Online-Only Supplemental Material

Supplemental Table S1

DDS-17, PHQ-9, and GAD-7 items

Label	Short content description	Full item
Diabetes distress items (DDS-17)		
dd1	Diabetes taking up too much energy	Feeling that diabetes is taking up too much of my mental and physical energy every day. (Emotional burden)
dd2	Doctor doesn't know about diabetes	Feeling that my doctor doesn't know enough about diabetes and diabetes care. (Physician-related stress)
dd3	Angry/scared/depressed when I think about living with diabetes	Feeling angry, scared, and/or depressed when I think about living with diabetes. (Emotional burden)
dd4	Doctor doesn't give clear directions	Feeling that my doctor doesn't give me clear enough directions on how to manage my diabetes. (Physician-related stress)
dd5	Not testing blood sugars enough	Feeling that I am not testing my blood sugars frequently enough. (Regimen-related stress)
dd6	Often failing with diabetes regimen	Feeling that I am often failing with my diabetes regimen. (Regimen-related stress)
dd7	Friends/family not supportive	Feeling that friends or family are not supportive enough of my self-care efforts. (Interpersonal distress)
dd8	Diabetes controls my life	Feeling that diabetes controls my life. (Emotional burden)
dd9	Doctor doesn't take concerns seriously	Feeling that my doctor doesn't take my concerns seriously enough. (Physician-related stress)
dd10	Not confident in day-to-day ability to manage diabetes	Not feeling confident in my day-to-day ability to manage diabetes. (Regimen-related stress)
dd11	Serious long-term complications, not matter what	Feeling that I will end up with serious long-term complications, no matter what I do. (Emotional burden)
dd12	Not sticking closely enough to meal plan	Feeling that I am not sticking closely enough to a good meal plan. (Regimen-related stress)
dd13	Friends/family don't appreciate difficulty of diabetes	Feeling that friends or family don't appreciate how difficult living with diabetes can be. (Interpersonal distress)
dd14	Overwhelmed by demands of diabetes	Feeling overwhelmed by the demands of living with diabetes. (Emotional burden)
dd15	Don't have doctor I can see regularly	Feeling that I don't have a doctor who I can see regularly about my diabetes. (Physician-related stress)
dd16	Not motivated to keep up self-management	Not feeling motivated to keep up my diabetes self-management. (Regimen-related stress)
dd17	Friends/family don't give emotional support	Feeling that friends or family don't give me the emotional support that I would like. (Interpersonal distress)
Depressive items (PHQ-9)		
dep1	Little interest or pleasure	Little interest or pleasure in doing things.
dep2	Feeling down, depressed, or hopeless.	Feeling down, depressed, or hopeless.
dep3	Sleep problems	Trouble falling or staying asleep, or sleeping too much.
dep4	Tired or little energy.	Feeling tired or having little energy.
dep5	Poor appetite/ overeating.	Poor appetite or overeating.
dep6	Failure	Feeling bad about yourself/ feeling like a failure.
dep7	Trouble concentrating.	Trouble concentrating.
dep8	Moving/speaking slowly or being restless.	Moving or speaking so slowly or being fidgety or restless.
dep9	Suicidal thoughts	Thoughts that you would be better off dead, or thoughts of hurting yourself
Anxiety items (GAD-7)		

anx1	Nervous, anxious, or on edge.	Feeling nervous, anxious, or on edge.
anx2	Uncontrollable worry	Not being able to stop or control worrying.
anx3	Worrying too much	Worrying too much about different things.
anx4	Trouble relaxing.	Trouble relaxing.
anx5	Restless.	Being so restless that it's hard to sit still.
anx6	Easily annoyed/irritable.	Becoming easily annoyed or irritable.
anx7	Afraid as if something awful might happen.	Feeling afraid as if something awful might happen

