self-report measurement which consists of 28 items with four answer categories, covering the preceding seven days. The item categories are adapted to each question, with a score of 0 on a question indicating that the symptom is not present, and a score of 3 indicating that the symptom is highly present. The sum score of the IDS was associated with the following interpretation: A total score up to 13 indicated no depressed mood, a total score between 14 and 25 indicated a mildly depressed mood, a total score between 26-38 indicated a moderate depressed mood, a total score between 39-48 indicated a severely depressed mood, and a score above 48 indicated a very severe depressed mood. The IDS has shown to have good psychometric properties (Cronbach's alpha around .90, Rush, Gullion, Basco, Jarrett, & Tivedi, 1996).

2.2.2 Anxiety

Anxiety symptoms were measured in the NESDA study with the CIDI and the Beck Anxiety Index (BAI) (www.nesda.nl). For the same reasons as described above, we used the BAI instead of the CIDI. The BAI is a self-report measurement and consists of 21 items with four

answer categories, covering the preceding month (Beck et al., 1979). Participants scored each item with a score between 0 and 3. A score of 0 corresponds with the answer category 'Not at all', a score of 1 corresponds with 'Mildly, but it didn't bother me much', a score of 3 corresponds with 'Moderately – it wasn't pleasant at times', and a score of 4 corresponds with 'Severely – it bothered me a lot'. A total score between 0-21 indicated low anxiety, a total score of 22-35 indicated moderate anxiety, and a total score of 36 and higher indicated potentially concerning levels of anxiety. The BAI has shown to have good psychometric properties (Cronbach's α = .92, Beck, Brown, Epstein, & Steer, 1998).

2.2.3 Suicidal ideation

Finally, to determine suicidal ideation, the Beck Scale of Suicide Ideation (BSS) was used (Beck et al., 1979). In the NESDA study, five items of the BSS were included, and all five items were included in the analyses of this study. The BSS measured suicidal ideation in the past week and has good psychometric properties (α = .94, Kliem, Lohmann, Mößle, & Brähler, 2017). The items were scored on a 1 to 4 scale. A score of 1 indicated that the participant did not experience any suicidal ideation, a score of 2 indicated some suicidal ideation, and a score of 3 indicated strong suicidal ideation. A score of 4 meant 'rather not say'. Therefore, we decided to only adopt score 1 to 3 to determine the severity of suicidal ideation. In contrast to the IDS and BAI, the BSS was measured via an interview.

2.3 Item selection

Network models require estimation of many parameters that grow exponentially. Therefore, we decided a priori to include 10 items per disorder from the baseline measure. The IDS consists of 28 symptoms covering the past seven days. The BAI consists of 21 items covering the past month. The items of both the IDS and the BAI were scored on a 0 to 3 scale. To determine which items should be included in the analyses, we decided on our selection procedure during the preregistration, and looked at the data after preregistration. For both

questionnaires, we took the 10 items that were most common in the sample, based on the mean score of each item. We used this selection procedure to avoid including items that were only rarely present in the sample, which would make it harder to draw any meaningful conclusions both due to prevalence rates and floor effects. There were three exceptions to this procedure. Firstly, if two items of the 10 most common items were very similar in terms of content. Secondly, if the 10 items showed multicollinearity (variance inflation factor (VIF) ≥ 5). Thirdly, if the items showed ceiling effects. Items that were assessed as being too similar are shown in Table 1. If items were too similar in content, only one item (with the highest mean) was included, and the next most common item was included as the tenth item. In case of multicollinearity, we excluded the multicollinear item and included the next most frequent one. To determine if a ceiling effect was present, we plotted a homogeneity of variance plot per item; if the plot showed signs of a ceiling effect, an ANOVA on the homogeneity of variance was performed. If the results of the ANOVA were significant, we excluded the item

Table 1. *Overview of items that were judged to be too similar to each other.*

Item	**Too similar to**
Feeling sad (ids05)	The quality of your mood (ids10)
Energy level (ids18)	Leaden paralysis/physical energy (ids28)
Change in appetite (ids11)	Weight change (ids12)
Wobbliness in legs (bai03)	
Dizzy or Lightheaded (bai06)	Faint, lightheaded (bai19)
Unsteady (bai08)	Shaky, unsteady (bai13)
Terrified or afraid (bai09)	Scared (bai17)

Note: IDS represents the items of the Inventory of Depressive Symptoms, BAI represents the items of the Beck Anxiety Index.

and included the next most common item. These steps were performed in IBM Statistical Package for the Social Sciences (SPSS) statistics 26.

We used the procedure above to select 10 items per MDD and GAD, and then performed network analyses as described in detail below. However, to ensure that this selection procedure is not responsible for the results we obtain, we additionally performed a robustness analysis, using a random selection of 10 items for MDD and GAD each. Specifically, we used the statistical software environment R, version 3.6.1 (R Core Team, 2019), and randomly selected 10 items from the IDS and BAI each, without replacement. We repeated this procedure 1000 times, and compared the outcome of the randomly selected items with the selection of the 10 most common items.

The BSS was used to determine suicidal ideation. For RQ1, we used the BSS from Wave 1, for RQ2, the BSS from Wave 2. The five items of the BSS have three categories, and were likely to have a skewed distribution. Because strongly skewed distributions can be difficult to model, we decided a priori that the items would be recoded into dichotomous items using IBM SPSS statistics 26. A score of 1 on an item was coded as 'no' (0), and a score of 2 or 3 on an item was coded as 'yes' (1). This procedure was done for all five items, and resulted in a sum score with a range of 0-5. Additionally, robustness analyses were performed with a dichotomized total BSS score. For this score, participants that scored 0 on all five items received a score of 0, and all other participants (i.e. those that endorsed at least one dichotomized item) received a score of 1.

2.4 Statistical analyses

All statistical analyses were done in R (version 3.6.1; R Core Team, 2019). The package 'qgraph' (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012) was used to visualize the estimated networks. To estimate the networks, we used unregularized Gaussian Graphical Models (GGM) (Marchetti, Drton, & Sadeghi, 2020). We used the unregularized

version of the GGM instead of the regularized GGM because of some recent criticism of regularized network estimation (Williams, Rhemtulla, Wysocki, & Rast, 2019), and because if false positives were to emerge from the unregularized model, they would be the same for both MDD and GAD, due to the same number of items and edges for both disorders. Due to the ordinal nature of symptom data, networks were estimated based on the Spearman correlations among MDD items, GAD items, and suicidal ideation. The 'bootnet' package (Epskamp et al., 2018) was used to estimate the networks. The centrality (connectedness) of the nodes in the network was estimated using the metric expected influence, which determines the strength and nature of the cumulative effect of a node in the network (Robinaugh, Millner, & McNally; 2016). Finally, we used the 'mgm' package (Haslbeck & Waldorp, 2020) to estimate the predictability of the nodes in the networks. Predictability is the degree to which a node shares variance with nodes in the network. When averaging predictability across all nodes, a high average predictability (i.e. high shared variances) indicates that the network is mostly statistically determined by interaction between the nodes, while low predictability indicates that the network is mainly determined by factors outside of the network (Haslbeck & Waldorp, 2017).

The dependent variable of interest was the sum of the edges from all MDD nodes to suicidal ideation, named MDD_SUI, and the sum of edges of all GAD nodes to suicidal ideation, named GAD_SUI. To control for the covariates age and gender (i.e. to partial out their effects), the values of these covariates at the baseline measure of the NESDA study were added to the network models. Further investigations for age and gender were beyond the scope of this paper, and we opted not to include these two nodes in the network graphs.

Finally, to determine if there was a difference between MDD_SUI and GAD_SUI, we used permutation tests, in two different ways to ensure robustness of results. Firstly, for the top-10 items, we estimated how the difference of MDD_SUI and GAD_SUI would look like

under chance. We did this by randomly distributing the 20 items over the two groups, MDD and GAD (i.e. disregarding what item belongs to what group). We repeated this procedure 1000 times, which provided a null distribution. The observed difference score of the two actual MDD_SUI and GAD_SUI scores was then compared to the null distribution of this resampling procedure to determine if the difference was larger than expected under chance. The difference was classified as significant within 2.5% on both sides of the null distribution. This method was then repeated for the random item selection procedure, rather than the top-10 items.

For RQ2, we used the same procedure and analyses as for RQ1. The items included in the model with the 10 most common items, and the outcome of the permutation test described above were again included for RQ2. The outcome of the random item selection procedure for RQ1 was also used for RQ2. However, the BSS scores from Wave 2, instead of Wave 1, were included to determine how MDD and GAD symptoms at baseline are predictive of symptoms of suicidal ideation at Wave 2.

3. Results

3.1 Sample characteristics

The sample at Wave 1 (N = 2981) included 1002 men (33.6%) and 1979 women (66.4%). At Wave 2, 878 men (33.9) and 1715 women (66.1%) were included. Mean age at baseline was 43.4 years (SD = 12.9) for men and 41.1 years (SD = 13.1) for women. Age range was 18-64 years for men and 18-65 years for women. At Wave 1, IDS scores ranged from 0 to 69 (M = 21.12, SD = 14.1), BAI scores ranged from 0 to 62 (M = 11.95, SD = 10.6), and 295 participants (9.9%) experienced suicidal ideation. At Wave 2, IDS scores ranged from 0 to 75 (M = 22.27, SD = 15.1), BAI scores ranged from 0 to 40 (M = 3.36, SD = 5.1), and 227 participants (8.7%) experienced suicidal ideation.

3.2 Item selection of the 10 most common items

To determine which 10 items should be included as the 10 most common items, we looked at the mean score of the items, taking into account multicollinearity between items, ceiling effects of items, and similarity in content of the items. Table 2 displays the 10 most frequent items that were included for both the IDS and the BAI after the abovementioned criteria were checked. Appendix A provides an overview of all IDS and BAI items, with the 10 most frequent items of MDD and GAD each printed in bold.

There were no signs of multicollinearity for both MDD and GAD, with VIF values not exceeding 2 for the IDS and not exceeding 2.5 for the BAI. There were no indications for any ceiling effects based on the homogeneity of variance plots, and therefore it was not necessary to perform an ANOVA on the homogeneity of variance.

Concerning the similarity between items in terms of their content, one item for the IDS and one item for the BAI were replaced. For the IDS, item 18 (Energy level) was excluded and replaced with item 10 (Quality of mood). For the BAI, item 6 (Dizzy or lightheaded) was excluded and replaced with item 7 (Heart pounding, racing).

Table 2. *Mean scores and standard deviations on the included items of the Inventory of Depressive Symptoms and Beck Anxiety Index.*

Inventory of Depressive Symptoms		Beck Anxiety Index	
Item	Mean (SD)	Item	Mean (SD)
Falling asleep	.87 (1.079)	Feeling hot	.83 (.858)
Sleep during the night	1.30 (1.061)	Unable to relax	1.08 (.953)
Feeling irritable	.90 (.824)	Fear of worst happening	.74 (.926)
Feeling anxious or tense	.93 (.847)	Heart pounding, racing	.62 (.777)
The quality of your mood	.87 (1.071)	Nervous	1.00 (.883)
Concentration/ Decision making	.88 (.876)	Fear of losing control	.69 (.888)
View of myself	.92 (1.181)	Scared	.68 (.854)
Aches and pains	1.03 (.813)	Indigestion	.62 (.827)
Interpersonal sensitivity	.99 (.985)	Faint, lightheaded	.74 (.857)
Leaden paralysis/ physical energy	1.14 (.999)	Hot, cold sweats	.71 (.909)

3.3 Research Question 1: How do MDD and GAD symptoms at Wave 1 relate to suicidal ideation at Wave 1, controlling for the covariates age and gender?

3.2.1 Top-10 item selection related to the sum score of BSS at Wave 1

Figure 1 depicts the estimated network corresponding to RQ1, including the sum score of BSS, and after controlling for the covariates age and gender. For this network, 'Feeling anxious or tense' (ids07) had the highest expected influence centrality, and the sum score of the BSS had the lowest expected influence centrality. Visual representations of the expected influence centrality are displayed in Appendix B. Furthermore, as depicted in Appendix C, all but one (Aches and pains) of the IDS items were directly connected to the BSS item, with edge weight values ranging between .004 (Sleep during the night) and .074 (Interpersonal sensitivity). However, only two of the BAI items (Scared and Indigestion) were connected to the BSS item, with values of .023 and .002, respectively.

