



Universiteit
Leiden
The Netherlands

Exploring Co-Occurrence of Shifts in Depression and Anxiety

Vellinga, Rixt

Citation

Vellinga, R. (2023). *Exploring Co-Occurrence of Shifts in Depression and Anxiety*.

Version: Not Applicable (or Unknown)

License: [License to inclusion and publication of a Bachelor or Master Thesis, 2023](#)

Downloaded from: <https://hdl.handle.net/1887/3620511>

Note: To cite this publication please use the final published version (if applicable).

Exploring Co-Occurrence of Shifts in Depression and Anxiety

Rixt Vellinga

Master's thesis Psychology

Faculty of Social and Behavioral Sciences – Leiden University

Unit: Clinical Psychology

Date: 29-05-2023

Project number: 26

First examiner: Carlotta Rieble

Abstract

The presence of both depression and anxiety can have a significant impact on individuals, affecting their well-being and daily functioning. There are many studies on the comorbidity of depression and anxiety, but there is little research on how these disorders change together. This thesis has aimed to investigate the co-occurrence of shifts in depression and anxiety symptom severity and compare standardized assessment measures and individuals' subjective experiences of these shifts. By exploring the co-occurrence of these disorders, this research seeks to contribute to the understanding of their dynamic nature, provide insights for clinical practice in terms of assessment strategies, and improve the selection of appropriate assessment measures. The study utilized an exploratory research design in a non-clinical sample with a sample size of 746 participants, all of whom were students. The measurement tools employed include the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7 (GAD-7) to assess symptoms of depression and anxiety, respectively. Additionally, perceived shift questions were included to capture participants' subjective experiences of shifts. The key findings revealed a co-occurrence of shifts in depression and anxiety, both when measured with standardized screeners and when assessing the perceived shift in symptom severity of depression and anxiety. Furthermore, outcomes of the standardized screeners and perceived shift questions were compared, suggesting that there was an overlap in outcome between the two different assessment measures, however, this overlap was not very strong. By highlighting the co-occurrence of shifts in depression and anxiety, this thesis contributes to the understanding of these disorders and provides insights for further research. It emphasizes the need to study the common components of both disorders. Additionally, it raises questions about the use of one-item screeners and suggests

exploring alternative assessment methods, such as Ecological Momentary Assessment (EMA) data.

Keywords: depression, anxiety, perceived shift, co-occurrence

Layman's Abstract

Depression and anxiety are two common mental health issues that can greatly affect a person's well-being and daily life. While there have been numerous studies on the coexistence of these disorders, little research has been done on how they change together over time. This thesis aimed to investigate the connection between shifts in symptom severity for depression and anxiety, comparing standardized assessment measures with individuals' experiences of these shifts. The study involved 746 participants, all of whom were students. To assess symptoms of depression and anxiety, the researchers used standardized questionnaires called the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder-7 (GAD-7), respectively. In addition, participants were asked specific questions about their personal experiences of symptom shifts. The main goal was to explore how depression and anxiety symptom severity might change together and examine the relationship between standardized measures and subjective reports. The findings revealed that shifts in depression and anxiety symptom severity often occurred simultaneously, as indicated by both the standardized measures and the participants' perceived experiences. Additionally, the results of the standardized questionnaires and personal shift questions were compared, indicating that there were similarities in the outcomes measured by both methods. However, the similarities between the two measures were not very strong. These results contribute to our understanding of depression and anxiety by highlighting the overlap of shifts and emphasizing the importance of studying the common aspects of these disorders. The research also raised questions about the effectiveness of using one-item screeners and suggested exploring

alternative assessment methods, such as Ecological Momentary Assessment (EMA) data, which involves gathering real-time information about individuals' experiences in their natural environments. Overall, this thesis provides valuable insights into the overlap of shifts in depression and anxiety, shedding light on the dynamic nature of these disorders. It underscores the need for further research to better understand and address the shared components of depression and anxiety.

Exploring Co-Occurrence of Shifts in Depression and Anxiety

Have you ever had a moment where you felt restless, panicked, tired, and you just could not stop worrying? Chances are that you were feeling anxious. Or maybe you have felt low, empty, and as if you were moving slowly. In that case, you were experiencing depressive symptoms. This does not immediately mean that you have a full-blown depression. Hopefully, these feelings went away after a few hours. Or maybe they lasted a couple of days. For some people, such feelings do not go away that quickly, and the feelings turn out to be diagnosed as depression or anxiety disorder.

Depression and anxiety disorders are among the most common psychopathological disorders (World Health Organization, 2022). In the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5; American Psychiatric Association, 2013), Major Depressive Disorder (MDD) is characterized by persistent symptoms that impact mood and daily functioning. It includes the presence of a depressed mood most of the day, nearly every day, or a significant loss of interest or pleasure in almost all activities. Several accompanying symptoms may be present including changes in appetite or weight, disturbances in sleep patterns, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive guilt, difficulties with concentration or decision-making, and recurrent thoughts of death or suicide (American Psychiatric Association, 2013). Anxiety is described as “anticipation of future threat” (American Psychiatric Association, 2013, p. 189). Generalized Anxiety Disorder (GAD) is characterized by the presence of excessive and persistent anxiety and worry, occurring on a majority of the day for at least six months. Individuals with GAD struggle with excessive worry, which can be accompanied by various symptoms including restlessness, fatigue, difficulty concentrating, irritability, muscle tension, and sleep disturbances (American Psychiatric Association, 2013).

In 2015, it was estimated that globally, 322 million adults (4.4% of the population) suffer from a depressive disorder, and 264 million (3.6%) suffer from an anxiety disorder (World Health Organization, 2017). Both GAD and MDD are associated with a large disease burden. Depression has been associated with negative physical health, which causes e.g. increased risk of cardiovascular disease (Lépine & Briley, 2011). As mentioned in the diagnostic criteria, it can also cause severe functional impairment, leading to decreased productivity and absence in work and education, as well as problems in social functioning and maintaining close relationships. On top of that it is a risk factor for suicidality (Lépine & Briley, 2011). Anxiety also causes impairment in social relationships, absence in work and education, and is a risk factor for suicidality (Baxter et al., 2014).

Depressive and anxiety disorders are highly comorbid (Kessler et al., 1996; Gorman, 1996; Pollack, 2005). Comorbidity means that both disorders occur or have occurred in the same person. They can be present at the same time (concurrent) or at different times (successive; Hall et al., 2001). For clarity, when writing ‘comorbidity’, only concurrent comorbidity will be meant within this thesis, as successive comorbidity is not a part of the research topic. Comorbid depression and anxiety comes with a considerable disease burden. It has been associated with a higher risk of relapse, increased risk of suicidality, diminished response to treatment, and more use of mental health care than a diagnosis of only one of the disorders (Garber & Weersing, 2010; Kaufman & Charney, 2000).

