Supplementary material

1. Correspondence of scale items to addiction symptoms

Supplementary Table A1. Correspondence of scale items to addiction symptoms

Conditions	Symptoms	Scale items
Internet addiction		*Compulsive Internet Use Scale*
	Continued use	Do you continue to use the Internet despite your intention to stop?
		Do you think you should use the Internet less often?
	Mood modification	Do you go on the Internet when you are feeling down?
		Do you use the Internet to escape from your sorrows or get relief from negative feelings?
	Loss of control	Do you find difficult to stop using the Internet when you are online?
		Have you unsuccessfully tried to spend less time on the Internet?
	Preoccupation	Do you think about the Internet, even when not online?
		Do you look forward to your next Internet session?
	Withdrawal	Do you feel restless, frustrated, or irritated when you cannot use the Internet?
	Consequences	Do others (e.g., partner, children, parents) say you should use the Internet less?
		Do you prefer to use the Internet instead of spending time with others (e.g., partner, children, parents)?
		Are you short of sleep because of the Internet?
		Do you rush through your (home) work in order to go on the Internet?
		Do you neglect your daily obligations (work, school, or family life) because you prefer to go on the Internet?
Gaming addiction		*Game Addiction Scale*
	Continued use	Have others unsuccessfully tried to make you reduce your time spent on games?
	Mood modification	Have you played games to forget about real life?
	Loss of control	Have you played longer than intended?
	Preoccupation	Have you thought all day long about playing a game?
	Withdrawal	Have you felt upset when you were unable to play?
	Consequences	Have you had arguments with others (e.g., family, friends) over your time spent on games?
		Have you neglected important activities (e.g., school, work, sports) to play games?
Smartphone addiction		*Smartphone Addiction Scale*
	Continued use	I use my smartphone longer than I had intended.
	Mood modification	-
	Loss of control	I have a hard time concentrating in class, while doing assignments, or while working due to smartphone use.
	Preoccupation	I have my smartphone in my mind even when I am not using it.
		I constantly check my smartphone so as not to miss conversations between other people on Twitter or Facebook.
	Withdrawal	I feel impatient and fretful when I am not holding my smartphone.
	Consequences	I miss planned work due to smartphone use.
		I feel pain in the wrists or at the back of the neck while using a smartphone.
		I will never give up using my smartphone even when my daily life is already greatly affected by it.
		The people around me tell me that I use my smartphone too much.
		Internet Sex Screening Test

Cybersex addiction	Continued use	I have made promises to myself to stop using the Internet for sexual purposes.
	Mood modification	I sometimes use cybersex as a reward for accomplishing something (e.g., finish a project, stressful day, etc.).
	Loss of control	I have punished myself when I use the Internet for sexual purposes (e.g., time-out from computer, cancel Internet subscription, etc.).
	Preoccupation	I believe I am an Internet sex addict.
	Withdrawal	When I am unable to access sexual information online, I feel anxious, angry, or disappointed.
	Consequences	Internet sex has sometimes interfered with certain aspects of my life.

2. Reliability of each scale

We ran confirmatory factor analyses with Maximum Likelihood Robust estimation, with a single factor for each technology-mediated addictive behavior. Fit indices include: robust Comparative Fit Index (CFI), robust Tucker-Lewis non-normed fit Index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). An acceptable fit is indicated by CFI and TLI values greater than .90, RMSEA values below .05, and SRMR values below .05. Robust Cronbach alphas, used for non-normal distributions, were also computed. Results are reported in Supplementary Table A2.

Supplementary Table A2. Reliability of the scales used to assess the four conditions

Condition	RMSEA	SRMR	Robust CFI	Robust TLI	Robust Cronbach alpha
Internet	0.143	**0.047**	**0.913**	0.854	**0.88**
Video gaming	0.109	**0.047**	**0.919**	0.865	**0.83**
Smartphone	0.103	**0.031**	**0.965**	**0.929**	**0.82**
Cybersex	**0.033**	**0.025**	**0.958**	**0.930**	0.59