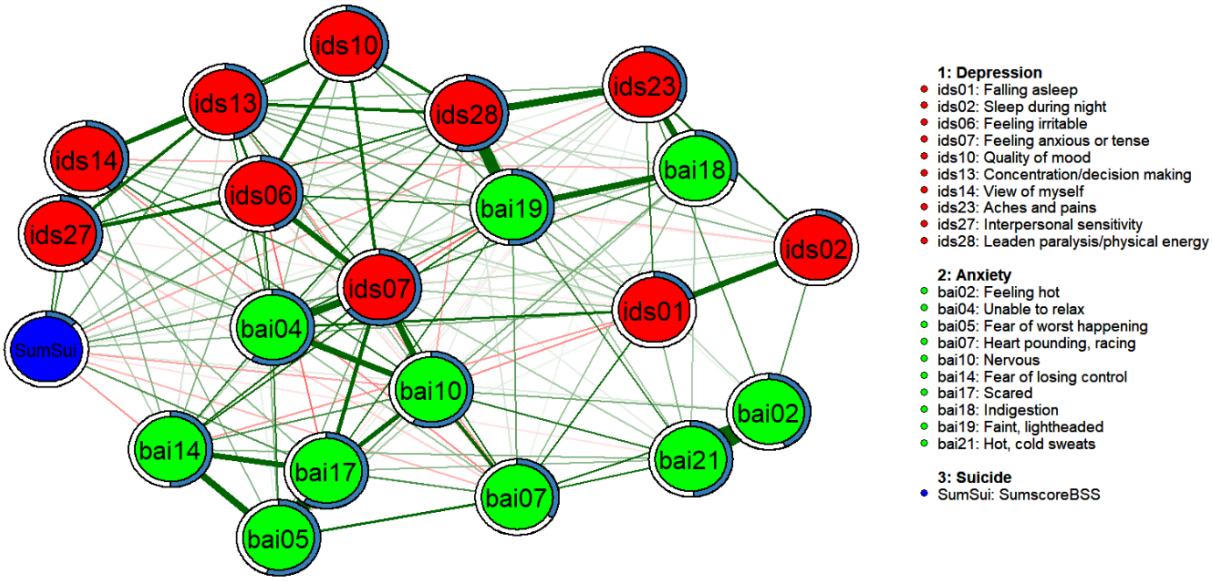

Figure 1. Estimated network with visualized predictability corresponding to RQ1, including the data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the sum score value for BSS. Green edges between nodes represent positive partial correlations, red edges between nodes represent negative partial correlations.

An overview of all edge weights between IDS and BAI items to suicidal ideation can be found in Appendix C. The sum score of edges was .358 for MDD_SUI and .003 GAD_SUI. This resulted in a difference score between the sum of edges of MDD_SUI and GAD_SUI, from hereon called the delta score, of .355. This implies that MDD symptoms are more strongly related to suicidal ideation than GAD symptoms

3.3.2 Top-10 item selection related to the dichotomized BSS score at Wave 1

Figure 2 shows the estimated network corresponding to RQ1, including the dichotomized BSS score, and after controlling for the covariates age and gender. The expected influence centrality of the nodes in this network was similar to the expected influence centrality of the nodes in the network shown in Figure 1 (see Appendix B), with the exception that 'Indigestion' (bai18) had a slightly higher expected influence centrality than 'Heart pounding, racing' (bai07) in the network including the dichotomized BSS score, which was the opposite in the previous network. Again, all but one (Aches and pains) of the IDS items were directly connected to the dichotomized BSS item, with values ranging between .017 (Sleep during the night) and .068 (View of myself). However, as opposed to the network including the sum score of the BSS, four BAI items (Heart pounding; Scared; Indigestion; and Faint, lightheaded) were connected to the dichotomized BSS item, with values between -.014 and .036, the item 'Heart pounding' being negatively correlated to the BSS item. The sum score of the edges was .412 for MDD_SUI and -.003 for GAD_SUI, resulting in a delta score of .415, also implying that MDD items are more strongly related to suicidal ideation than GAD items.

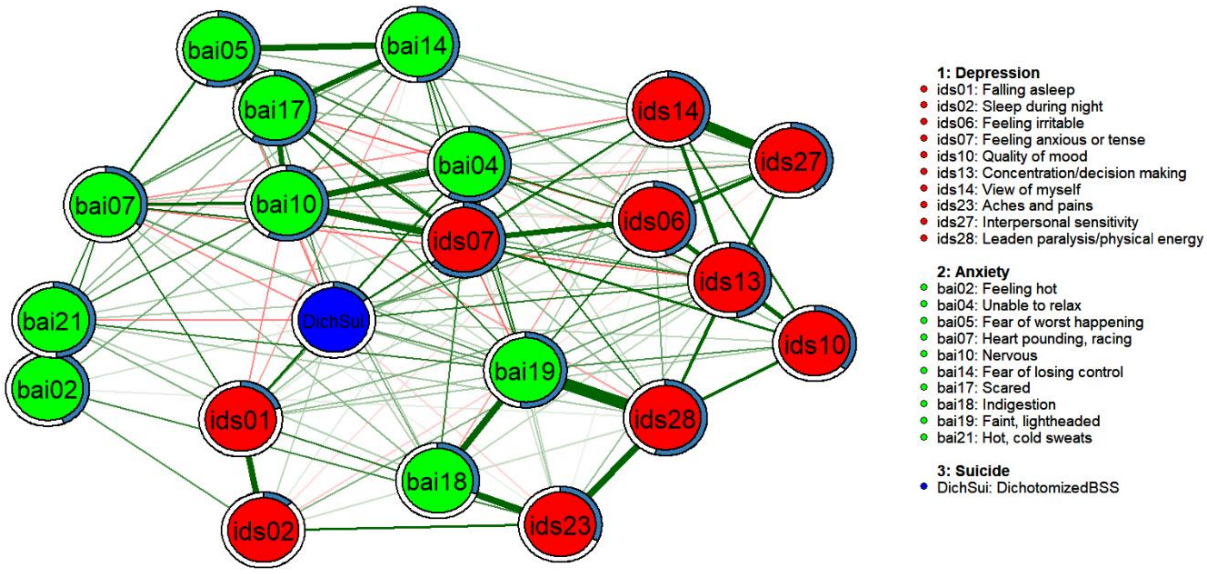

Figure 2. Estimated network with visualized predictability corresponding to RQ1, including the data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the dichotomized value for BSS. Green edges between nodes represent positive partial correlations, red edges between nodes represent negative partial correlations.

3.3.3 Predictability of the nodes in the networks corresponding to RQ1

The predictability of the nodes for both networks corresponding to RQ1 is displayed in Appendix D. The explained variance for the sum score of BSS was .124, and .151 for the dichotomized BSS score, indicating that 12.4% up to 15.1% of suicidal ideation in these networks was predicted by factors included in the networks. The explained variance of the items for the network including the sum score of BSS varied between .188 for IDS-item 'Sleep during night' – indicating that the node was mainly determined by factors outside of the network –, and .644 for IDS-item 'Feeling anxious or tense' – indicating that the node was mainly determined by interactions between the nodes in the network. The explained variance was similar for the network including the dichotomized BSS score. Visual representations of

the predictability of the MDD and GAD items to the sum score of BSS and the dichotomized BSS score are shown in Figure 1 and Figure 2, respectively.

3.3.4 Bootstrapped random item selection related to BSS at Wave 1

Because the selection in paragraphs 3.3.1 and 3.3.2 may be biased given the single draw, we also repeated the drawing procedure 1000 times drawing random items each time. After performing 1000 bootstraps on all 28 IDS items and 21 BAI items, the sum of edges between MDD and suicidal ideation, and GAD and suicidal ideation was computed. A visual representation of the delta scores between items of the IDS and BAI to the sum score of BSS is shown in Figure 3. Figure 4 represents the delta score including the dichotomized BSS score. After bootstrapping, the sum of edges of the IDS items to suicidal ideation was larger than the sum of edges of BAI items to suicidal ideation for all 1000 bootstraps performed, both for the sum score of BSS and the dichotomized BSS score. The average delta score was .374 (*SD* = .093, *Mdn* = .351) for the sum score of BSS, and .425 (*SD* = .081, *Mdn* =.405) for the dichotomized BSS score. This implies that the MDD items are more strongly related to suicidal ideation than GAD items when a bootstrapped selection of the IDS and BAI items is taken.

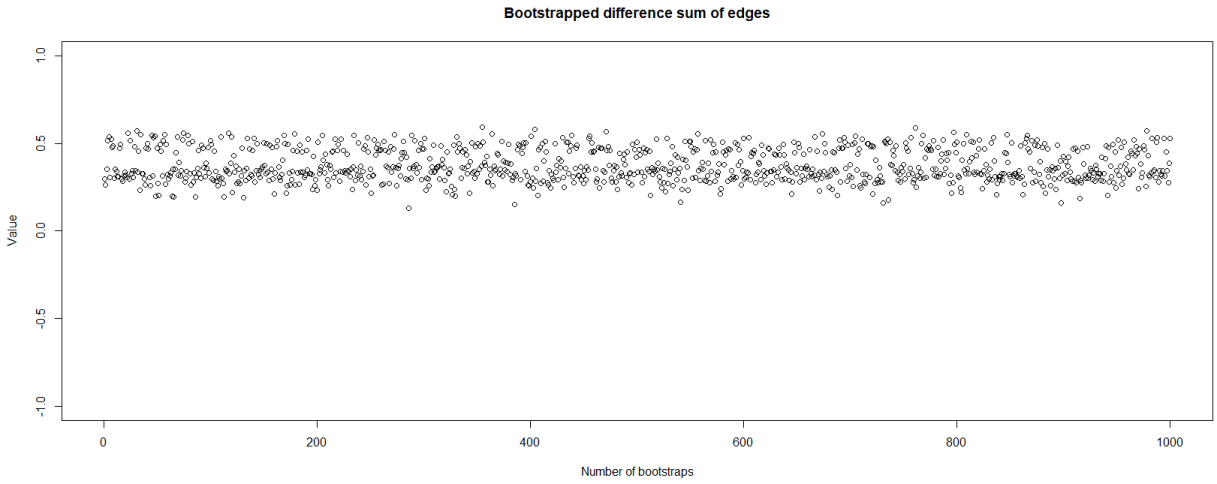

Figure 3. Delta scores including the sum score of suicidal ideation after bootstrapping at Wave 1.

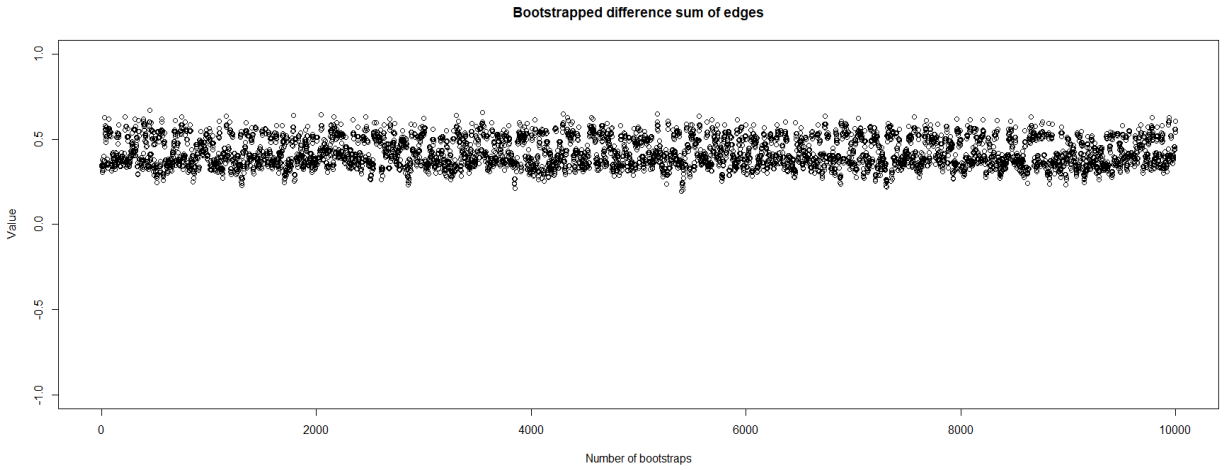

Figure 4. Delta scores including the dichotomized score of suicidal ideation after bootstrapping at Wave 1.