Clark and Watson (1991) have developed a model around comorbidity between depression and anxiety: the tripartite model. This model suggests that depression and anxiety share the component of negative affect (NA), which explains part of the comorbidity between both disorders. NA illustrates the amount of unpleasantness or upset an individual feels. Along with this common factor there are two unique characteristics: positive affect (PA) for

depression and physiological hyperarousal (PH) for anxiety. PA is the opposite of NA, and it represents how pleasant, active, and energetic someone feels. In depression, PA is usually low and NA is high, causing the individual to feel inactive, fatigued, and unmotivated. PH is about bodily states such as shortness of breath, bodily tension, and feeling lightheaded. In individuals with anxiety, there is usually a presence of both high PH and high NA (Clark & Watson, 1991). This model of comorbidity will be kept in mind while researching the topic of this thesis.

While there are many studies on depression and anxiety being concurrently present at a certain point in time (e.g. Kessler et al., 1996; Pollack, 2005), there is not much research on whether shifts in depression and anxiety co-occur. A shift could for example mean that the symptom severity of depression gets higher in a person, and at the same time, the symptom severity of anxiety also gets higher. This is important to study since it views the comorbidity of depression and anxiety not as a static piece of information, but as a dynamic process from which we can discover how and whether depression and anxiety influence each other, and the ways in which they co-occur. A study done by Persons and colleagues (2003) even suggests viewing comorbid depression and anxiety as a singular disorder, since they found that symptoms of depression and anxiety change together when treated with Cognitive-Behavioral Therapy (CBT). So, we know the disorders can exist at the same time and that they might have the common factor of NA, we know they can change together when treated, but do we also see a change when observing a sample without any variable manipulation? That brings us to the first research objective, which is whether shifts in depression and anxiety seem to co-occur when measured with validated self-report screeners, namely the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001), which measures symptom severity of Major Depressive Disorder, and the General Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006),

which measures symptom severity of Generalized Anxiety Disorder. The research question that comes from this objective is: do shifts in symptom severity of depression and anxiety co-occur when measured with the PHQ-9 and GAD-7?

Next, to introduce the second research objective, we will give some background on subclinical depression and anxiety. Both disorders can exist on a subclinical level, or in other words, outside of a full diagnosis of the disorder as specified in the DSM-5. It is estimated that subclinical depression is more prevalent than MDD, 29.2% as opposed to between 5 and 19.4%, respectively (Carrellas et al., 2017; Noyes et al., 2022). Furthermore, subclinical depression has been associated with suicidality, functional impairment, impacted quality of life, as well as it being a predictive factor of MDD later in life (Noyes et al., 2022). As mentioned in Garber and Weersing (2010): “Subsyndromal levels of symptoms often have not been assessed in studies of comorbidity..., and these co-occurring, subthreshold symptoms may account for the apparent link between anxiety and subsequent depressive disorder” (p. 294).

To assess subclinical or undiagnosed symptoms of depression and anxiety, it is important to know how people perceive their own symptoms. When asking people about the severity of their symptoms, they can easily over- or underestimate. This can be due to several factors. One of these factors is one’s beliefs about mental health, for example, the belief that feeling depressed and anxious for over half of each month is a normal part of life (Melrose et al., 2013). Another factor is people ranking their symptom severity based on what they already know about depression or anxiety. When they have a certain frame of reference regarding symptom severity, they will rank their own symptom severity accordingly (Melrose et al., 2013).

This is why we do not only want to look at data from self-report screeners to assess symptom severity of depression and anxiety, but also ask individuals how they have perceived the severity of their depression and anxiety over time. We also want to know whether an individual themselves has perceived a shift in their depression or anxiety and what kind of shift that was. So, as mentioned in the previous paragraph, for research question one, we are looking at the co-occurrence of shifts in depression and anxiety measured with self-report screeners. For research question two we will study whether people have perceived a shift in their feelings of depression and anxiety, and with that information we will again study the co-occurrence of these shifts. Therefore, the second research question of this thesis is: do perceived shifts in depression and anxiety co-occur with each other?

Lastly, we will introduce the third and final research objective. As has been explained before, two different measures will be used to establish whether a shift took place. These measures are the self-report screeners PHQ-9 and GAD-7, and perceived shift questions for both depression and anxiety. Seeing as people can over- or underestimate their own symptom severity when directly assessing their own perceptions of the severity (Melrose et al., 2013), we want to compare the different measures to each other. A study relevant to this topic was done by Serra-Blasco and colleagues (2019), where the difference between the objective and subjective experience of MDD was researched. The study found that depressive symptoms had stronger correlations with subjective cognitive measures than they did with objective cognitive measures. They also found that people who have current MDD tend to underestimate cognitive abilities such as attention and memory as opposed to what was objectively measured. This was contrary to remitted patients, who tended to overestimate their abilities. Since people seem to respond significantly different to objective measures, like the PHQ-9 and the GAD-7, and subjective measures, like the perceived shift questions, we want

to compare the outcome of both measures. With this comparison, we will research whether the occurrence of shifts overlaps. This brings us to the third research question: to which degree do the conclusions from the two assessment sources overlap? The main function of this research objective is to further interpret the results of research questions one and two.

The aim of this thesis is to investigate the co-occurrence of shifts in depression and anxiety symptom severity and compare the differences between standardized assessment measures and individuals' subjective experiences of shifts. Furthermore, the study aims to compare the outcomes obtained from self-report screeners and perceived shift questions to determine the extent of overlap between the two assessment approaches. By addressing these objectives, we intend to contribute to the understanding of the dynamic nature of depression and anxiety, provide some possibly useful insight for clinical practice in terms of assessment strategies, and contribute to the improvement of the selection of appropriate assessment measures. This thesis is an exploratory research, which is why there are no hypotheses made to the research questions.

Methods

Design

The present study has used data from the larger research project WARN-D (Fried et al., 2022). WARN-D seeks to develop an early warning system for depression through longitudinal observations of different cohorts of participants. Data from cohorts one and two have been used in this thesis. Specifically, data from the baseline survey was used, as well as data from the first follow-up survey which was administered three months after the baseline.

Ethics

The Leiden University Psychology Research Ethics Committee approved the research proposal with number 2021-09-06-E.I.Fried-V2-3406 and entitled: WARN-D ERC Project (1) amendment on 06-09-2021.

Participants

The total sample size was $N = 746$. The age of participants ranged from 18 to 61 ($M = 22.54$, $SD = 3.87$). Of the entire sample, 15% was male and 85% was female. For detailed information on the subsamples, see Appendix A.

Procedure

Participants were recruited via posters, social media, e-mail newsletters, and word-of-mouth. People interested in participating could indicate their e-mail address in an online survey and were then invited to online surveys assessing inclusion and exclusion criteria and asking for their informed consent. When participants met the criteria, they were sent and asked to fill out the WARN-D baseline battery. The total baseline battery took about 75 minutes to complete. After three months, participants answered a follow-up survey reassessing the most important constructs from the baseline assessment. Participants were reimbursed for their time and effort. They received €7,50 for completing the baseline survey, and €3,75 for completing the follow-up survey.