Supplemental Table S2

Details on statistical analysis and packages used

Statistical analysis	Description	Package used
Item inspection	The mean, standard deviation, and polychoric correlations between items were calculated and inspected for each item in the DDS-17, PHQ-9, and GAD-7.	
Item informativeness	To quantify the amount of information that can be obtained from each item, or the item's informativeness, item standard deviations were examined. In line with previous studies using network analysis (1), an item was deemed poorly informative if its standard deviation was 2.5 SDs below the mean standard deviation. Results: No item was found to be poorly informative (M_{SD}: diabetes distress symptoms $M_{SD} = 0.96\pm0.13$; depressive symptoms $M_{SD} = 0.82\pm0.26$; anxiety symptoms $M_{SD} = 0.85\pm0.09$)	
Item redundancy test	An item redundancy test was used to test for overlapping pairs of items. Two items were deemed to be redundant (measuring the same construct) if the polychoric correlations between each of those items and all other items were statistically different in less than 25% of the cases (2). Results: The redundancy test suggested no reductions (i.e., no item was found to be measuring the same construct as another).	R package *networktools 1*.20 (2) was used.
Polychoric correlation matrix	As the data were ordinal, a polychoric correlation matrix was estimated as input. Polychoric correlations assume that a normal distribution underlies the observed ordinal variable (i.e., "feeling nervous, anxious, or on edge", GAD-7 item 1, is assumed to be a normally distributed variable, but participants selected one of four options to describe their experience).	The *cor_auto* function in *qgraph* (3) and the R-package *lavaan* (4) were used.
Statistical regularization technique	A statistical regularization technique is used to estimate many parameters, as is needed when estimating psychological networks. The 'least absolute shrinkage and selection operator' (LASSO(5)) regularization technique was used to estimate a more interpretable network and to limit the number of spurious edges. With EBIC model selection, a hyperparameter must be set to control the balance between sensitivity (a model with more edges estimated) and specificity (a model with fewer edges estimated). In this study, the	The network was regularized using the graphical LASSO (glasso(7)) with the *glasso* package (8) in R.

	hyperparameter was set to 0.5, as suggested by Foygel and Drton(6) to estimate a more parsimonious network.	
Visualising the network	To visualize the network, the Fructerman-Reingold algorithm places at the centre of the network the nodes with higher centrality (9).	
Cluster analysis	Nodes that play a similar role within the network and share similar properties will have stronger connections with one another and weaker connections with groups of less similar nodes, creating subgroups or communities(10). For the diabetes distress network, communities were also examined.

To assess the stability of the algorithm, as each time it is run it can provide a different result, it was run 100 times and the number of communities obtained with the most frequency was used (11).

Results:
The pattern of clusterization, identifying 4 clusters, is shown in Supplemental Figure S1. The identified clusters correspond with the 4 subscales of the DDS-17 scale. | The *spinglass* algorithm was used to identify communities of symptoms, based on the principle that edges should connect nodes of the same community, while nodes of different communities should not be connected (12).

This analysis was complemented with the *walktrap* algorithm, which uses random walks to identify similarities between nodes (12). Both the *spinglass* and *walktrap* algorithms were run using the R package igraph(13). |
| Network stability and accuracy | A post-hoc bootstrapping framework was used to assess the stability and accuracy of the networks. The non-parametric 2500-boostrapped confidence intervals (CIs) for each edge-weight were inspected and wide bootstrapped CIs taken to indicate that caution should be exercised in interpreting the strength, but not the presence or direction, of an edge (14). The stability of network and bridge indices were also investigated using subset bootstrapping and the computation of a correlation stability coefficient (CS-coefficient) (14). A CS-coefficient above 0.25 was considered interpretable with caution and above 0.5 was considered highly stable (14). | R package *bootnet* (15). |

Note: All analysis were carried out using R (16) version 4.0.5.

Supplemental Table S3

Diabetes distress (DDS-17), depressive (PHQ-9), and anxiety (GAD-7) item Mean and Standard deviations

Item	*M*	*SD*
dd1	1.73	.973
dd2	1.35	.817
dd3	1.46	.925
dd4	1.33	.801
dd5	1.63	.972
dd6	1.73	1.005
dd7	1.33	.771
dd8	1.57	.999
dd9	1.31	.815
dd10	1.53	.904
dd11	1.88	1.205
dd12	2.05	1.168
dd13	1.49	.944
dd14	1.58	1.011
dd15	1.52	1.11
dd16	1.73	1.077
dd17	1.35	.827
dep1	1.36	.786
dep2	1.35	.792
dep3	1.82	1.157
dep4	1.94	1.129
dep5	1.72	1.134
dep6	1.25	.694
dep7	1.24	.723
dep8	1.15	.537
dep9	1.1	.441
anx1	1.49	.932
anx2	1.45	.905
anx3	1.34	.807
anx4	1.46	.923
anx5	1.27	.731
anx6	1.48	.882
anx7	1.28	.736

Abbreviations: *M* = mean; *SD* = Standard deviation; dd1 - dd17 = DDS-17, Diabetes Distress Scale, items 1 - 17; anx1 – anx7 = GAD-7, Generalized Anxiety Disorder Questionnaire, items 1 – 7; dep1 – dep9 = PHQ-9, Patient Health Questionnaire, items 1-9.