3.3.5 Permutation tests

After we have obtained differences of sum scores MDD_SUI and GAD_SUI, we now want to understand whether these differences are of significant meaning for the different procedures described above. Permutation tests were used to determine if the sum of edges between MDD_SUI and GAD_SUI was significantly larger than would be expected under chance. Figure 5 shows the difference of the sum of edges including the 10 most common IDS and BAI items in the sample and the sum score of BSS at Wave 1. The delta scores clustered around zero, with an average of .0009 (*SD* = .104, *Mdn* = .009), which indicates that the sum of edges of IDS items was slightly stronger than that of BAI items. When including the dichotomized BSS score instead of the sum score, the average delta score was somewhat lower, with a value of .0006 (*SD* = .099, *Mdn* = .009). Individual values remained clustered around zero (Figure 6).

Significance tests showed that the average delta score, including the 10 most common IDS and BAI items, was significantly larger than would be expected under chance. This held

true both for the sum score of BSS ($p < .001$) and the dichotomized BSS score ($p < .001$) for the data from wave 1.

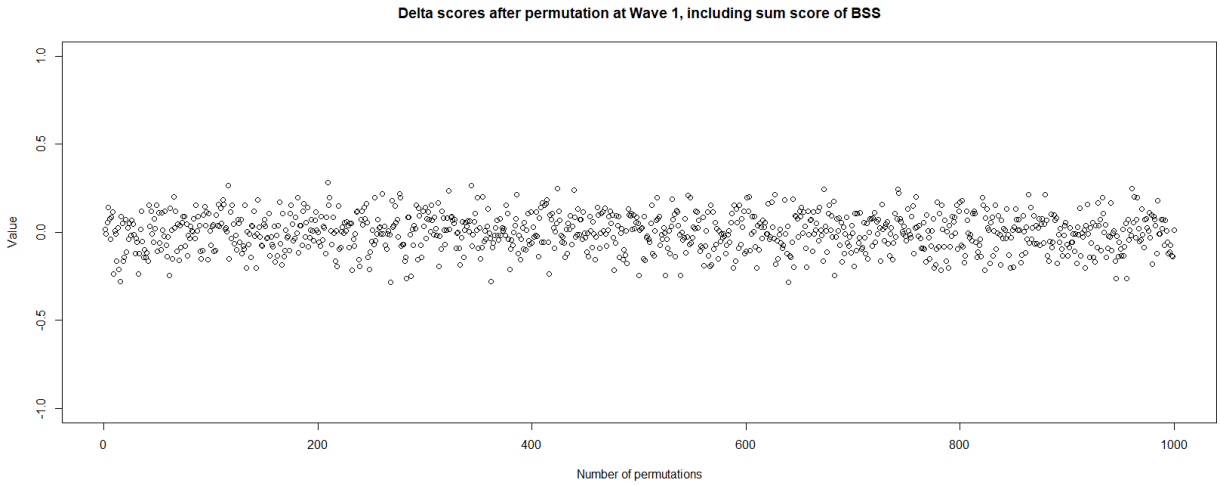

Figure 5. Delta scores using the sum score of suicidal ideation after permutation at Wave 1, including the 10 most common IDS and BAI items in the sample.

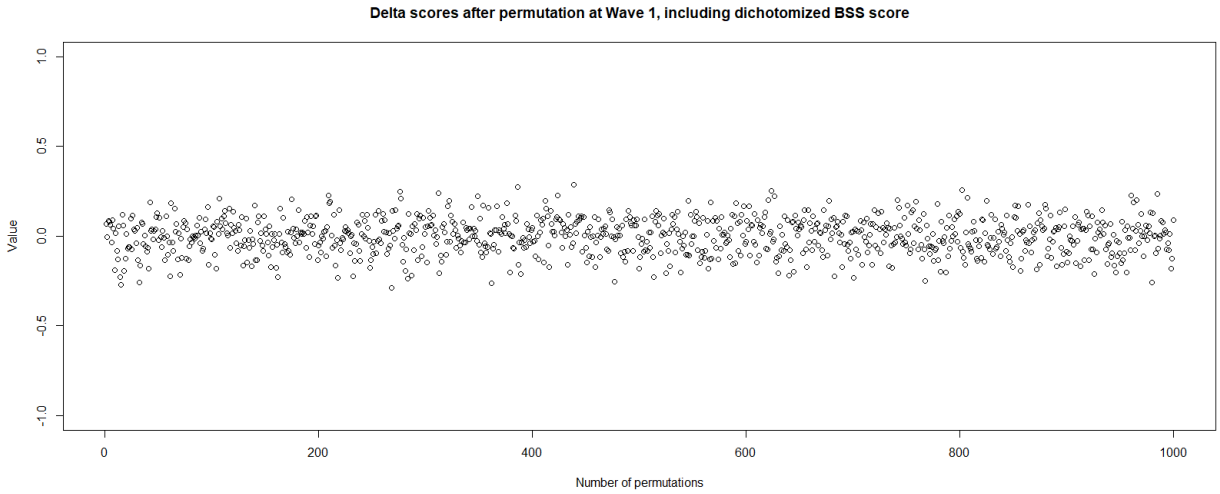

Figure 6. Delta scores using the dichotomized score of suicidal ideation after permutation at Wave 1, including the 10 most common IDS and BAI items in the sample.

3.4 Research Question 2: How do MDD and GAD symptoms and suicidality at Wave 1 predict suicidal ideation at Wave 2, controlling for the covariates age and gender?

3.4.1 Top-10 item selection related to the sum score of BSS at Wave 2

Figure 7 depicts the estimated network corresponding to RQ2, including the 10 most common items of both the IDS and the BAI, the relations between items, and relations between items and the sum score of the BSS. The sum score of the BSS had a low expected influence centrality in the network. Appendix B provides more information about the centrality of the nodes in the network. Seven IDS items and two BAI items were directly connected to the sum score of BSS. The IDS item 'View of myself' had the strongest edge weight to the sum score of BSS with an edge weight of .060. For this network, the sum of edges was .285 for MDD_SUI and .036 for GAD_SUI, resulting in a delta score of .249. Again, this showed that MDD items are more strongly related to suicidal ideation than GAD items. As expected, this delta score was smaller than the delta score for the network with the sum score of BSS in Wave 1 (see Figure 1).

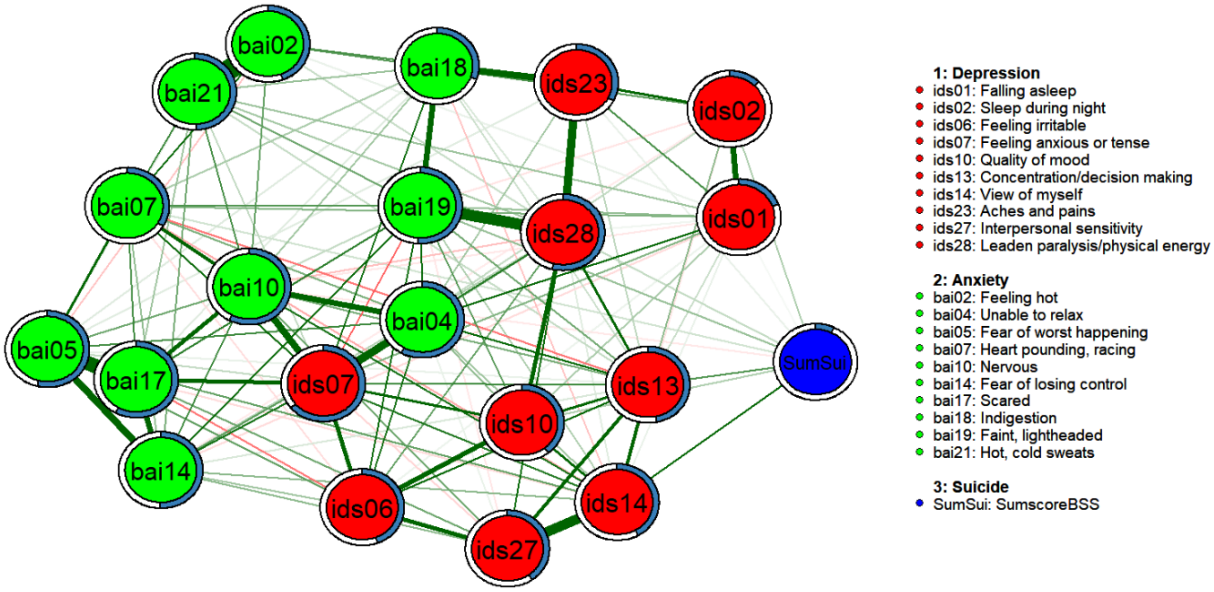

Figure 7. Estimated network with visualized predictability corresponding to RQ2, including the data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the sum score value for BSS. Green edges between nodes represent positive partial correlations, red edges between nodes represent negative partial correlations.

3.4.2 Top-10 item selection related to the dichotomized BSS score at Wave 2

As robustness analyses, we again repeated the same analyses as above, but included the dichotomized BSS score instead of the sum score of BSS. Figure 8 shows the corresponding estimated network. The expected influence centrality of included items was similar to the networks corresponding to RQ1. Suicidal ideation, again, had the lowest expected influence centrality in the network. Seven IDS items and three BAI items were directly connected to the BSS score. Unlike the previous network, the IDS item 'View of myself' had the strongest edge weight to the sum score of BSS, with a value of .048. The sum of edges was .259 for MDD_SUI and .028 for GAD_SUI, resulting in a delta score of .230, implying that MDD items are more strongly related to suicidal ideation than GAD items.

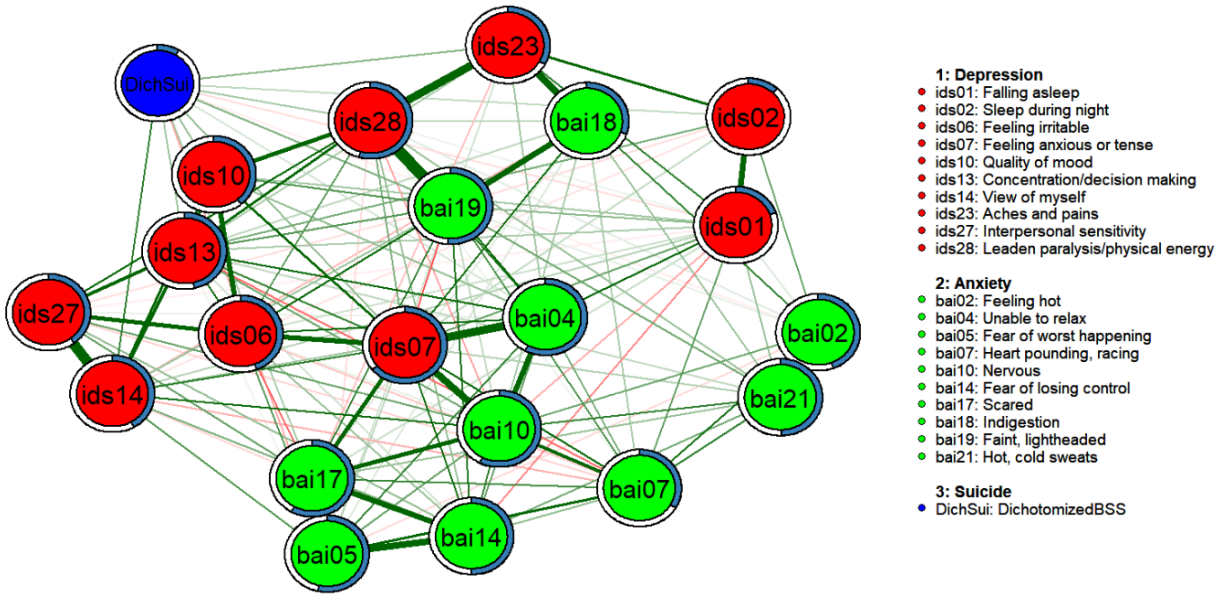

Figure 8. Estimated network with visualized predictability values corresponding to RQ2, including the data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the dichotomized value for BSS. Green edges between nodes represent positive partial correlations, red edges between nodes represent negative partial correlations.