Inclusion Criteria

Participants needed to 1) be at least 18 years old, 2) study at a Dutch higher education facility (pursuing an MBO, HBO, or WO degree), 3) be fluent in either Dutch or English, 4) own a smartphone with an Android/iOS operating system, and 5) have a European bank account with an IBAN.

Exclusion Criteria

Potential participants were assessed on current 1) schizophrenia, psychosis, or thought disorder, 2) moderate to severe major depressive disorder, 3) (hypo)mania / bipolar disorder, 4) primary substance use disorder, and 5) moderate or severe suicidal ideation. Participants were asked if they were currently waiting for/in treatment by a licensed psychologist/psychiatrist for criteria 1 through 4; participants indicating yes were excluded. Then, validated self-report screeners were used to exclude potential participants meeting exclusion criteria 1 through 5. Finally, potential participants were excluded if they indicated that they would find seeing a daily calories burnt estimate very stressful; a smartwatch that participants wear during a different phase of the WARN-D study provides such an estimate.

Measures

Symptoms of Depression

Symptoms of depression were assessed with an adapted version of the Patient Health Questionnaire (PHQ-9, see Appendix B for the full questionnaire; Kroenke et al., 2001). Participants answered 14 items ($\alpha = .83$) assessing problems experienced in the last two weeks (e.g. “feeling hopeless”) on a four-point Likert scale (0 = *not at all*, 1 = *several days*, 2 = *more than half the days*, 3 = *nearly every day*). After this, they answered one item on impairment. From the adapted fifteen-item version, a sum score of the original PHQ-9 was reconstructed to be able to compare participants’ depression severity to existing norms for the PHQ-9. Scoring for this questionnaire is as follows: 0-4 indicates minimal or no depression, 5-9 indicates mild depression, 10-14 indicates moderate depression, 15-19 indicates moderately severe depression, and 20-27 indicates severe depression (Kroenke et al., 2001).

Symptoms of Anxiety

Symptoms of anxiety were assessed with the General Anxiety Disorder-7 (GAD-7, see Appendix C for the full questionnaire; Spitzer et al., 2006). Participants answered seven items

($\alpha = .85$), again assessing problems experienced in the last two weeks (e.g. “trouble relaxing”) on a four-point Likert scale (0 = *not at all*, 1 = *several days*, 2 = *more than half the days*, 3 = *nearly every day*). Scoring for this questionnaire is as follows: 5-9 indicates mild anxiety, 10-14 indicates moderate anxiety, and 15-21 indicates severe anxiety (Spitzer et al., 2006).

Perceived Shift

The questions to assess a perceived shift in anxiety and depression were developed by the researchers of WARN-D (Fried et al., 2022). The four questions were preceded by: “Over the last 3 months, did you notice any changes in...” for depression this was followed by “... feeling down or depressed?” and for anxiety, it was followed by “... feeling anxious?”.

Answers were given on a five-point Likert scale (1 = *it got much worse*, 2 = *it got a little bit worse*, 3 = *there were no changes*, 4 = *it got a little bit better*, 5 = *it got much better*; see Appendix D for the questions; Fried et al., 2022, Suppl.). A score of one or two indicates a perceived increase in depression or anxiety, whereas a score of four or five indicates a perceived decrease. A score of three indicates no perceived shift in depression or anxiety.

Statistical Analysis

Statistical analyses were done using JASP (Version 0.16.4, 2022). This is an exploratory study, therefore no corrections for multiple testing were done. Kendall’s tau (τ) (Kendall, 1938) was used to analyze the overlap in shifts in depression and anxiety across disorders as well as across measures within each disorder, respectively. Interpretation of τ that is laid out by Botsch (2011) will be followed (Appendix E). Kendall’s tau has two assumptions. Assumption one is that the variable should be ordinal or continuous. Assumption two is that the data preferably follows a monotonic relationship (Laerd Statistics, n.d.). No assumption was violated. See Appendix F for a report on the checked assumptions.

Furthermore, we computed multi-way chi-square contingency tables with the same goal as the calculation of Kendall's tau: to analyze the overlap in shifts that had occurred in depression and anxiety across the disorders as well as across measures within each disorder. The chi-square test has four assumptions (Statology, 2021). Assumption one is that both variables are categorical, assumption two is that all observations are independent, assumption three is that the cells in the contingency table are mutually exclusive, and assumption four is that the expected value of the cells should be five or more in at least 80% of the cells. No assumptions were violated. For a report on the checked assumptions, see Appendix F.

Co-Occurrence of Shifts in Symptom Severity of Depression and Anxiety

As mentioned before, the PHQ-9 and GAD-7 were used to assess symptom severity of depression and anxiety, respectively. The process was the same for both screeners. The screeners were administered at baseline and at the three-month follow-up. Firstly, the sum scores of the baseline and follow-up were calculated. A paired samples t-test was done using these sum scores, comparing baseline to follow-up for both the PHQ-9 and the GAD-7. This was done to see whether symptom severity at baseline and follow-up significantly differ from each other, indicating a shift. The paired t-test has four assumptions (Statistics Solutions, n.d.). Assumption one is that the dependent variable has to be numeric and continuous, assumption two is that the groups have to be matched with each other, assumption three is that the differences between the variables should be approximately normally distributed, and assumption four is that the variables should not contain outliers. Assumptions one, two, and four were met. Assumption three was met for the PHQ-9, but not for the GAD-7. Because of this, an additional Wilcoxon signed-rank test was done for the GAD-7 (Goss-Sampson, 2018). For a full report on the assumptions, see Appendix F.

Secondly, we calculated a difference in symptom severity from baseline to follow-up. This difference score was used to investigate whether a shift has occurred in any given participant. For the PHQ-9, a relevant shift in symptom severity was indicated by a sum score difference of five or more points (following Titov et al., 2011). For the GAD-7, the same method has been used to indicate a change, but with four points higher or lower (following Toussaint et al, 2020). We summarized this information in a shift variable for depression and anxiety, respectively. This variable has three values which indicate whether symptom severity has increased (-1), no shift occurred (0), or it has decreased (1).

Following, a chi-square contingency table (Stigler, 1999) was computed to analyze the overlap in shifts that had occurred in depression and anxiety as measured with the self-report screeners. The null hypothesis of a contingency table is that there is no association between the rows and columns in the table. This would mean that the values in each cell do not statistically differ from each other. The alternative hypothesis is that rows and columns are associated, and the values in the cells differ significantly from each other.

Furthermore, the correlation between the shifts in depression and anxiety was calculated utilizing Kendall's tau (τ) (Kendall, 1938; Xiao et al., 2016). Values of τ can lie between -1 and 1 (Kendall, 1938). A perfect correlation would be if $\tau = 1$. This would mean that when for example depression heightens, exactly the same shift occurs in anxiety. If $\tau = 0$, this would indicate no correlation. If $\tau = -1$, this would mean that the shifts are the inverse of each other, i.e., when depression increases, anxiety decreases, and vice versa.