Supplemental Table S4

Polychoric correlations: Diabetes distress – Diabetes distress

	dd1	dd2	dd3	dd4	dd5	dd6	dd7	dd8	dd9	dd10	dd11	dd12	dd13	dd14	dd15	dd16	dd17
dd1	1																
dd2	.54	1															
dd3	.69	.56	1														
dd4	.47	.8	.61	1													
dd5	.38	.39	.42	.41	1												
dd6	.47	.39	.48	.43	.66	1											
dd7	.47	.5	.52	.57	.45	.49	1										
dd8	.67	.49	.71	.52	.44	.52	.59	1									
dd9	.48	.76	.56	.81	.43	.43	.61	.6	1								
dd10	.56	.51	.65	.57	.6	.67	.58	.65	.59	1							
dd11	.57	.49	.64	.51	.47	.55	.53	.67	.57	.65	1						
dd12	.42	.39	.46	.43	.57	.66	.49	.46	.48	.66	.63	1					
dd13	.55	.57	.62	.59	.5	.55	.77	.66	.65	.67	.64	.58	1				
dd14	.62	.53	.71	.58	.51	.6	.61	.76	.61	.73	.72	.61	.78	1			
dd15	.4	.65	.47	.71	.43	.4	.53	.46	.74	.51	.53	.45	.59	.56	1		
dd16	.51	.44	.55	.53	.63	.69	.56	.55	.53	.73	.67	.75	.68	.69	.58	1	
dd17	.49	.54	.57	.57	.43	.46	.76	.59	.64	.62	.53	.53	.82	.7	.61	.62	1

Abbreviations: dd1 - dd17 = DDS-17, Diabetes Distress Scale, items 1 – 17.

Supplemental Table S5

Polychoric correlations: Diabetes distress- depression and Diabetes distress - anxiety

	dep1	dep2	dep3	dep4	dep5	dep6	dep7	dep8	dep9	anx1	anx2	anx3	anx4	anx5	anx6	anx7
dd1	.39	.39	.31	.4	.3	.44	.38	.41	.46	.43	.38	.47	.42	.4	.36	.41
dd2	.25	.31	.15	.22	.17	.3	.24	.2	.34	.29	.22	.31	.25	.24	.21	.21
dd3	.47	.44	.32	.38	.31	.54	.41	.44	.51	.5	.44	.52	.46	.43	.39	.43
dd4	.26	.37	.22	.29	.17	.34	.29	.25	.35	.29	.26	.32	.35	.28	.22	.22
dd5	.26	.23	.19	.25	.21	.38	.24	.23	.2	.21	.19	.23	.24	.19	.2	.21
dd6	.29	.3	.28	.32	.25	.46	.24	.26	.29	.28	.28	.32	.32	.23	.26	.29
dd7	.3	.35	.3	.33	.2	.37	.25	.33	.32	.34	.26	.31	.31	.26	.26	.32
dd8	.38	.35	.28	.35	.29	.45	.37	.4	.43	.37	.32	.39	.39	.37	.31	.41
dd9	.23	.3	.24	.24	.19	.3	.27	.27	.28	.3	.23	.33	.3	.27	.21	.22
dd10	.4	.4	.28	.36	.29	.49	.37	.37	.43	.37	.37	.4	.38	.33	.32	.38
dd11	.33	.36	.26	.35	.26	.45	.3	.33	.38	.36	.31	.38	.34	.22	.32	.33
dd12	.29	.29	.29	.32	.27	.44	.23	.27	.28	.27	.27	.31	.34	.24	.28	.24
dd13	.39	.44	.31	.37	.24	.46	.37	.39	.38	.38	.32	.42	.39	.32	.34	.38
dd14	.43	.41	.31	.4	.3	.51	.39	.4	.44	.4	.35	.43	.44	.37	.33	.41
dd15	.24	.3	.2	.24	.14	.32	.23	.2	.28	.27	.23	.3	.29	.24	.22	.21
dd16	.39	.41	.32	.39	.29	.56	.38	.36	.44	.36	.33	.36	.39	.3	.33	.34
dd17	.39	.39	.31	.4	.3	.44	.38	.41	.46	.37	.36	.43	.35	.32	.32	.37

Abbreviations: dd1 - dd17 = DDS-17, Diabetes Distress Scale, items 1 - 17; anx1 – anx7 = GAD-7, Generalized Anxiety Disorder Questionnaire, items 1 – 7; dep1 – dep9 = PHQ-9, Patient Health Questionnaire, items 1-9.