3.4.3 Predictability of the nodes in the networks corresponding to RQ2

The predictability of the nodes for both networks corresponding to RQ2 is displayed in Appendix E. The explained variance of the items for the networks corresponding to RQ2 was similar to the explained variance of the items corresponding to RQ1, although the values for the networks in RQ2 are somewhat lower. The explained variance was 13.3% for the sum score of BSS and 11.2% for the dichotomized BSS score. Although this suggests that suicidality is mainly predicted by factors that were not included in the network, 13.3% and 11.2% were considered to be substantial given the temporal prediction. The explained variance of the items in the network including the sum score of BSS varied between .185 for the IDS-item 'Sleep during night' and .640 for the IDS-item 'Feeling anxious or tense'. The explained variance was similar for the network including the dichotomized BSS score. Visual representations of the predictability of the MDD and GAD items to the sum score of BSS and the dichotomized BSS score are shown in Figure 7 and Figure 8.

3.4.4 Bootstrapped random item selection related to BSS at Wave 2

After performing 1000 bootstraps on all 28 IDS items and 21 BAI items, the delta scores for Wave 2 were computed. Visual results of the delta scores between MDD and GAD to the sum score of suicidal ideation are shown in Figure 9. Figure 10 represents the relation to the dichotomized suicidal ideation score. After bootstrapping, the sum of edges of the IDS items to suicidal ideation was larger than the sum of edges of BAI items to suicidal ideation. This held true both for the sum score of BSS and the dichotomized BSS score, with average delta scores of .245 (*SD* = .063 , *Mdn* = .243) and .250 (*SD* = .058, *Mdn* = .248), respectively. These outcomes imply that MDD symptoms are more strongly related to suicidal ideation than GAD symptoms when a bootstrapped selection of the IDS and BAI items is taken.

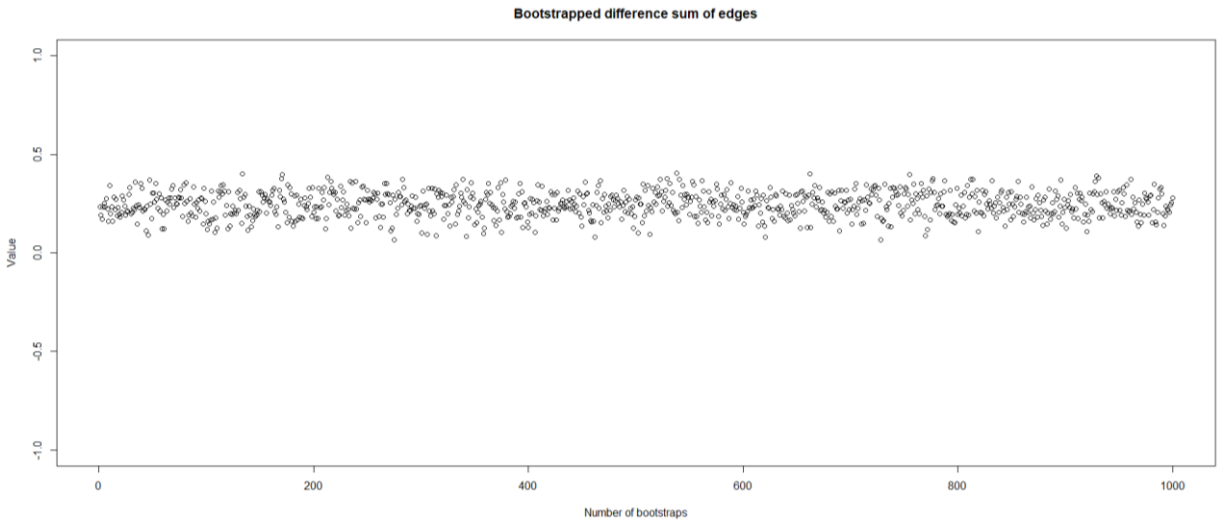

Figure 9. Delta scores using the sum score of suicidal ideation after bootstrapping at Wave 2.

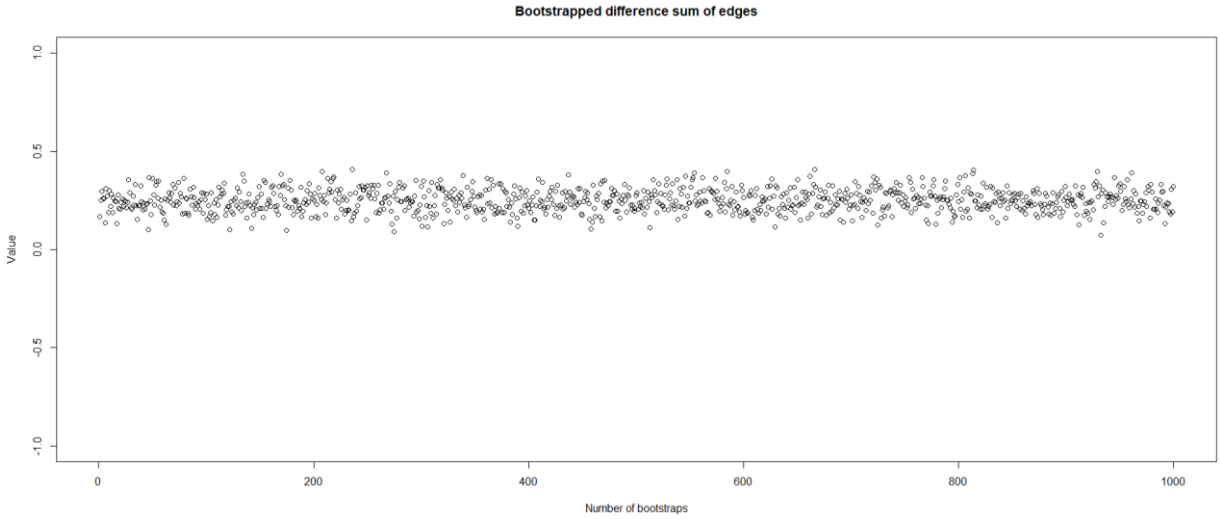

Figure 10. Delta scores using the dichotomized score of suicidal ideation after bootstrapping at Wave 2.

3.4.5 Permutation tests

Figure 11 shows the delta scores including the 10 most common IDS and BAI items in the sample and the sum score of BSS at Wave 2. Values after permutation clustered around zero, with an average of .0009 (*SD* = .091, *Mdn* = .0007). When the dichotomized BSS score was included instead of the sum score, the average was slightly lower, with a value of .0003 (*SD* =

.086, *Mdn* = -.0002) (Figure 12). The one sample t-test showed that the delta score of MDD_SUI and GAD_SUI, including the 10 most common items, was significantly larger than would be expected under chance. Again, this held true both for the sum score of BSS ($p < .001$) and the dichotomized BSS score ($p < .001$).

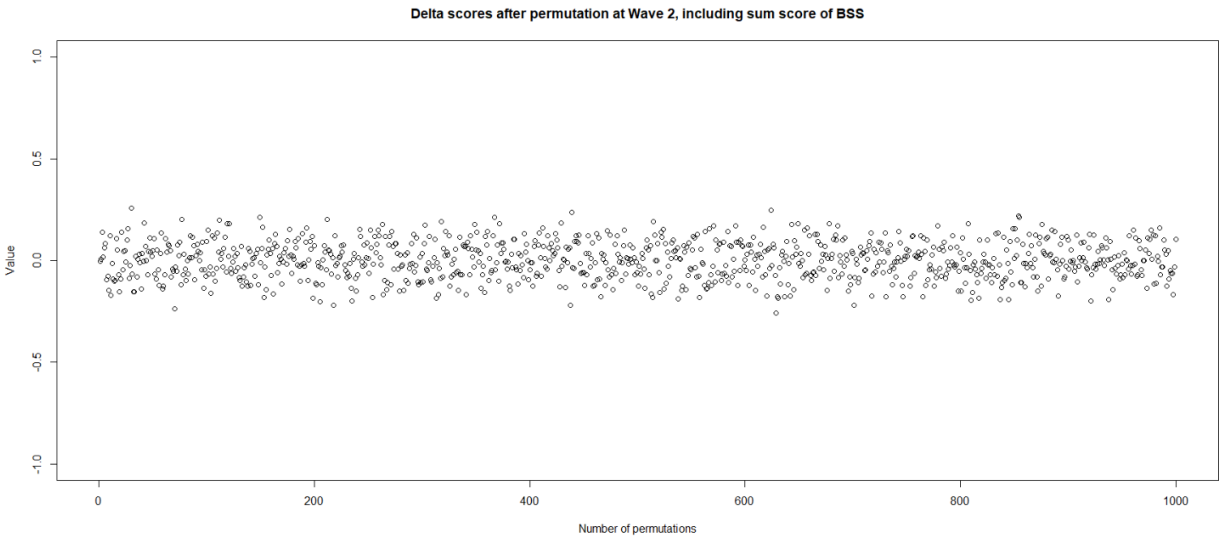

Figure 11. Delta scores using the sum score of suicidal ideation after permutation at Wave 2, including the 10 most common IDS and BAI items in the sample.

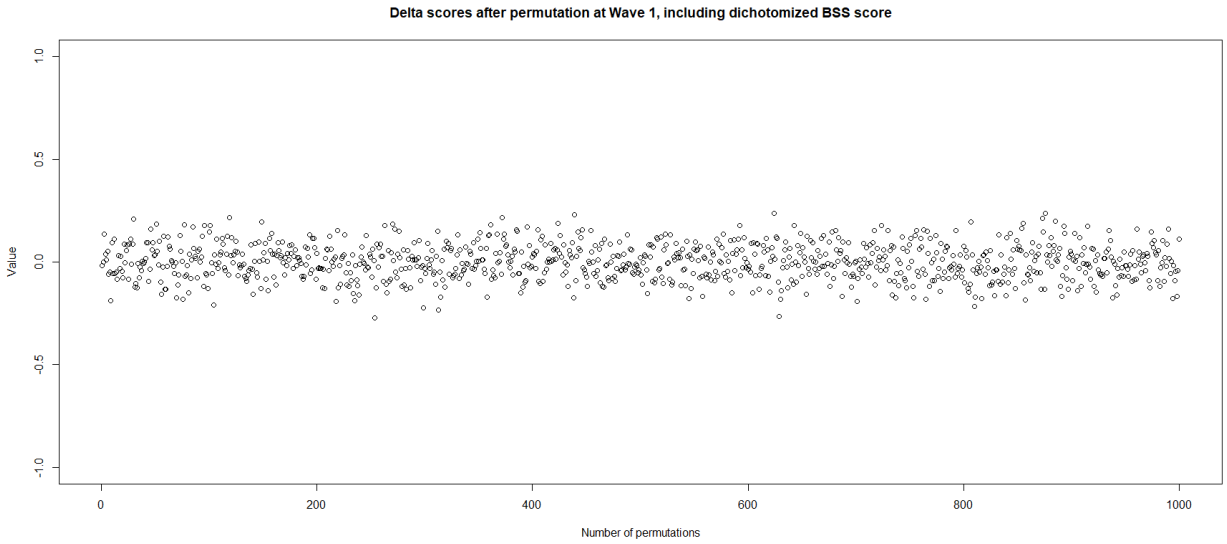

Figure 12. Delta scores using the dichotomized score of suicidal ideation after permutation at Wave 2, including the 10 most common IDS and BAI items in the sample.

4. Discussion

In this exploratory study, we aimed to contribute to existing knowledge about how MDD and GAD symptoms relate to suicidal ideation. We did this by investigating if MDD and GAD symptoms were more strongly related to suicidal ideation than would be expected under chance. Furthermore, we compared MDD and GAD items in their relation to suicidal ideation. We used network psychometric models and controlled for the covariates age and gender. Various methods were used to investigate and potentially increase the robustness of our results, such as bootstrap and permutation tests.

4.1 Main findings

Our main findings are that the difference score between the sum of edges between MDD and suicidal ideation, and GAD and suicidal ideation items, termed delta score, was stronger for MDD than for GAD, and that more MDD items than GAD items were connected directly to suicidal ideation. Secondly, permutation tests showed that the average delta score for the top-10 items was significantly greater than would be expected under chance at both timepoints (Wave 1 and Wave 2). This implies that the top-10 item selection procedure led to robust results. Thirdly, between 12.4% and 15.1% at Wave 1 and between 13.3% and 11.2% at Wave 2 of suicidal ideation could be explained by the symptoms included in the networks. Several findings are worth considering in more detail.