Co-Occurrence of Perceived Shifts in Depression and Anxiety

In addition to the validated questionnaires, participants answered whether they perceived a shift in their depression and anxiety. The answers were condensed from five to three categories. That is, a new variable was calculated for depression as well as anxiety to

indicate whether participants felt their depression or anxiety had increased (-1), there was no shift (0), or it decreased (1). This was done by combining the answers ‘it got much worse’ and ‘it got a little bit worse’ into the category ‘increased’ (-1) and combining the answers ‘it got much better’ and ‘it got a little bit better’ into the category ‘decreased’ (1). A chi-square contingency table (Stigler, 1999) was again computed to analyze the overlap in shifts that had occurred in depression and anxiety as measured with the perceived shift questions. The same correlation calculation as for the symptom severity has been done here, making use of Kendall’s tau (τ) (Kendall, 1938; Xiao et al., 2016).

Correlation Between Symptom Severity and Perceived Shift

The correlation between symptom severity outcomes and perceived shift outcomes for depression and anxiety, respectively, was again investigated using τ (Kendall, 1938; Xiao et al., 2016), and by computing chi-square contingency tables (Stigler, 1999). The calculations were done for the correlation between the PHQ-9 and the perceived shift in depression. This was repeated in the same manner for the GAD-7 and the perceived shift in anxiety.

Results

Table 1 displays relevant descriptive statistics for all measures that were used. The means of symptom severity of depression and anxiety were measured both at baseline and follow-up with the PHQ-9 and GAD-7, respectively. When looking at these group means, it seems that for both depression and anxiety the mean has decreased over time. This indicates a decrease in symptom severity in the sample as a whole. To test whether this decrease is statistically significant, a Student’s t-test was done. We found that the decrease is indeed significant for depression, $t(745) = 2.19$, $p = .029$, but not for anxiety, $t(745) = 1.54$, $p = .124$. The Wilcoxon signed-rank test that was done for the GAD-7 was also not significant, $W = 122671$, $p = .284$. Furthermore, when asked whether participants perceived a shift in

depression and anxiety, the sample as a whole indicated close to no shift. This can be seen in the follow-up column of Table 1. The mean is close to three, which indicates no shift.

Table 1

Descriptive Statistics for the PHQ-9, GAD-7, and Perceived Shifts in Depression and Anxiety

Scale	Range	n	Baseline		Follow-up	
			Mean	SD	Mean	SD
PHQ-9 (depression)	0-27	746	7.46	4.57	6.97	4.34
GAD-7 (anxiety)	0-21	746	6.22	4.64	5.87	4.18
Perceived shift depression	0-5	739	-	-	2.95	1.01
Perceived shift anxiety	0-5	739	-	-	2.88	0.97

Note: n = 739 in the perceived shift questions due to missing data points from seven participants.

Co-Occurrence of Shifts in Symptom Severity of Depression and Anxiety

We examined whether shifts in symptom severity of depression and anxiety seemed to co-occur when measured with the PHQ-9 and GAD-7 (research question 1). A chi-square test of independence was performed to examine the overlap of shifts in symptom severity of depression and anxiety. The result of the chi-square test was significant, $\chi^2(4, n = 746) = 326.0, p < .001$, indicating that the rows and columns have a statistically significant association with each other. As shown in Table 2, participants who had an increased symptom severity score for depression were likely to also have this increased score for anxiety (13.7%). The same goes for decreased symptom severity score (16.5%) and a score that did not shift (33.5%). Also see Figure 1 for a visualization of the interaction of the measurements when looking at the sum scores.

Furthermore, calculation of Kendall's tau indicated a strong positive correlation ($\tau_b = .55, p < .001, N = 746$) between the shifts in symptom severity of depression and anxiety as measured with the PHQ-9 and GAD-7. Thus, when someone was categorized as having an increased, decreased, or not shifted symptom severity score on depression they were likely to fall in the same category for anxiety.

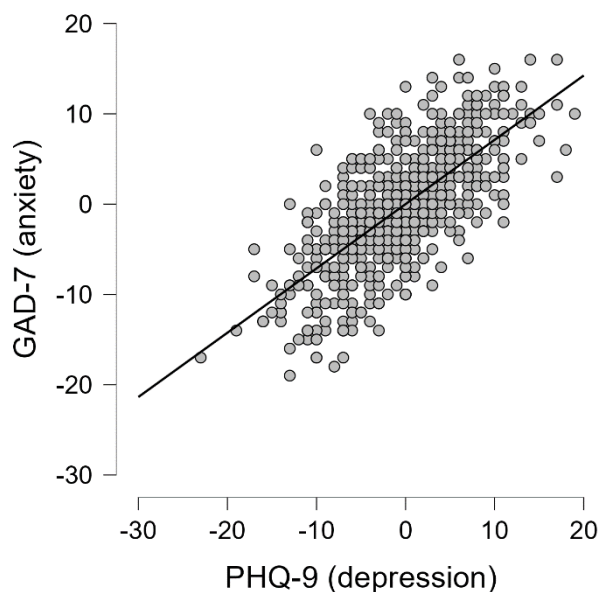
Table 2

Interaction Between Shifts of Symptom Severity as Measured With PHQ-9 and GAD-7

PHQ-9 (depression)	GAD-7 (anxiety)			Total
	Increased	No shift	Decreased	
	n (%)	n (%)	n (%)	n (%)
Increased	102 (13.7)	51 (6.8)	2 (.3)	155 (20.8)
No shift	74 (9.9)	250 (33.5)	78 (10.5)	402 (53.9)
Decreased	9 (1.2)	57 (7.6)	123 (16.5)	189 (25.3)
Total	185 (24.8)	358 (48.0)	203 (27.2)	746 (100.0)

Figure 1

Scatterplot Showing the Interaction Between Shifts of Symptom Severity as Measured With PHQ-9 and GAD-7



Note: scores lie between -27 and 27 for the PHQ-9, and between -21 and 21 for the GAD-7.

The scores are calculated by subtracting baseline sum score from follow-up sum score, for both screeners separately.

Co-Occurrence of Perceived Shifts in Depression and Anxiety

Next, we examined whether shifts in symptom severity of depression and anxiety seemed to co-occur when measured with the perceived shift question (research question 2). A chi-square test was performed again to test the relation between the perceived shifts in depression and anxiety. The chi-square was again significant, $\chi^2(4, n = 739) = 265.1, p < .001$. Results are shown in Table 3. An increase in both disorders was indicated by 20.8% of participants, a decrease was reported by 16.2%, and no shift was reported by 22.9%. This result was supported by calculation of Kendall's tau, which indicated a strong positive correlation ($\tau_b = .48, p < .001, N = 739$) between a perceived shift in depression and anxiety.