Supplemental Table S6

Polychoric correlations: Depression-depression

	dep1	dep2	dep3	dep4	dep5	dep6	dep7	dep8	dep9
dep1	1								
dep2	.7	1							
dep3	.49	.5	1						
dep4	.56	.58	.61	1					
dep5	.42	.41	.43	.48	1				
dep6	.67	.66	.5	.53	.45	1			
dep7	.58	.6	.44	.53	.37	.65	1		
dep8	.54	.59	.49	.48	.43	.65	.64	1	
dep9	.7	.64	.49	.57	.44	.71	.6	.54	1

Abbreviations: dep1 – dep9 = PHQ-9, Patient Health Questionnaire, items 1-9.

Supplemental Table S7

Polychoric correlations: Anxiety - anxiety

	Anx1	Anx2	Anx3	Anx4	Anx5	Anx6	Anx7
Anx1	1						
Anx2	.76	1					
Anx3	.71	.79	1				
Anx4	.65	.62	.73	1			
Anx5	.62	.61	.63	.65	1		
Anx6	.57	.57	.62	.54	.56	1	
Anx7	.64	.67	.72	.62	.59	.56	1

Abbreviations: anx1 – anx7 = GAD-7, Generalized Anxiety Disorder Questionnaire, items 1 – 7

Supplemental Table S8

Polychoric correlations: Depression – anxiety

	anx1	anx2	anx3	anx4	anx5	anx6	anx7
dep1	.66	.66	.67	.6	.58	.55	.62
dep2	.58	.6	.61	.57	.54	.54	.56
dep3	.45	.47	.53	.62	.45	.42	.46
dep4	.51	.54	.55	.56	.45	.5	.48
dep5	.39	.44	.47	.41	.42	.41	.38
dep6	.6	.63	.68	.63	.59	.57	.62
dep7	.56	.54	.56	.53	.53	.51	.52
dep8	.59	.56	.61	.55	.67	.56	.55
dep9	.64	.61	.61	.55	.56	.57	.57

Abbreviations: dep1 – dep9 = PHQ-9, Patient Health Questionnaire, items 1-9; anx1 – anx7 = GAD-7, Generalized Anxiety Disorder Questionnaire, items 1 – 7

Supplemental Figure S1

DDS-17 pattern of clusterization, showing 4 clusters of items as identified by the *spinglass* and *walktrap* algorithms.
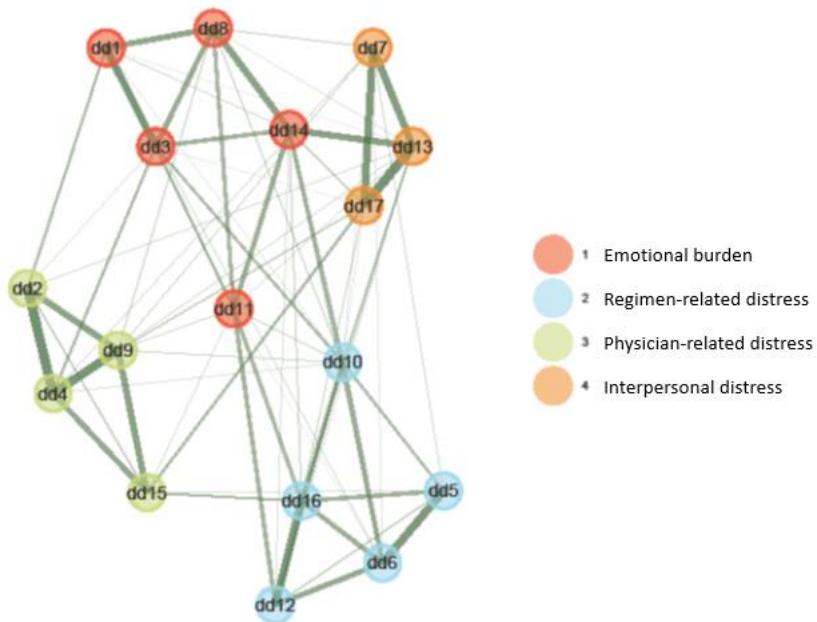
Note: Each node represents an item on the DDS-17 scale. Clusters are coloured and labelled to correspond with DDS-17 subscales: emotional burden (red); regimen-related distress (blue); physician-related distress (green); interpersonal distress (orange). A list of the diabetes distress items can be found in Supplemental Table 1.

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