First, MDD had a stronger connection to suicidal ideation than GAD had, irrespective of the particular symptoms selected for inclusion in the model, the wave of data we modeled, or whether the sum or dichotomized BSS score was included, although the difference was smaller when the dichotomized score was included. Overall, these results suggest that, although both MDD and GAD were related to suicidal ideation, participants who experienced symptoms of depression during Wave 1 were somewhat more likely to also experience suicidal ideation at Wave 1 and at Wave 2 than participants who experienced symptoms of

anxiety. Note that we removed suicidal ideation from the pool of potential depression symptoms to avoid confounding. Results from our study are consistent with the study of De Beurs et al. (2019), in which the association of suicidal ideation with MDD was stronger than with GAD. Furthermore, the study of De Beurs et al. (2019) showed that one has an increased vulnerability of experiencing suicidal ideation once one has had a lifetime prevalence of MDD or GAD, although this increased risk is higher for MDD than for GAD. This again is in line with our finding that one has a higher risk of experiencing suicidal ideation at Wave 2 if one had experienced symptoms of MDD than GAD at Wave 1.

Secondly, for the network including data from Wave 1, the predictability of the sum score of BSS was .124 and the dichotomized BSS item was .151, indicating that between 12.4% and 15.1% of suicidal ideation was explained by IDS and BAI items in the network. The explained variance of all included IDS and BAI items for the 10 most common items was between 18% and 64% for both the sum and dichotomized score of BSS at Wave 1.

For the network including BSS data from Wave 2, the predictability of the sum score of BSS different somewhat from the predictability of the dichotomized BSS item, with values of 13.3% and 11.2%, respectively. These percentages indicate that up to 13.3% of suicidal ideation at Wave 2 was predicted by MDD and GAD symptoms at Wave 1. This percentage was considered to be substantial given the temporal prediction. The explained variance of all included IDS and BAI items for the 10 most common items was again between 18% and 64% for both the sum and dichotomized score of BSS at Wave 2.

The predictability values of 12.4% up to 15.1% at RQ1 (How do MDD and GAD symptoms at Wave 1 relate to suicidal ideation at Wave 1, controlling for the covariates age and gender?), and between 13.3% and 11.2% at RQ2 (How do MDD and GAD symptoms and suicidality at Wave 1 predict suicidal ideation at Wave 2, controlling for the covariates age and gender?) suggests that multiple other factors could have influenced the development and

severity of suicidal ideation in the sample. Examples of these possible factors are employment status, marital status (Inder et al., 2014), socioeconomic status (Eikelenboom et al., 2019; Ju et al., 2016), and comorbid psychiatric disorder (Eikelenboom et al. 2019; Ju et al., 2016). While our study focused on comparing MDD versus GAD symptoms in their relation to current and future suicidal ideation, future work on prediction of suicidal ideation should obviously include a broader range of predictors.

4.2 Implications and future research

The current study raises new questions about the relation between individual symptoms of depression and anxiety to suicidal ideation. Our study showed that up to 15% of suicidal ideation can be explained by the 10 MDD and 10 GAD items that were included using the top-10 selection procedure at the same timepoint. Additionally, up to 13% of suicidal ideation can be explained by the included 10 items of the IDS and BAI questionnaires when predicting suicidal ideation prospectively. However, we have not identified individual symptoms that pose one at a particularly higher risk of experiencing suicidal ideation, with the highest edge weight between an individual item and suicidal ideation being .074 (Interpersonal sensitivity).

Further, the smaller delta score for the top-10 item selection than for the random item selection can have multiple possible implications. The first being that the top-10 selection method included items of MDD and GAD that are similar, and therefore had a high mean score in both the IDS and BAI questionnaires. On the other hand, the smaller difference in sum of edges for the top-10 selection method can also mean that symptoms from both MDD and GAD are related to suicidal ideation, and that when highly prevalent items are selected the difference between MDD and GAD decreases.

The results of this study show that MDD symptoms are more strongly related to suicidal ideation than GAD symptoms are. If future research can identify which symptoms of MDD and GAD are associated with a higher risk of suicidal ideation, suicide attempts, and

completed suicide, it may be possible to create more adequate screening and treatment procedures for patients with MDD and GAD, thus treating the high-risk symptoms adequately and rapidly. Study results show that early intervention is effective in reducing symptoms of psychosis, depression, and anxiety in young people (age < 17 years) with first episode psychosis and who are at risk for developing persistent mental illness (Lower et al., 2015).

Additionally, in future research it should be considered that drop-outs in studies like the present one could be due to suicide. If researchers have access to the national registration of causes of death, for example Statistics Netherlands (CBS), they can search if the participants who have dropped out died, and what the cause of their death was, as was done by Niederkrotenthaler, Mittendorfer-Rutz, Mehlum, Qin, and Björkenstam (2020) to determine the cause of death of participants.

Furthermore, research should look into which MDD and GAD symptoms are related to suicidal ideation in participants with a diagnosis MDD and/or GAD in comparison to participants without either of these diagnoses. Although this data is available in the NESDA study, we did not include this as a covariate. We chose to include the covariates age and gender, and more covariates would make it hard to model the data properly. By including the presence of these disorders as a covariate, it can be determined if there is a difference in risk symptoms between a sample consisting of people with and without at least one of these diagnoses. Additionally, other comorbid mental disorders should be considered. Research shows that approximately 50% of people with MDD are simultaneously suffering from an anxiety disorder (Hirschfeld, 2001) and that 60% of patients who experience GAD have at least one comorbid disorder (Newman, Przeworski, Fisher, & Borkovec, 2010). Further, approximately 90% of people with GAD experience another mental disorder during their lifetime (Judd et al., 1998). Additionally, approximately 30% of patients who suffer from MDD also suffer from a substance use disorder, a comorbidity that increases the risk of

experiencing suicidal ideation (Davis, Uezato, Newell, & Frazier, 2008).

Finally, it would be valuable to take more covariates into account. By controlling for factors that are known to influence suicidal ideation, such as marital status, employment status (Inder et al., 2014), comorbid mental disorders (Eikelenboom et al., 2019; Ju et al., 2016), and socioeconomic status (Eikelenboom et al., 2019; Ju et al., 2016), the results of a study would provide information that translates better to clinical practice.

4.3 Strengths and limitations of the study

4.3.1 Strengths

Our study has several methodological strengths. Firstly, our study used network analysis to explore how individual MDD and GAD items are related to suicidal ideation. By looking at an item-level instead of a disorder-level, it provided the opportunity to identify possible high-risk factors. Further, it provided insight into how individual items are connected to each other and to suicidal ideation.

Secondly, our study used a form of self-replication by repeating the same analyses for both research questions. By including data from Wave 2 in the second research question, the temporal prediction could be investigated. This showed that up to 13.3% of the suicidal at Wave 2 was predicted by depression and anxiety symptoms at Wave 1. The temporal prediction was valuable to investigate, because it provides more information about how symptoms are related to suicidal ideation, not only when they exist simultaneously, but also over time.

Thirdly, we performed a number of robustness analyses. Firstly, we randomly selected 10 IDS items and 10 BAI items without replacement, and repeated this procedure 1000 times. The mean outcome was then compared to the top-10 item selection. Secondly, we also used permutation tests to increase the robustness of our results. By randomly distributing the top-

10 IDS and BAI items and repeating this procedure 1000 times, we created a null distribution. The observed delta score could then be compared to this null distribution.

4.3.2 Limitations

Despite the strengths to our study, there are also limitations. Firstly, 385 participants were lost from Wave 1 to Wave 2. We did not look into why participants had dropped out, but it is possible that some of the dropouts had died from suicide between Wave 1 and Wave 2. If this were the case, our results might be biased, especially for RQ2, because the connections between symptoms and suicide got lost for these participants.

Secondly, although the NESDA study included questions about participants' previous suicide attempts, such as how many previous attempts they had made and when the last time was that they attempted suicide, we did not include this information in our analyses. We chose to only include the five BSS items that measure suicidal ideation based on participants' desire to live or die. It is possible that important information got lost by excluding the additional information about suicidal behavior.

Thirdly, the two network models are not directly comparable, because only in the analyses corresponding to RQ2 did we control for baseline suicidal ideation. To make the comparison equal, the network corresponding to RQ1 should have been controlled for previous suicidal ideation as well. Another solution would be to not include previous suicidal ideation, but only include MDD and GAD symptoms from Wave 1 to determine their relation to suicidal ideation at Wave 2.

Fourthly, the NESDA sample includes participants both with and without a MDD and/or GAD diagnosis. On the one hand it is possible that the relation between MDD and GAD symptoms and suicidal ideation would be different if we would have investigated a sample of participants who were all diagnosed with at least either one of the two diagnoses. On the other hand, our study provides more generalizable results for the general population,

because of the inclusion of participants with and without any diagnoses.

Fifthly, to determine which items were the most common in the sample, we looked at the mean of each item. Although it is likely that the items with the highest mean score were also the items that were most frequently present in the sample, it is not a certainty. An alternative method to determine the most common items would have been to look at the items on which participants scored above zero (>0) most often. This might have resulted in a different selection of items.

Finally, although we did control for the covariates age and gender, we chose not to include other influential factors, such as comorbid psychiatric disorders (De Graaf et al., 2013), chronic physical disorders (Scott et al., 2010), socioeconomical status (Eikelenboom et al., 2019), employment status, or marital status (Inder et al., 2014), despite knowing that these factors can influence suicidal ideation (De Graaf et al., 2013; Eikelenboom et al., 2019; Inder et al., 2014). Due to restrictions of the chosen method and the nature of this project, it was not possible to control for all these factors. However, it seems plausible that these factors had at least some impact on the presence and severity of suicidal ideation in the sample.

4.4 Conclusion

To summarize, the current study explored the relations between symptoms of MDD and GAD and suicidal ideation after controlling for the covariates age and gender. Results showed that MDD items were more strongly related to suicidal ideation than GAD items, although the difference is small. Further, up to 15% of suicidal ideation in the networks could be explained by other items included in the network. Finally, there were no items that were particularly strongly related to suicidal ideation.

5. References

Aalbers, G., McNally, R. J., Heeren, A., De Wit, S., & Fried, E. I. (2019). Social media and depression symptoms: A network perspective. *Journal of Experimental Psychology-General, 148*(8) 1454-1462. doi: 10.1037/xge0000528

Armour, C., Fried, E. I., Deserno, M. K., Tsai, J., & Pietrzak, R. H. (2017). A network analysis of DSM-5 posttraumatic stress disorder symptoms and correlates in US military veterans. *Journal of Anxiety Disorders, 45*, 49-59. doi: 10.1016/j.janxdis.2016.11.008

Baek, J. H., Heo, J. Y., Fava, M., Mischoulon, D., Nierenberg, A., Hong, J. P., Roh, S., & Jeon, H. J. (2015). Anxiety symptoms are linked to new-onset suicidal ideation after six months of follow-up in outpatients with major depressive disorder. *Journal of Affective Disorders, 187,* 183-187. doi: 10.1016/j.jad.2015.08.006

Balazs, J., Miklosi, M., Kereszteny, A., Hoven., C. W., Carli, V., Wasserman, C., … Wasserman, D. (2013). Adolescent subthreshold-depression and anxiety: Psychopathology, functional impairment and increased suicide risk. *Journal of Child Psychology and Psychiatry, 54*(6), 670-677. doi: 10.1111/jcpp.12016

Beard, C., Millner, A. J., Forgeard, M. J. C., Fried, E. I., Hsu, K. J., Treadway, M. T, Leonard, C. V., Kertz, S. J., & Björgvinsson, T. (2016). Network analysis of depression and anxiety symptom relationships in a psychiatric sample. *Psychological Medicine, 46*(16), 3359-3369. doi: 10.1017/S0033291716002300

Beck, A. T., Brown, G., Epstein, N., & Steer, R. A. (1998). An inventory for measuring clinical anxiety – Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893 – 897. doi: 10.1037/0022-006X.56.6.893