Table 3

Interaction Between Shifts of Symptom Severity as Measured With the Perceived Shift Questions

Perceived shift depression	Perceived shift anxiety			
	Increased	No shift	Decreased	Total
	n (%)	n (%)	n (%)	n (%)
Increased	154 (20.8)	61 (8.3)	23 (3.1)	238 (32.2)
No shift	87 (11.8)	169 (22.9)	47 (6.4)	303 (41.0)
Decreased	20 (2.7)	58 (7.9)	120 (16.2)	198 (26.8)
Total	261 (35.3)	288 (39.0)	190 (25.7)	739 (100.0)

Correlation Between Symptom Severity and Perceived Shift

Lastly, we examined whether there is a correlation between shifts in depression and anxiety as measured with self-report screeners and the perceived shift questions (research question 3).

Symptoms of Depression

For depression, a chi-square test was done to test the relation between the categorization of a shift with the PHQ-9 and with the perceived shift question. A non-significant result again would indicate no statistically significant difference between the rows and columns of the table. The outcome was significant, $\chi^2(4, n = 739) = 59.2, p < .001$. A calculation of Kendall's tau indicates a moderately strong positive correlation ($\tau_b = .22, p < .001, N = 739$). When looking at Table 4, 11.8% of participants indicated an increase in depression on both measures, 8.7% indicated a decrease, and 23.8% indicated no shift.

Table 4

Interaction Between Measurements of Shifts Between Outcome of the PHQ-9 and Perceived Shift of Depression

PHQ-9 (depression)	Perceived shift depression			Total
	Increased	No shift	Decreased	
	n (%)	n (%)	n (%)	n (%)
Increased	87 (11.8)	41 (5.6)	27 (3.7)	155 (21.0)
No shift	117 (15.8)	176 (23.8)	107 (14.5)	400 (54.1)
Decreased	34 (4.6)	86 (11.6)	64 (8.7)	184 (24.9)
Total	238 (32.2)	303 (41.0)	198 (26.8)	739 (100)

Symptoms of Anxiety

For anxiety, the method of testing is the same as for depression. The chi-square test is again significant, $\chi^2(4, n = 739) = 30.6, p < .001$. The result of Kendall's tau indicates a weak positive correlation ($\tau_b = .12, p < .001, n = 739$) between shifts in anxiety as measured by the GAD-7 and as measured with the perceived shift question. This means that the shifts that were measured with GAD-7 and with the perceived shift question are positively associated with each other, but one is only a weak reflection of the other. For example, as can be seen in Table 5, the percentage of people who indicated no shift on the GAD-7 but an increase in anxiety on the perceived shift question is higher (16.0%) than people who indicated an increase on both measures (12.5%). Furthermore, 6.6% of participants indicated a decrease on both measures, and 18.5% indicated no shift.

Table 5

Interaction Between Measurements of Shifts Between Outcome of the GAD-7 and Perceived Shift of Anxiety

GAD-7 (anxiety)	Perceived shift anxiety			
	Increased	No shift	Decreased	Total
	n (%)	n (%)	n (%)	n (%)
Increased	92 (12.5)	52 (7.0)	40 (5.4)	184 (24.9)
No shift	118 (16.0)	137 (18.5)	101 (13.7)	356 (48.1)
Decreased	51 (6.9)	99 (13.4)	49 (6.6)	199 (26.9)
Total	261 (35.3)	288 (39.0)	190 (25.7)	739 (100.0)

Discussion

We examined the co-occurrence of shifts in symptom severity measured with self-report screeners for depression (PHQ-9) and anxiety (GAD-7) on the one hand (research question 1) and by asking participants directly about perceived shifts on the other hand (research question 2). Furthermore, we studied to which degree the conclusions from these two data sources overlap (research question 3).

For the co-occurrence of shifts when measured with the PHQ-9 and GAD-7, our findings suggest that shifts in depression and anxiety do indeed co-occur. When looking at the co-occurrence of perceived shifts of depression and anxiety, this yields the same result. Participants mostly indicated a shift in the same direction (increase, decrease, or no shift) for both depression and anxiety. When looking at the specific measurement tools, there also seems to be a co-occurrence between shifts in depression when measured by the PHQ-9 and by perceived shift in depression. The same goes for shifts when measured by GAD-7 and by perceived shift in anxiety. The strength of the found relationship between the different measurement tools was however not very high. A suggestion for future research would be to

further study the different measurement tools for symptoms of depression and anxiety, and shifts thereof.

While previous research has found that shifts happen while treating patients with depression and anxiety (Persons et al., 2003), the co-occurrence of shifts also seems to be present in our sample that does not receive current treatment. Our results suggest that depression and anxiety generally follow a similar pattern of change, whether that be increasing, decreasing, or staying the same. There were participants for whom this finding was not true, however, the majority of participants indicated the same shift in symptom severity of depression and anxiety. We speculate that the shifting of both depression and anxiety is at least partly due to both disorders sharing similar characteristics. This is supported by the tripartite model of depression and anxiety (Clark & Watson, 1991). They hypothesized that the relationship between depression and anxiety lies in an underlying component that both disorders share (negative affect; NA), as well as each disorder having its own unique symptoms (positive affect; PA and physiological hyperarousal; PH). This same theory could explain why not all participants indicated a shift in the same direction. Some participants, for example, indicated an increased symptom severity in depression, while indicating a decreased symptom severity in anxiety. It could be that such a participant experienced a decrease in their PA, reporting an increase in their symptoms of depression, while simultaneously experiencing a decrease in PH and thus their anxiety symptoms. Our suggestion for further research would be to include the specific components of the tripartite model in a follow-up study to further research whether these components can be pointed out as mediating factors or predictors for a shift in both depression and anxiety.

When comparing the screeners and the perceived shift questions with each other, we see that more people tend to indicate an increase in both disorders on the perceived shift

questions. This might have to do with the findings of Melrose and colleagues (2013), who found that people tend to rank their symptoms based on their existing frame of reference regarding depression or anxiety. This can cause an over- or underestimation of the symptom severity that would be found when testing the individual with validated measures. In the present study, it seems that participants tend to overestimate their symptoms when comparing shifts as measured with the perceived shift questions to the self-report screeners.

We also compared the different measures with each other. The outcome of the PHQ-9 was compared with the outcome of the perceived shift in depression question, as well as the GAD-7 and the perceived shift in anxiety question. For both disorders, the comparison of measures did not seem to accurately present the data. For example, there was a higher amount of people that indicated no shift when measured with the PHQ-9 while indicating an increase in depression with the perceived shift question than there were participants indicating an increase on both measures. This again could have to do with the overestimation of symptom severity when asking people as opposed to measuring symptom severity with a validated screener such as the PHQ-9. There could also be an effect of using a one-item question as opposed to more items. While one-item screeners are being used in the clinical field, it is still debatable how well they work. For example, a study done by Davey and colleagues (2007) tested current anxiety with a twenty-item screener and a one-item screener. Results were very promising and both measures seemed to quite accurately predict current anxiety. However, as was mentioned in the study too, when comparing the outcome of a one-item screener to the norm it may not be inappropriate to interpret the results in the same way a longer screener would be interpreted. A suggestion for future research would be to further test the use of one-item screeners and how they can be implicated in the clinical field.