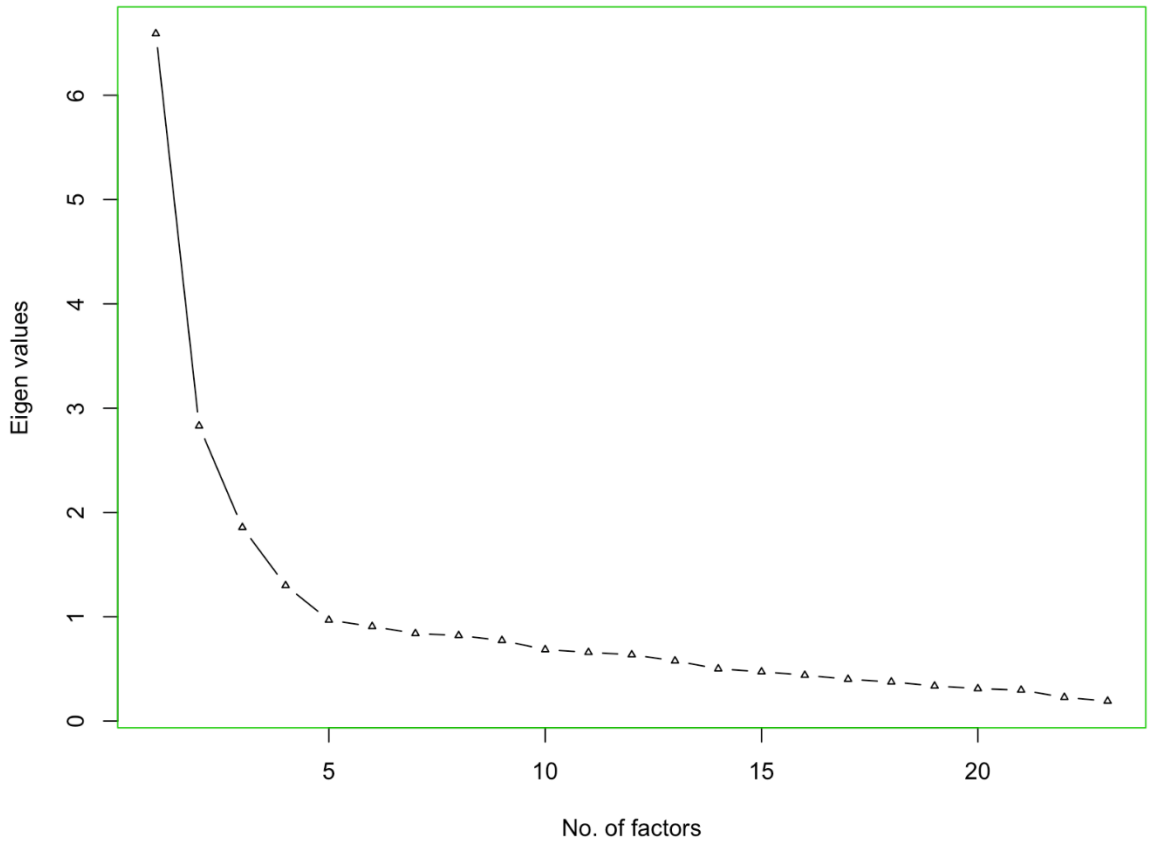
Fit indices corresponding to a good fit are highlighted in bold.

Overall, the reliability of the scales seemed acceptable, with at least three out of five fit indices corresponding to the threshold of a good fit for the four conditions. The use of two alternative statistical techniques developed for non-normal data and the large sample size strongly support the robustness of single-factor models for all scales.

3. Exploratory factor analysis for the four conditions

The screeplot is depicted in Supplementary Figure A1. Four eigen values were higher than one and were selected for the factor analysis.

Supplementary Figure A1. Screeplot for the exploratory factor analysis of the four conditions



Loadings for the four factors are reported in Supplementary Table A3. This solution had an acceptable fit (SRMS=.030, RMSEA=.068, TLI=.874). Each condition loaded on a separate factor: factor 1 for Internet, factor 2 for video gaming, factor 3 for smartphone, and factor 4 for cybersex. The results are consistent with the existence of four distinct technology-mediated addictive behaviors. Correlations between factors indicated that Internet-related

factor had strong relationships with other factors ($r \geq .42$). Relationships between other factors were moderate ($.15 \leq r \leq .29$).