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression.*

New York: Guilford Press

Borsboom, D., & Cramer, A. O. J. (2013). Network analysis: An integrative approach to the structure of psychopathology. *Annual Review of Clinical Psychology, 9*, 91- 121. Doi: 10.1146/annurev-clinpsy-050212-185608

Boschloo, L., Van Borkulo, C. D., Rhemtulla, M., Keyes, K. M., & Borsboom, D. (2015). The network structure of symptoms of the Diagnostic and Statistical Manual of Mental Disorders. *PLOS ONE, 10*(9), e0137621. doi: 10.1371/journal.pone.0137621

Bostwick, J. M., Pabbati, C., Geske, J. R., McKean, A. J. (2016). Suicide attempt as a risk factor for completed suicide: Even more lethal than we knew. *American Journal of Psychiatry, 173*(11), 1094-1100. doi: 10.1176/appi.ajp.2016.15070854

Caspi, A., & Moffitt, T. E. (2018). All for one and one for all: Mental disorders in one dimension. *American Journal of Psychiatry, 175*(9), 831-844. doi: 10.1176/appi.ajp.2018.17121383

CBS. (2019). Fewer suicide deaths in 2018. Retrieved at April 25 2020 from https://www.cbs.nl/en-gb/news/2019/26/fewer-suicide-deaths-in-2018

Cougle, J. R., Keough, M. E., Riccardi, C. J., & Sachs-Ericsson, N. (2009). Anxiery disorders and suicidality in the National Comorbidity Survey-Replication. *Journal of Psychiatric Research, 43*(9), 825-829. doi: 10.1016/j.jpsychires.2008.12.004

Cramer, A. O. J., Waldorp, L. J., Van der Maas, H. L. J., & Borsboom, D. (2010). Comorbidity: A network perspective. *Behavioral and Brain Sciences, 33*(2-3), 137-150. doi: 10.1017/S0140525X09991567

Davis, L., Uezato, A., Newell, J. M., & Frazier, E. (2008). Major depression and comorbid substance use disorders. *Current Opinion in Psychiatry, 21*(1), 14-18. doi: 10.1097/yco.0b013e3282f32408

De Beurs, D. P. (2017)[b]. Network analysis: A novel approach to understand suicidal

behaviour. *International Journal of Environmental Research and Public Health, 14*(3). Doi: 10.3390/ijerph14030219

De Beurs, D., Fried, E. I., Wetherall, K., Cleare, S., O'Connor, D. B., Ferguson, E., O'Carroll, R. E., & O'Connor, R. C. (2019). Exploring the psychology of suicidal ideation: A theory driven network analysis. *Behaviour Research and Therapy, 120*, 103419. doi: 10.1016/j.brat.2019.103419

De Beurs, D. P., Ten Have, M., Cuijpers, P., & De Graaf, R. (2019). The longitudinal association between lifetime mental disorders and first onset or recurrent suicide ideation. *BMC Psychiatry, 19*(1), 345. doi: 10.1186/s12888-019-2328-8

De Beurs, D. P., Van Borkulo, C. D., & O'Çonnor, R. C. (2017). Association between suicidal symptoms and repeat suicidal behaviour within a sample of hospital-treated suicide attempters. *BJPsych Open, 3*(3), 120-126. doi: 10.1192/bjpo.bp.116.004275

De Graaf, R., Ten Have. M., Tuithof, M., & Van Dorsselaer, S. (2013). First-incidence of DSM-IV mood, anxiety and substance use disorders and its determinants: Results from the Netherlands Mental Health Survey and Incidence Study-2. *Journal of Affective Disorders, 149*(1-3), 100-107. doi: 10.1016/j.jad.2013.01.009

De Graaf, R., Ten Have, M., Van Gool, C., & Van Dorsselaer, S. (2012). Prevalence of mental disorders and trends from 1996 to 2009. Results from the Netherlands Mental Health Survey and Incidence Study-2. *Social Psychiatry and Psychiatric Epidemiology, 47*(2), 203-213. doi: 10.1007/s00127-010-0334-8

Eikelenboom, M., Beekman, A. T. F., Penninx, B. W. J. H., & Smith, J. H. (2019). A 6-year longitudinal study of predictors for suicide attempts in major depressive disorder. *Psychological Medicine, 49*(6), 911-921. doi: 10.1017/S0033291718001423

Epskamp, S., Borsboom, D., & Fried, E. I. (2018). Estimating psychological networks and their accuracy: A tutorial paper. *Behavior Research Methods, 50*(1), 195-212. doi:

10.3758/s13428-017-0862-1

Epskamp, S., Cramer, A. O. J., Waldorp, L. J., Schmittmann, V. D., & Borsboom, D. (2012). qgraph: Network Visualizations of Relationships in Psychometric Data. *Journal of Statistical Software, 48(*4), 1-18. URL http://www.jstatsoft.org/v48/i04/

Fiske, A., Wetherell, J. L., & Gatz, M. (2009). Depression in older adults. *Annual Review of Clinical Psychology, 5*, 363-389. doi: 10.1146/annurev.clinpsy.032408.153621

Fried, E. I., Eidhof, M. B., Palic, S., Costantini, G., Huisman-van Dijk, H. M., Bockting, C. L. H., … Karstoft, K. I. (2018). Replicability and Generalizability of posttraumatic stress disorder (PTSD) networks: A cross-cultural multisite study of PTSD symptoms in four trauma patient samples. *Clinical Psychological Science, 6*(3), 335-351. doi: 10.1177/2167702617745092

Fried, E. I., Van Borkulo, C. D., Cramer, A. O. J., Boschloo, L., Schoevers, R. A., Borsboom, D. (2016). Mental disorders as networks of problems: A review of recent insights. *Social Psychiatry and Psychiatric Epidemiology, 52*(1), 1-10. doi: 10.1007/s00127-016-1319-z

Haslbeck, J. M. B., & Waldorp, L. J. (2020). Mgm: Estimating time-varying mixed graphical models in high-dimensional data. *Jounral of Statistical Software, 93*(8), 1-46 doi: 10.18637/jss.v093.i08

Haslbeck, J. M. B., & Waldorp, L. J. (2017). How well do network models predict observations? On the importance of predictability in network models.

Heeren, A., & McNally, R. J. (2016). An integrative network approach to social anxiety disorder: The complex dynamic interplay among attentional bias for threat, attentional control, and symptoms. *Journal of Anxiety Disorders, 42*, 95-104. doi: 10.1016/j.janxdis.2016.06.009

Hirschfeld, R. M. A. (2001). The Comorbidity of Major Depression and Anxiety Disorders:

Recognition and Management in Primary Care. *United States: Physician Postgraduate Press, Inc*, 3*(6), 244-254. doi: 10.4088/PCC.v03n0609*

Inder, K. J., Handley, T. E., Johnston, A., Weaver, N., Coleman, C., Lewin, T. J., Slade, T., & Kelly, B. J. (2014). Determinants of suicidal ideation and suicide attempts: parallel cross-sectional analyses examining geographical location. *BMC Psychiatry, 14*(208). doi: 10.1186/1471-244X-14-208

Isvoranu, A. M., Borsboom, D., Van Os, J., & Guloksuz, S. (2016). A network approach to environmental impact in psychotic disorder: Brief theoretical framework. *Schizophrenia Bulletin, 42*(4), 870-873 doi: 10.1093/schbul/sbw049

Isvoranu, A. M., Van Borkulo, C. D., Boyette, L. L., Wigman, J. T. W., Vinkers, C. H., & Borsboom, D. (2017). A network approach to psychosis: Pathways between childhood trauma and psychotic symptoms. *Schizophrenia Bulletin, 43*(1), 187-196. doi: 10.1093/schbul/sbw055

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., … Murray, C. J. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet, 392*(10159), 1789-1858: doi: 10.1016/S0140-6736(18)32279-7

Ju., Y. J., Park, E. C., Han, K. T., Choi, J. W., Kim, J. L., Cho, K. H., Park, S. (2016). Low socioeconomic status and suicidal ideation among elderly individuals. *International Psychogeriatrics, 28*(12), 2055-2066. doi: 10.1017/S1041610216001149

Judd, L. L., Kessler, R. C., Paulus, M. P., Zeller, P. V., Wittchen, H. U., & Konovac, J. L. (1998). Comorbidity as a fundamental feature of generalized anxiety disorders: results from the National Comorbidity Study (NCS). *Acta Psychiatrica Scandinavica, 98*(393), 6-11. doi: 10.1111/j.1600-0447.1998.tb05960.x

Kendler, K. S. (2012). The dappled nature of causes of psychiatric illness: replacing the organic-functional/hardware-software dichotomy with empirically based pluralism. *Molecular Psychiatry, 17*(4), 377-388. doi: 10.1038/mp.2011.182

Kessler, R. C., McGonagle, K. A., Nelson, C. B., Hughes, M., Swartz, M., & Blazer, D. G. (1994). Sex and depression in the National Comorbidity Survey. II: Cohort effects. *Journal of Affective Disorders, 30*(1), 15-26. doi: 10.1016/0165-0327(94)90147-3

Kliem, S., Lohmann, A., Mößle, T., & Brähler, E. (2017). German Beck Scale for Suicide Ideation (BSS): psychometric properties from a representative population survey. *BMC Psychiatry, 17*. doi: 10.1186/s12888-017-1559-9

Large, M., Corderoy, A., & McHugh, C. (2020). Is suicidal behaviour a stronger predictor of later suicide than suicidal ideation? A systematic review and meta-analysis. *Australian and New Zealand Journal of Psychiatry.* doi: 10.1177/0004867420931161

Lower, R., Wilson, J., Medin, E., Corlett, E., Turner, R., Wheeler, K., Fowler, D. (2015). Evaluating an early intervention in psychosis service for 'high-risk' adolescents: symptomatic and social recovery outcomes. *Early Intervention in Psychiatry, 9*(3), 260-267. doi: 10.1111/eip.12139

Marchetti, G. M., Drton, M.& Sadeghi, K. (2020). Ggm: Graphical Markov models with mixed graphs. R package version 2.5. https://CRAN.R-project.org/package=ggm

McNally, R. J., Robinaugh, D. J., Wu, G. W. Y., Wang, L., Deserno, M. K., & Borsboom, D. (2015). Mental disorders as causal systems: A network approach to posttraumatic stress disorder. *Clinical Psychological Science, 3*(6), 836-849. doi: 10.1177/2167702614553230

Murphy, J., McBride, O., Fried, E. I., & Shevlin, M. (2018). Distress, impairment and the extended psychosis phenotype: A network analysis of psychotic experiences in an US general population sample. *Schizophrenia Bulletin, 44*(4), 768-777. doi:

10.1093/schbul/sbx134

Newman, M.G., Przeworski, A., Fisher, A. J., & Borkovec, T. D. (2010). Diagnostic comorbidity in adults with generalized anxiety disorder: Impact of comorbidity on psychotherapy outcome and impact of psychotherapy on comorbid diagnoses. *Behavior Therapy, 41*(1), 59-72 doi: 10.1016/j.beth.2008.12.005

Niederkrotenthaler, T., Mittendorfer-Rutz, E., Mehlum, L., Qin, P., & Bjorkenstam, E. (2020). Previous suicide attempt and subsequent risk of re-attempt and suicide: Are there differences in immigrant subgroups compared to Swedish-born individuals? *Journal of Affective Disorders, 265,* 263-271. doi: 10.1016/j.jad.2020.01.013

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). The preregistration revolution. *Proceedings of the National Academy of Sciences of the United States of America, 115*(11), 2600-2606. doi: 10.1073/pnas.1708274114

Posner, K., Oquendo, M. A., Gould, M., Stanley, B., & Davies, M. (2007). Columbia classification algorithm of suicide assessment (C-CASA): Classification of suicidal events in the DFA's pediatric suicidal risk analysis of antidepressants. *American Journal of Psychiatry, 164*(7), 1035-1043. doi: 10.1176/ajp.2007.164.7.1035

R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Rhemtulla, M., Fried, E. I., Aggen, S. H., Tuerlinckx, F., Kendler, K. S., & Borsboom, D. (2016). Network analysis of substance abuse and dependence symptoms. *Drug and Alcohol Dependence, 161*, 230-237. doi: 10.1016/j.drugalcdep.2016.02.005

Robinaugh, D. J., Millner, A. J., & McNally, R. J. (2016). Identifying highly influential nodes in the complicated grief network. *Journal of Abnormal Psychology, 125*(6), 747-757. doi: 10.1037/abn0000181

Rogers, M. L., Ringer, F. B., & Joiner, T. E. (2018). The association between suicidal ideation

and lifetime suicide attempts is strongest at low levels of depression. *Psychiatric Research, 270,* 324-328. doi: 0.1016/j.psychres.2018.09.061

Rouquette, A., Pingault, J., Fried, E. I., Orri, M., Falissard, B., Kossakowski, J. J., Vitaro, F., Tremblay, R., Cote, S. M., Borsboom, D. (2018). Emotional and behavioral symptom network structure in elementary school girls and association with anxiety disorders and depression in adolescence and early adulthood: A network analysis. *JAMA Psychiatry*. doi: 10.1001/jamapsychiatry.2018.2119

Rush, A. J., Giles, D. E., Schlesser, M. A., Fulton, C. L., Weissenburger, J., & Burns, C. (1986). The inventory for depressive symptomatology (IDS) – Preliminary findings. *Psychiatry Research, 18*(1), 65-87.