Implications

The most important implication of this thesis is the finding that shifts in depression and anxiety seem to co-occur, both when measured with validated screeners and when asking participants how they have perceived the shifting of their symptom severity. Relating to previous research (e.g. Clark & Watson, 1991; Persons et al., 2003; Melrose et al., 2013) we see that there has been research before on shifts of depression or anxiety, as well as the co-occurrence of depression and anxiety, but not a lot has been studied about the co-occurrence of shifts of depression and anxiety. Since MDD and GAD are the two most prevalent disorders (World Health Organization, 2017) it is important to keep researching the disorders, how they are construed, and how they influence each other. From the results retrieved in this thesis, we cannot yet formulate practical implications, but further research into the co-occurrence of shifts in depression and anxiety could help create new insights into treatment for both disorders. Often now, both disorders are treated separately (Persons et al., 2003), while people might benefit more from treatment of the common components of both disorders.

Furthermore, we have looked at different ways of measuring shifts. There is some research on one-item screeners (e.g. Davey et al., 2007), but the use of one-item questions could cause an over- or underestimation of symptom severity since people might answer based on an arbitrary ranking system in their own minds (Melrose et al., 2013). We have found that participants may indeed have over- or underestimated when answering the perceived shift question. It would be interesting to conduct more research on the data using the WARN-D Ecological Momentary Assessment (EMA) data. Similar approaches were reviewed in the study of Antosik-Wójcińska and colleagues (2020) where shifts in symptom severity of bipolar disorder were researched. A suggested approach to use the EMA data is to conduct exploratory analyses. Such analyses can be used to better understand the data that is

worked with, visualize them, and calculate correlations (Antosik-Wójcińska, et al., 2020). The data could for example be used to visualize shifts that have happened over time. One could then do similar calculations to those in this thesis, calculating whether participants indicate a shift when using self-report data. The self-report data and EMA data could then be compared. A step further would be to use predictive modeling, in order to identify and predict different phases in the shifting of depression and anxiety. This approach is also mentioned in the paper by Antosik-Wójcińska and colleagues (2020).

Strengths and Limitations

Strengths

This thesis is written on a topic that has not been researched much. There are many studies on the comorbidity of depression and anxiety (e.g. Kessler et al., 1996; Pollack, 2005), but not on the co-occurrence of shifts in depression and anxiety. Another strength of the present research is the use of direct questions about perceived shifts as well as using validated screeners. By doing this, a comparison can be made between the several possible measures. Additionally, a large sample size is used, which is also a strength.

Limitations

Design and Procedures. The categorization of shifts in the PHQ-9 and GAD-7 was done in a way that was supported by studies by Titov and colleagues (2011) and Toussaint and colleagues (2020). However, there might be more ways to establish a shift. It would for example be useful to look at the WARN-D depression and anxiety data which was collected daily to see how often people shifted from one severity category to another. Categorizing shifts in ways other than based on previous research was outside of the scope of this thesis but would be possible to research with WARN-D data. This is a limitation of the study, since different methods of establishing a result as a shift will yield different results.

Furthermore, people might not exactly know what depression and anxiety are when answering the perceived shift question. A multiple-question screener leaves less room for this ambiguity and faulty interpretations since it focuses its questions on particular symptoms instead of a syndrome as a whole. As mentioned before, advice for further research would be to conduct further research into one-item screeners.

Participants. For this research, an inclusion criterium was that participants had to be students. While this relieves some recruitment hardships, it does limit the generalizability of the results. The way students experience their symptoms, categorize their symptoms, interpret the questions, etcetera, may differ from other samples and from the general population. A suggestion for further research is to utilize a different sample, preferably one that entails participants that represent a larger part of the general population.

Analyses. The broader research of which this thesis is a part entails a 3-month Ecological Momentary Assessment (EMA) period. This period yields daily results with data on feelings of depression and anxiety, as well as physiological data measured with a smartwatch. This thesis looks at measurements of symptom severity of depression and anxiety at one point in time and again at another point in time three months later. While being outside of the scope of this thesis, it would be more accurate to also consider the EMA data in analyses. As mentioned before, a suggestion for future research is to take into account the EMA data when looking at the shifts. That data could more accurately predict whether a shift actually occurred, as well as take into account physiological data such as heart rate to measure anxiety symptoms.

Conclusion

In summary, this thesis has provided an exploration of the co-occurrence of shifts in depression and anxiety. By employing various measurement approaches and considering how

individuals perceive shifts in their symptom severity, we hope this thesis can contribute to moving toward a comprehensive understanding of the relationship between these disorders. The findings from this study suggest the need for further research to advance our knowledge, refine treatment approaches, and hopefully be able to develop preventative strategies. Ultimately, by addressing the co-occurrence of depression and anxiety, we can work towards better mental health outcomes and improved well-being for individuals experiencing these conditions.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>
- Antosik-Wójcińska, A. Z., Dominiak, M., Chojnacka, M., Kaczmarek-Majer, K., Opara, K. R., Radziszewska, W., . . . Świącicki, Ł. (2020). Smartphone as a monitoring tool for bipolar disorder: a systematic review including data analysis, machine learning algorithms and predictive. *International Journal of Medical Informatics*, *138*, 104131. <https://doi.org/10.1016/j.ijmedinf.2020.104131>
- Baxter, A. J., Vos, T., Scott, K. M., Ferrari, A. J., & Whiteford, H. A. (2014). The global burden of anxiety disorders in 2010. *Psychological Medicine*, *44*(11), 2363-2374. <https://doi.org/10.1017/S0033291713003243>
- Botsch, R. (2011). Chapter 12: Significance and measures of association. In *Scopes and Methods of Political Science*. <https://polisci.usca.edu/apls301/Text/Chapter%2012.%20Significance%20and%20Measures%20of%20Association.htm>
- Carrellas, N. W., Biederman, J., & Uchida, M. (2017). How prevalent and morbid are subthreshold manifestations of major depression in adolescents? A literature review. *Journal of Affective Disorders*, *210*, 166-173. <https://doi.org/10.1016/j.jad.2016.12.037>
- Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*(3), 316-336. <https://d1wqtxts1xzle7.cloudfront.net/73721674/a2becd62b093b8914b33109792e64f16e9af-libre.pdf?1635359481=&response-content->