Supplementary Table A3. Factor loadings with Promax rotation for the four-factor solution

Conditions	Symptoms	Factor 1	Factor 2	Factor 3	Factor 4
Internet addiction	Continued use	**0.95**	-0.16	-0.04	0.00
	Mood modification	**0.61**	0.15	-0.03	-0.01
	Loss of control	**0.96**	-0.14	-0.01	-0.04
	Preoccupation	**0.62**	0.14	0.03	-0.06
	Withdrawal	**0.41**	0.12	0.15	0.05
	Consequences	**0.77**	0.17	0.00	-0.03
Gaming addiction	Continued use	-0.04	**0.72**	0.00	0.01
	Mood modification	0.09	**0.62**	-0.05	0.03
	Loss of control	-0.02	**0.66**	0.01	-0.03
	Preoccupation	-0.04	**0.72**	-0.04	-0.03
	Withdrawal	0.00	**0.68**	0.03	0.03
	Consequences	0.00	**0.80**	0.02	0.02
Smartphone addiction	Continued use	0.13	-0.09	**0.65**	0.02
	Loss of control	0.08	-0.02	**0.54**	0.03
	Preoccupation	-0.05	-0.02	**0.83**	-0.03
	Withdrawal	-0.10	0.00	**0.74**	-0.04
	Consequences	-0.03	0.09	**0.84**	0.01
Cybersex addiction	Continued use	0.02	-0.05	0.06	**0.54**
	Mood modification	0.13	-0.08	0.01	**0.29**
	Loss of control	-0.07	-0.01	0.01	**0.43**
	Preoccupation	0.00	0.06	0.00	**0.55**
	Withdrawal	-0.01	0.04	0.00	**0.37**
	Consequences	-0.07	0.05	0.03	**0.58**

The highest loadings for each factor are highlighted in bold.

Correlations between factors: $r_{F1, F2} = .50$; $r_{F1, F3} = .61$; $r_{F1, F4} = .42$; $r_{F2, F3} = .21$; $r_{F2, F4} = .15$; $r_{F3, F4} = .29$.

4. Check of model accuracy

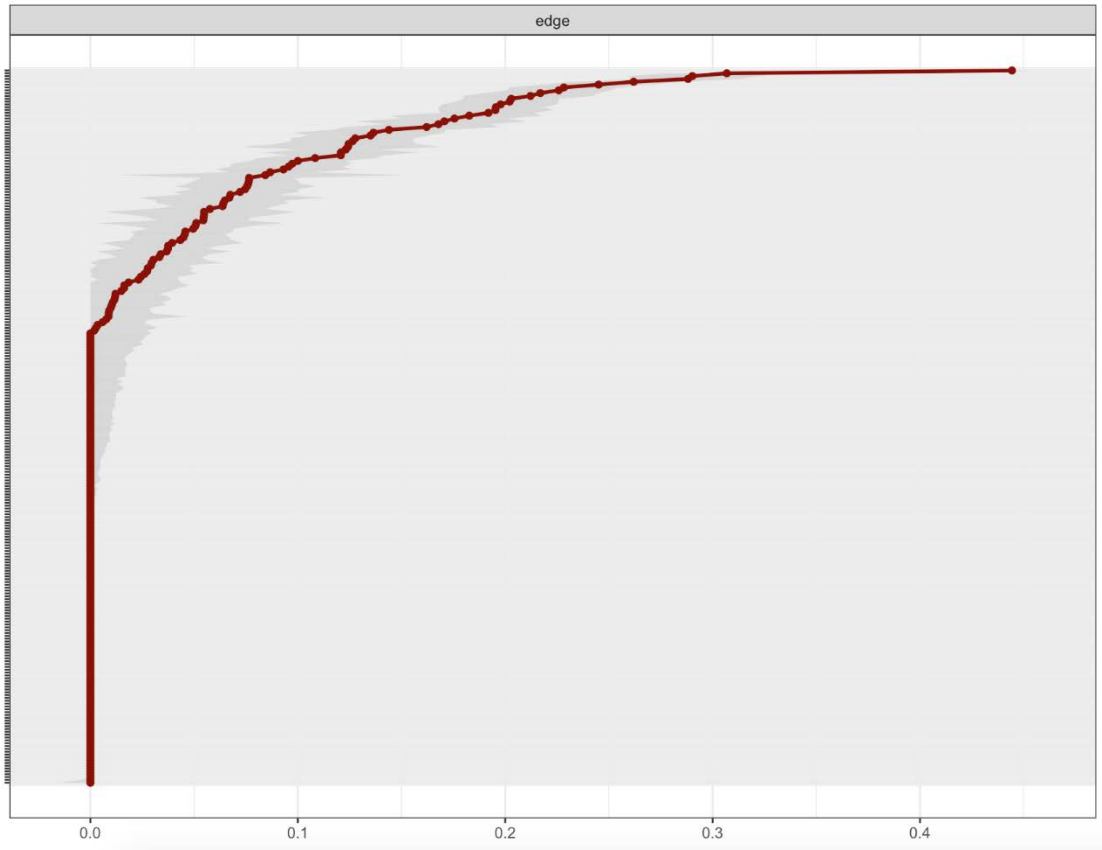
Edge weight accuracy

To test the edge weight accuracy, we computed bootstrapped 95% confidence intervals (1,000 bootstraps performed on edges with confidence intervals defined as the interval between the

2.5th to the 97.5th quantiles of the bootstrapped values). Overlapping confidence intervals for different edges mean that these edges are not significantly different from one another.