Rush, A. J., Gullion, C. M., Basco, M. R., Jarrett, R. B., & Trivedi, M. H. (1996). The Inventory of Depressive Symptomatology (IDS): Psychometric properties. *Psychological Medicine, 26*(3), 477-486. doi: 10.1017/S0033291700035558

Santos, H. P., Kossakowski, J. J., Schwartz, T. A., Beeber, L., & Fried, E. I. (2018). Longitudinal network structure of depression symptoms and self-efficacy in low-income mothers. *PLOS ONE, 13*(1), e0191675. doi: 10.1371/journal.pone.0191675

Schmittmann, V. D., Cramer, A. O. J., Waldorp, L. J., Epskamp, S., Kievit, R. A., & Borsboom, D. (2013). Deconstructing the construct: A network perspective on psychological phenomena. *New Ideas in Psychology, 31*(1) 43-53. doi: 10.1016/j.newideapsych.2011.02.007

Scott, K. M., Hwang, I., Chiu, W. T., Kessler, R. C., Sampson, N. A., Angermeyer, M., … Nock, M. K. (2010). Chronic physical conditions and their association with first onset of suicidal behavior in the World Mental Health surveys. *Psychosomatic Medicine, 72*(7), 712-719. doi: 10.1097/PSY.0b013e3181e3333d

Ten Have, M., Van Dorsselaer, S., & De Graaf, R. (2013). Prevalence and risk factors for first

onset of suicidal behaviors in theNetherlands Mental Health Survey and Incidence Study-2. *Journal of Affective Disorders, 147*(1-3), 205-211. doi: 10.1016/j.jad.2012.11.005

Van de Leemput, I. A., Wichers, M., Cramer, A. O. J., Borsboom, D., Tuerlinckx, F., Kuppens, P., … Scheffer, M. (2014). Critical slowing down as early warning for the onset and termination of depression. *Proceedings of the National Academy of Sciences of the United States of America, 111*(1), 87-92. doi: 10.1073/pnas.1312114110

Van Loo, H. M., Van Borkulo, C. D., Peterson, R. E., Fried, E. I., Aggen, S. H., Borsboom, D., & Kendler, K. S. (2018). Robust symptom networks in recurrent major depression across different levels of genetic and environmental risk. *Journal of Affective Disorders, 227*, 313-322. doi: 10.1016/j.jad.2017.10.038

Wei, S. N., Li, H. Y., Hou, J. L., Chen, W., Tan, S. Y., Chen, X., Qin, X. X. (2018). Comparing characteristics of suicide attempters with suicidal ideation and those without suicidal ideation treated in the emergency departments of general hospitals in China. *Psychiatric Research, 262*, 78-83. doi: 10.1016/j.psychres.2018.02.007

Wichers, M., & Groot, P. C. (2016). Critical slowing down as a personalized early warning signal for depression. *Psychotherapy and Psychosomatics, 85*(2), 114-116. doi: 10.1159/000441458

Williams, D. R., Rhemtulla, M., Wysocki, A. C., & Rast, P. (2019). On nonregularized estimation of psychological networks. *Multivariate Behavioral Research, 54*(5), 719-750. doi: 10.1080/00273171.2019.1575716

Zhang, Y., Yip, P. S. F., Chang, S. S., Wong, P. W. C., & Law, F. Y. W. (2015). Association between changes in risk factor status and suicidal ideation incidence and recovery. *Crisis – The Journal of Crisis Intervention and Suicide Prevention, 36*(6), 390-398 doi: 10.1027/0227-5910/a000343

6. Appendices

Appendix A: *Mean scores and standard deviations on the Inventory of Depressive Symptoms and Beck Anxiety Index. The items that were included in the analyses are printed in bold.*

Inventory of Depressive Symptoms		Beck Anxiety Index	
Item	Mean (SD)	Item	Mean (SD)
Falling asleep	**.87 (1.079)**	Numbness or tingling	.40 (.659)
Sleep during the night	**1.30 (1.061)**	**Feeling hot**	**.83 (.858)**
Waking up too early	.52 (.903)	Wobbliness in legs	.39 (.679)
Sleeping too much	.48 (.712)	**Unable to relax**	**1.08 (.953)**
Feeling sad	.85 (.863)	**Fear of worst happening**	**.74 (.926)**
Feeling irritable	**.90 (.824)**	Dizzy or lightheaded	.65 (.773)
Feeling anxious or tense	**.93 (.847)**	**Heart pounding, racing**	**.62 (.777)**
Response of your mood to good or desired events	.45 (.752)	Unsteady	.41 (.668)
Mood in relation to time of day	.50 (.848)	Terrified or afraid	.29 (.654)
The quality of your mood	**.87 (1.071)**	**Nervous**	**1.00 (.883)**

(Continued)

Appendix A: *Mean scores and standard deviations on the Inventory of Depressive Symptoms and Beck Anxiety Index. The items that were included in the analyses are printed in bold (continued).*

Inventory of Depressive Symptoms		Beck Anxiety Index	
Item	Mean (SD)	Item	Mean (SD)
Change in appetite	.65 (.905)	Feeling of choking	.19 (.545)
Weight change (within the last two weeks)	.77 (.954)	Hands trembling	.40 (.692)
Concentration/ Decision making	**.88 (.876)**	Shaky, unsteady	.37 (.662)
View of myself	**.92 (1.181)**	**Fear of losing control**	**.69 (.888)**
View of my future	.85 (.770)	Difficulty in breathing	.35(.654)
Thoughts of death or suicide	.42 (.732)	Fear of dying	.33 (.714)
General interest	.57 (.827)	**Scared**	**.68 (.854)**
Energy level	.91 (.913)	**Indigestion**	**.62 (.827)**
Capacity for pleasure or enjoyment (excluding sex)	.54 (.727)	**Faint, lightheaded**	**.73 (.857)**
Interest in sex (interest, not activity)	.75 (.949)	Face flushed	.61 (.814)
Feeling slowed down	.47 (.820)	**Hot, cold sweats**	**.71 (.909)**
Feeling restless	.75 (.917)		
Aches and pains	**1.03 (.813)**		

(Continued)

Appendix A:*Mean scores and standard deviations on the Inventory of Depressive Symptoms and Beck Anxiety Index. The items that were included in the analyses are printed in bold (continued).*

Inventory of Depressive Symptoms		Beck Anxiety Index	
Item	Mean (SD)	Item	Mean (SD)
Other bodily symptoms	.81 (.719)		
Panic/Phobic symptoms	.76 (.876)		
Constipation/ diarrhea	.66 (.828)		
Interpersonal sensitivity	**.99 (.985)**		
Leaden paralysis/ physical energy	**1.14 (.999)**		

Appendix B: Centrality plots

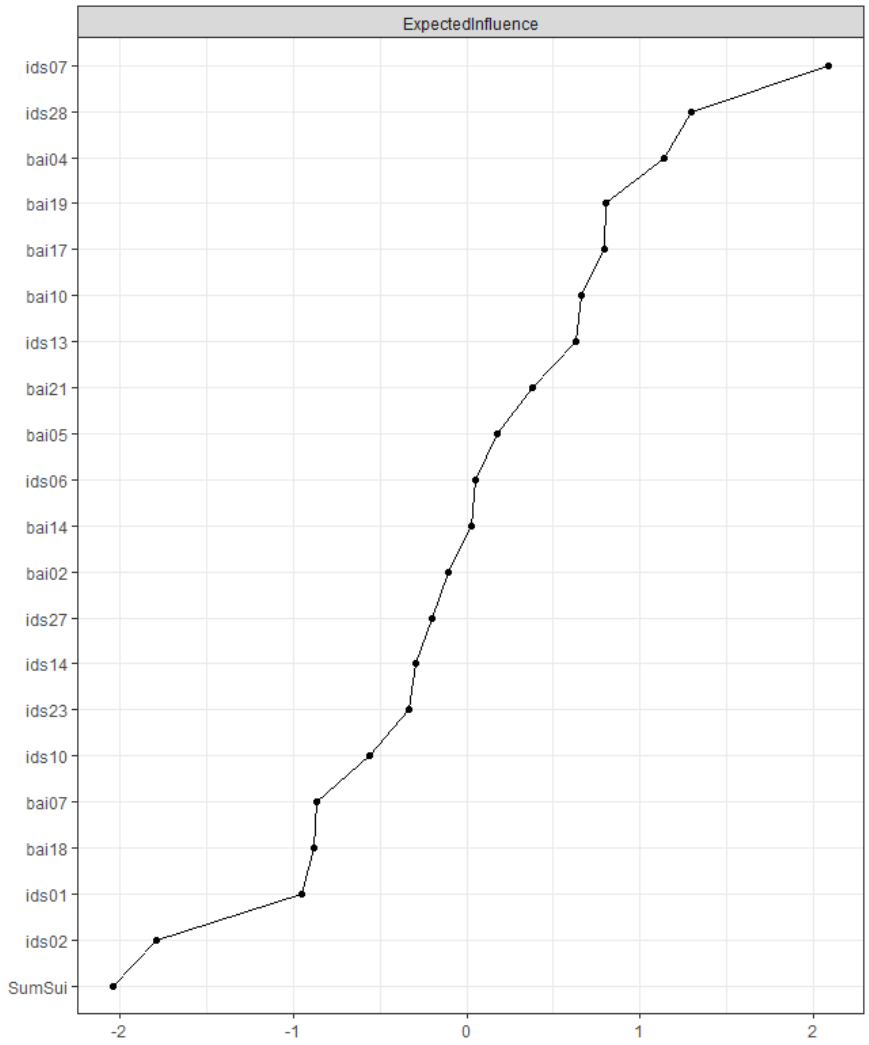

Figure B1. Centrality of the nodes estimated using the metric expected influence centrality in the network corresponding to RQ1, including data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the sum score value for BSS.