- disposition=inline%3B+filename%3DTripartite_model_of_anxiety_and_depressi.pdf
&Expires=1685014131&Signature=ZEHopoGOviedMIDZZUad6lYan
- Davey, H. M., Barratt, A. L., Butow, P. N., & Deeks, J. J. (2007). A one-item question with a Likert or Visual Analog Scale adequately measured current anxiety. *Journal of Clinical Epidemiology*, 60(4), 356-360. <https://doi.org/10.1016/j.jclinepi.2006.07.015>
- Fried, E. I., Rieble, C. L., & Proppert, R. K. (2022). *Building an early warning system for depression: rationale, objectives, and methods of the WARN-D study*. PsyArXiv. <https://doi.org/10.31234/osf.io/9qcvs>
- Garber, J., & Weersing, V. R. (2010). Comorbidity of anxiety and depression in youth: implications for treatment and prevention. *Clinical Psychology: Science and Practice*, 17(4), 293-306. <https://doi.org/10.1111/j.1468-2850.2010.01221.x>
- Gorman, J. M. (1996). Comorbid depression and anxiety spectrum disorders. *Depression and Anxiety*, 4(4), 160-168. [https://doi.org/10.1002/\(SICI\)1520-6394\(1996\)4:4<160::AID-DA2>3.0.CO;2-J](https://doi.org/10.1002/(SICI)1520-6394(1996)4:4<160::AID-DA2>3.0.CO;2-J)
- Goss-Sampson, M. A. (2018). Paired Samples T-Test. In *Statistical Analysis in JASP: A Guide for Students* (pp. 38-40). <https://static.jasp-stats.org/Statistical%20Analysis%20in%20JASP%20-%20A%20Students%20Guide%20v1.0.pdf>
- Hall, W., Lynskey, M., & Teesson, M. (2001). What is comorbidity and why does it matter? In M. Teesson, & L. Byrnes, *National Comorbidity Project* (pp. 11-17). https://www.researchgate.net/profile/Mark-Dadds/publication/238521699_Potential_for_innovative_prevention_strategies/links/0deec52f942fde8e79000000/Potential-for-innovative-prevention-strategies.pdf#page=24

- JASP Team. (2022). JASP (Version 0.16.4) [Computer Software]. BibTeX.
- Kaufman, J., & Charney, D. (2000). Comorbidity of mood and anxiety disorders. *Depression and Anxiety, 12*(S1), 69-76. <https://doi.org/10.1002/1520-6394%282000%2912%3A1%2B%3C69%3A%3AAID-DA9%3E3.0.CO%3B2-K>
- Kendall, M. G. (1938). A new measure of rank correlation. *Biometrika, 30*(1/2), 81-93. <https://doi.org/10.2307/2332226>
- Kessler, R. C., Nelson, C. B., McGonagle, K. A., Liu, J., Swartz, M., & Blazer, D. G. (1996). Comorbidity of DSM-III-R major depressive disorder in the general population: results from the US National Comorbidity Survey. *The British Journal of Psychiatry, 168*(S30), 17-30. <https://doi.org/10.1192/S0007125000298371>
- Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606-613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>
- Laerd Statistics. (n.d.). *Kendall's Tau-b using SPSS Statistics*. <https://statistics.laerd.com/spss-tutorials/kendalls-tau-b-using-spss-statistics.php>
- Lépine, J. P., & Briley, M. (2011). The increasing burden of depression. *Neuropsychiatric disease and treatment, 7*(Suppl. 1), 3-7. <https://doi.org/10.2147/NDT.S19617>
- Melrose, K. L., Brown, G. D., & Wood, A. M. (2013). Am I abnormal? Relative rank and social norm effects in judgments of anxiety and depression symptom severity. *Journal of Behavioral Decision Making, 26*(2), 174-184. <https://doi.org/10.1002/bdm.1754>
- Noyes, B. K., Munoz, D. P., Khalid-Khan, S., Brietzke, E., & Booij, L. (2022). Is subthreshold depression in adolescence clinically relevant? *Journal of Affective Disorders, 309*, 123-130. <https://doi.org/10.1016/j.jad.2022.04.067>

- Persons, J. B., Roberts, N. A., & Zalecki, C. A. (2003). Anxiety and depression change together during treatment. *Behavior Therapy*, *34*(2), 149-163.
[https://doi.org/10.1016/S0005-7894\(03\)80010-2](https://doi.org/10.1016/S0005-7894(03)80010-2)
- Pollack, M. H. (2005). Comorbid anxiety and depression. *Journal of Clinical Psychiatry*, *66*, 22-29. https://www.psychiatrist.com/wp-content/uploads/2021/02/11964_comorbid-anxiety-depression.pdf
- Serra-Blasco, M., Torres, I. J., Vicent-Gil, M., Goldberg, X., Navarra-Ventura, G., Aguilar, E., . . . Cardoner, N. (2019). Discrepancy between objective and subjective cognition in major depressive disorder. *European Neuropsychopharmacology*, *29*(1), 46-56.
<https://doi.org/10.1016/j.euroneuro.2018.11.1104>
- Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine*, *166*(10), 1092-1097. <https://doi.org/10.1001/archinte.166.10.1092>
- Statistics Solutions. (n.d.). *Paired T-Test*. <https://www.statisticssolutions.com/free-resources/directory-of-statistical-analyses/paired-sample-t-test/>
- Statology. (2021). *The four assumptions of a chi-square test*. <https://www.statology.org/chi-square-test-assumptions/>
- Stigler, S. M. (1999). *Statistics on the table: The history of statistical concepts and methods*. Harvard University Press.
<https://books.google.nl/books?hl=nl&lr=&id=qQusWukdPa4C&oi=fnd&pg=PP11&dq=Statistics+on+the+table:+The+history+of+statistical+concepts+and+methods&ots=6grDZJqIQF&sig=I-Larr6G1hFTmw669k3NQzW7ggY#v=onepage&q=Statistics%20on%20the%20table>

%3A%20The%20history%20of%20statistical%20concepts%20and%20methods&f=fa
lse

- Titov, N., Dear, B. F., McMillan, D., Anderson, T., Zou, J., & Sunderland, M. (2011). Psychometric comparison of the PHQ-9 and BDI-II for measuring response during treatment of depression. *Cognitive Behaviour Therapy*, *40*(2), 126-136. <https://doi.org/10.1080/16506073.2010.550059>
- Toussaint, A., Hüsing, P., Gumz, A., Wingenfeld, K., Härter, M., Schramm, E., & Löwe, B. (2020). Sensitivity to change and minimal clinically important difference of the 7-item Generalized Anxiety Disorder Questionnaire (GAD-7). *Journal of Affective Disorders*, *265*, 395-401. <https://doi.org/10.1016/j.jad.2020.01.032>
- World Health Organization. (2017). *Depression and other common mental disorders: Global health estimates*. World Health Organization. <https://apps.who.int/iris/bitstream/handle/10665/254610/WHO-MSD-MER-2017.2-eng.pdf?sequence=1&isAllowed=y>
- World Health Organization. (2022). *Mental disorders*. <https://www.who.int/news-room/fact-sheets/detail/mental-disorders>
- Xiao, C., Ye, J., Esteves, R. M., & Rong, C. (2016). Using Spearman's correlation coefficients for exploratory data analysis on big dataset. *Concurrency and Computation: Practice and Experience*, *28*(14), 3866-3878. <https://doi.org/10.1002/cpe.3745>

Appendix A

Detailed Information on the Subsamples

For the first cohort, the sample size at baseline was $n = 448$. Only participants that also answered the follow-up ($n = 381$) were included in the analyses in this thesis. The age of participants in this cohort ranged from 18 to 53 ($M = 22.65$, $SD = 4.00$). Of this cohort, 15% were male and 85% were female.