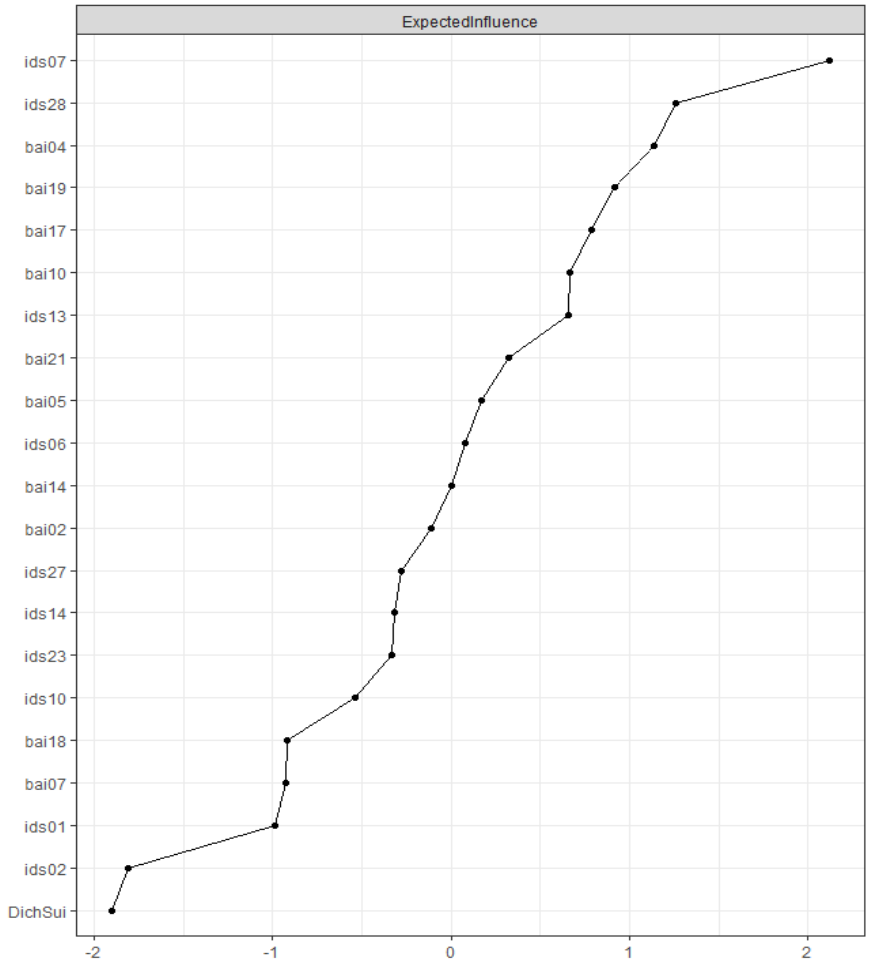

Figure B2. Centrality of the nodes estimated using the metric expected influence of the nodes in the network corresponding to RQ1, including data from Wave 1, with the 10 most common items of the sample included for the IDS and BAI, and the dichotomized score value for BSS.

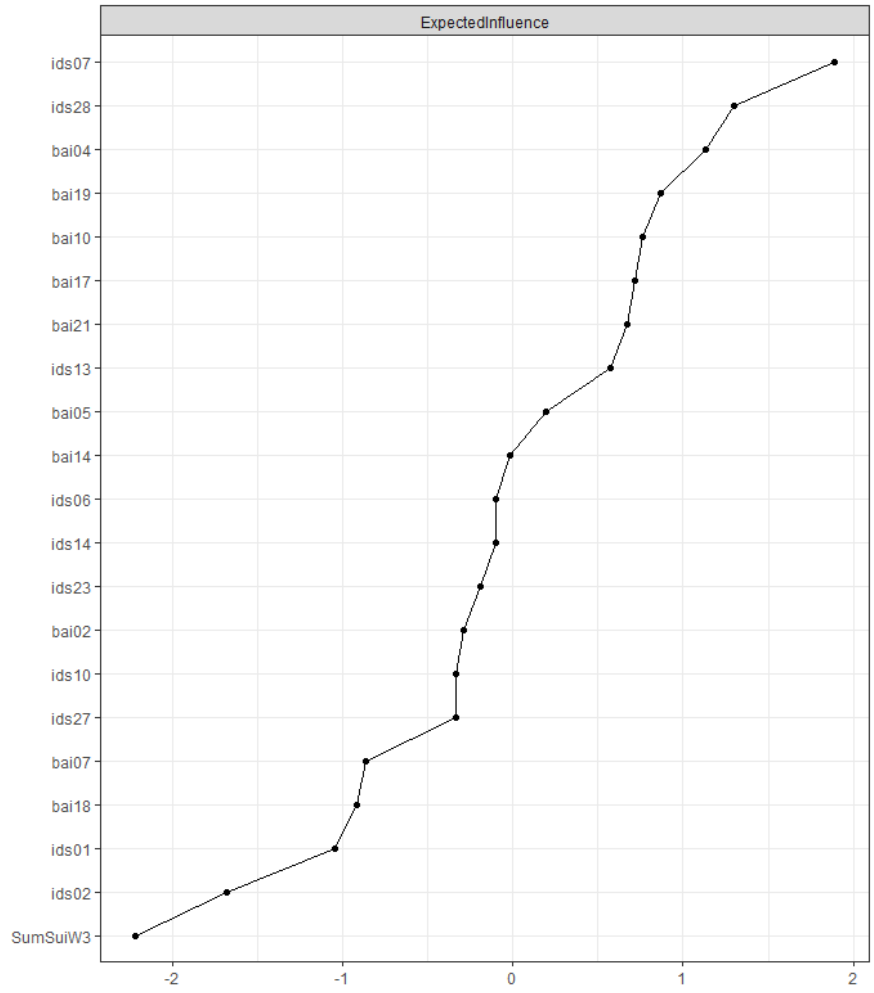

Figure B3. Centrality of the nodes estimated using the metric expected influence in the network corresponding to RQ2, including data from Wave 2, with the 10 most common items of the sample included for the IDS and BAI, and the sum score value for BSS.

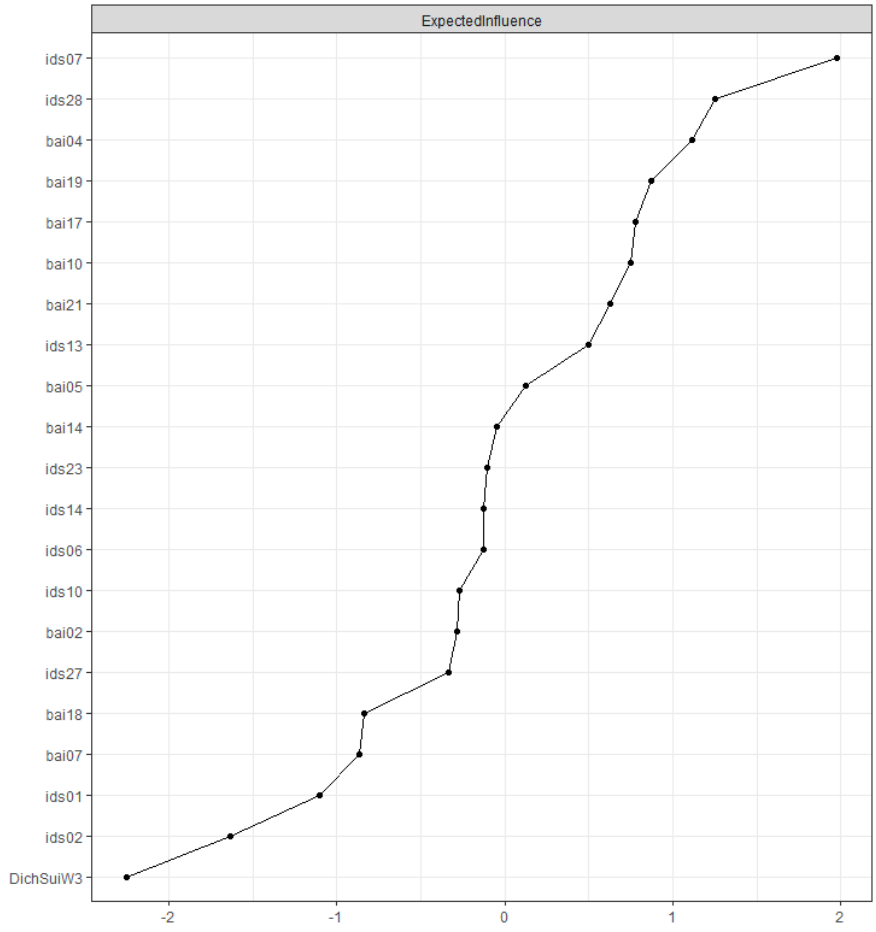

Figure B4. Centrality of the nodes estimated using the metric expected influence in the network corresponding to RQ2, including data from Wave 2, with the 10 most common items of the sample included for the IDS and BAI, and the dichotomized score value for BSS.

Appendix C: *Edge weights between BSS scores and items of the IDS and BAI after controlling for age and gender at baseline, and suicidal ideation from Wave 1 to Wave 2.*

	Beck Scale of Suicide Ideation (BSS)			
	RQ1		RQ2	
	Top-10 item selection		Top-10 item selection	
	Sum score	Dichotomized score	Sum score	Dichotomized score
Falling asleep	.025	.029	.002	.000
Sleep during the night	.004	.017	.021	.002
Feeling irritable	.029	.046	.000	.000
Feeling anxious or tense	.040	.037	.000	.016
Quality of mood	.007	.027	.025	.036
Concentration/ decision making	.040	.053	.027	.014
View of myself	.066	.068	.060	.048
Aches and pains	.000	.000	.008	.028
Interpersonal sensitivity	.074	.058	.000	.000
Leaden paralysis/ physical energy	.041	.027	.023	.024

(Continued)

Appendix C: *Edge weights between BSS scores and items of the IDS and BAI after controlling for age and gender at baseline, and suicidal ideation from Wave 1 to Wave (continued).*

	Beck Scale of Suicide Ideation (BSS)			
	RQ1		RQ2	
	Top-10 item selection		Top-10 item selection	
	Sum score	Dichotomized score	Sum score	Dichotomized score
Feeling hot	.000	.000	.000	.000
Unable to relax	.000	.000	.000	.011
Fear of worst happening	.000	.000	.000	.000
Heart pounding, racing	.000	-.014	.000	.000
Nervous	.000	.000	.000	.000
Fear of losing control	.000	.000	.000	.000
Scared	.023	.016	.000	.004
Indigestion	.002	.002	.000	.000
Faint, lightheaded	.000	.036	.023	.027
Hot, cold sweats	.000	.000	.007	.000

Appendix D. Explained variance of the nodes corresponding to RQ1, after controlling for the covariates age and gender.

Variable	Explained variance (R^2) sum score BSS	Explained variance (R^2) dichotomized score BSS
Falling asleep (ids01)	.203	.205
Sleep during night (ids02)	.188	.191
Feeling irritable (ids06)	.451	.457
Feeling anxious or tense (ids07)	.644	.645
Quality of mood (ids10)	.375	.377
Concentration/decision making (ids13)	.465	.471
View of myself (ids14)	.406	.407
Aches and pains (ids23)	.339	.338
Interpersonal sensitivity (ids27)	.416	.417
Leaden paralysis/physical energy (ids28)	.543	.544
Feeling hot (bai02)	.442	.445
Unable to relax (bai04)	.586	.586
Fear of worst happening (bai05)	.548	.550
Heart pounding, racing (bai07)	.343	.344
Nervous (bai10)	.576	.578
Fear of losing control (bai14)	.500	.501
Scared (bai17)	.594	.597
Indigestion (bai18)	.310	.312

(Continued)

Appendix D. Explained variance of the nodes corresponding to RQ1, after controlling for the covariates age and gender (continued).

Variable	Explained variance (R^2) sum score BSS	Explained variance (R^2) dichotomized score BSS
Faint, lightheaded (bai19)	.525	.529
Hot, cold sweats (bai21)	.492	.494
BSS score	.124	.151

Appendix E. Explained variance of the nodes corresponding to RQ2, after controlling for baseline suicidal ideation and the covariates age and gender.

Variable	Explained variance (R^2) sum score BSS	Explained variance (R^2) dichotomized score BSS
Falling asleep (ids01)	.200	.195
Sleep during night (ids02)	.185	.182
Feeling irritable (ids06)	.442	.443
Feeling anxious or tense (ids07)	.640	.641
Quality of mood (ids10)	.391	.391
Concentration/decision making (ids13)	.462	.464
View of myself (ids14)	.414	.413
Aches and pains (ids23)	.340	.340
Interpersonal sensitivity (ids27)	.416	.416
Leaden paralysis/physical energy (ids28)	.541	.544
Feeling hot (bai02)	.446	.450
Unable to relax (bai04)	.581	.580
Fear of worst happening (bai05)	.537	.536
Heart pounding, racing (bai07)	.338	.338
Nervous (bai10)	.573	.573
Fear of losing control (bai14)	.502	.503
Scared (bai17)	.588	.588
Indigestion (bai18)	.307	.307

(Continued)

Appendix E. Explained variance of the nodes corresponding to RQ2, after controlling for baseline suicidal ideation and the covariates age and gender (continued).

Variable	Explained variance (R^2) sum score BSS	Explained variance (R^2) dichotomized score BSS
Faint, lightheaded (bai19)	.513	.517
Hot, cold sweats (bai21)	.496	.500
BSS score	.133	.112