In the second cohort, the baseline sample size was $n = 456$. The follow-up was answered by $n = 366$ participants. Again, only people that also answered the follow-up were included in the analyses. The age of participants in cohort two ranged from 18 to 61 ($M = 22.42$, $SD = 3.69$). In this cohort, the distribution of male participants (15%) and female participants (85%) was the same as in cohort one.

Appendix B

Full Questionnaire: Patient Health Questionnaire-15

The following full questionnaire was retrieved from the study of Fried and colleagues (figure B.1; 2022, Suppl.) The questionnaire has been transformed from PHQ-15 to PHQ-9 by leaving items 14 and 15 out, as well as combining the following items: 2 and 3, 4 and 5, 7 and 8, 11 and 12. The highest score of the combined items was taken as the measured outcome for the PHQ-9. For example, when item 2 was answered with ‘*nearly every day*’ and item 3 was answered with ‘*several days*’, the combined outcome was registered as ‘*nearly every day*’.

Figure B.1

Full Questionnaire: PHQ-15

Over the past 2 weeks, how often have you been bothered by the following problems?

	Not at all (0)	Several Days (1)	More Than Half the Days (2)	Nearly Every Day (3)
Little interest or pleasure in doing things (PHQ_1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling down or depressed (PHQ_2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling hopeless (PHQ_3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Trouble falling asleep or staying asleep (PHQ_4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sleeping too much (PHQ_5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling tired or having little energy (PHQ_6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Poor appetite (PHQ_7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overeating (PHQ_8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling bad about yourself – or that you’re a failure or have let yourself or your family down (PHQ_9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Trouble concentrating on things, such as	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

reading or
watching
television
(PHQ_10)

Moving or
speaking so
slowly that other
people could
have noticed
(PHQ_11)

Being so fidgety
or restless that
you have been
moving around a
lot more than
usual (PHQ_12)

Thoughts that
you would be
better off dead
or of hurting
yourself in some
way (PHQ_13)



Little interest in

sex (PHQ_14)

PHQ_15 If you checked any problems, how difficult have they made it for you to do your work, take care of things at home, or get along with other people?

- Not difficult at all (0)
- Somewhat difficult (1)
- Very difficult (2)
- Extremely difficult (3)

Appendix C

Full Questionnaire: Generalized Anxiety Disorder-7

The following full questionnaire was retrieved from the study of Fried and colleagues (figure C.1; 2022, Suppl.)

Figure C.1

Full Questionnaire: GAD-7

Over the last 2 weeks, how often have you been bothered by the following problems?

	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)
Feeling nervous, anxious, or on edge (GAD_1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Not being able to stop or control worrying (GAD_2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worrying too much about different things (GAD_3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Trouble relaxing

(GAD_4)

Being so restless

that it is hard to

sit still

(GAD_5)

Becoming easily

annoyed or

irritable

(GAD_6)

Feeling afraid,

as if something

awful might

happen

(GAD_7)

Appendix D

Perceived Shift Questions

The following questionnaire was retrieved from the study of Fried and colleagues (figure D.1; 2022, Suppl.). In this research, only the questions about feeling anxious and feeling down or depressed were used.

Figure D.1

Full Questionnaire: Perceived Shift Questions

Over the last 3 months, did you notice any changes in...

	It got much worse (1)	It got a little bit worse (2)	There were no changes (3)	It got a little bit better (4)	It got much better (5)
... feeling stressed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... feeling anxious?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... feeling down or depressed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... being able to carry out routine daily activities (e.g. studying, cleaning, meeting friends)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix E**Interpretation of Kendall's Tau****Table E.1***Interpretation of Kendall's Tau*

Value	Strength
Less than + or - .10	Very weak
+ or -.10 to .19	Weak
+ or -.20 to .29	Moderate
+ or -.30 or above	Strong

Note: by Botsch (2011)

Appendix F

Full Report on Assumptions

Kendall's Tau

Assumption One

The variable should be ordinal or continuous. The data is labeled as -1, 0, or 1, making the data ordinal.

Assumption Two

The data preferably follows a monotonic relationship. The data seems to have a monotonic relationship, as indicated by the data in Tables 2 through 5.

Paired T-Test

Assumption One

The dependent variable has to be numeric and continuous. The sum scores from baseline and follow-ups were used, this was numeric and continuous data ranging from 0 to 27 for the PHQ-9, and from 0 to 21 for the GAD-7.

Assumption Two

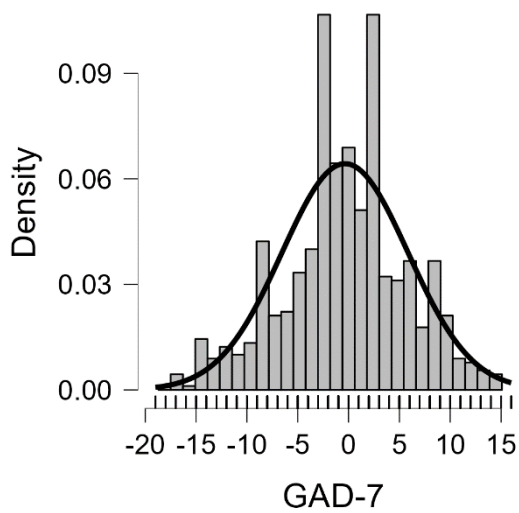
Each participant is matched in both groups. This was done by labeling each participant uniquely so the data sets could be matched with each other.

Assumption Three.

The difference between the matched pairs has to be approximately normally distributed. This was true for the PHQ-9, $W = .99$, $p = .09$. However, for the GAD-7 the result was significant, $W = .99$, $p < .001$. This result suggests a deviation from normality. See Figure F.1 for a visual representation of the data.

Figure F.1

Histogram Showing Distributions of GAD-7 Difference Scores



Note: this figure shows the distribution of difference scores between the GAD-7 baseline and follow-up.

Assumption Four

There should not be significant outliers in the groups. No significant outliers were identified.

Multi-Way Chi-Square Contingency Table

Assumption One

Both variables are categorical. The data is labeled as -1, 0, or 1, making the data categorical.

Assumption Two

All observations are independent. Participants were recruited randomly, which predicts the observations to most likely be independent.

Assumption Three

The cells in the contingency table are mutually exclusive. The categories of the cells do not overlap with each other and are each their own category.

Assumption Four

The expected value of the cells should be five or more in at least 80% of the cells. All cells but one in Table 2 have a value of five or more.