Figure A1 shows 95% confidence intervals for all positive edges of the network. Some edges had overlapping confidence intervals, so interpreting edges' strength should be done cautiously. However, the between-disorders edges were lower in comparison with within-disorders edges (not shown in Supplementary figure A2).

Supplementary figure A2. Bootstrapped confidence intervals of estimated edge-weights of the symptom network



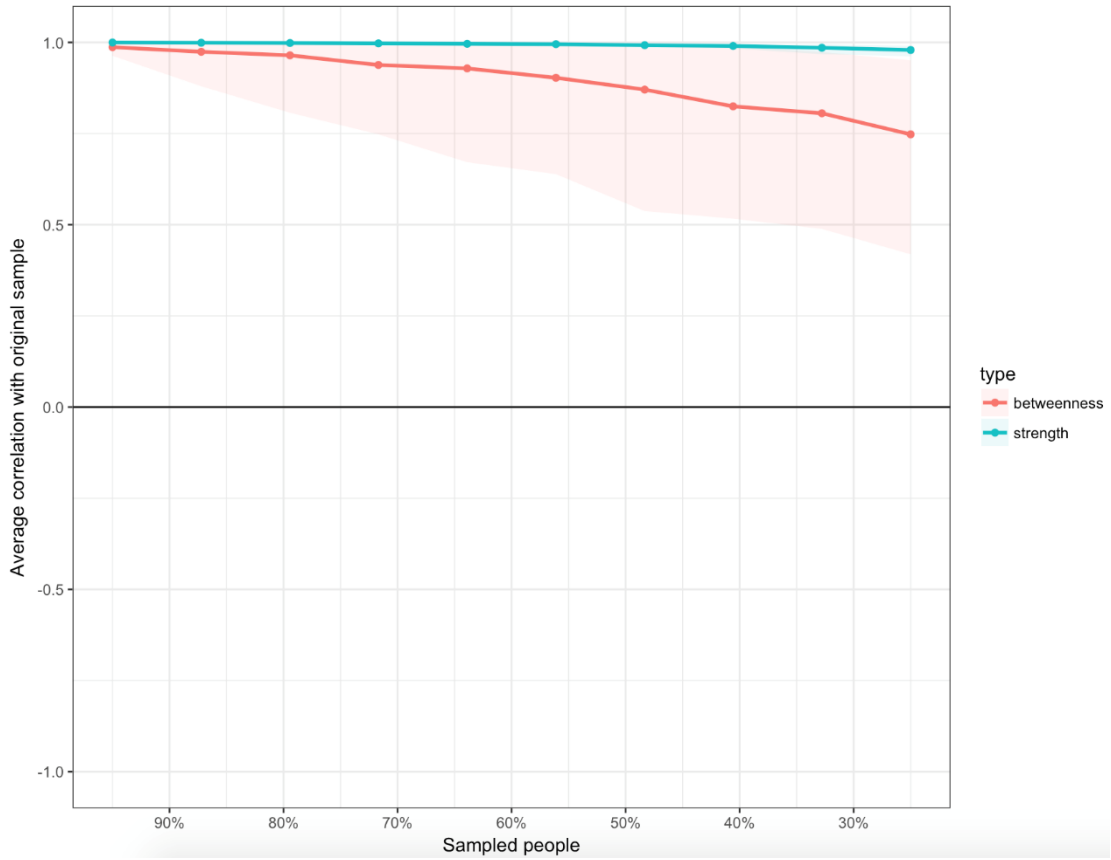
The line indicates the edge weights estimated in the sample, with each line corresponding to an edge. Edges are ordered from the lowest (bottom) to the highest (top). The area indicates the range from the 2.5th to the 97.5th quantiles (bootstrapped 95% confidence interval using 1,000 estimations). y-axis labels are removed to avoid cluttering. Confidence intervals for these edges are represented in red.

Stability of centrality indices

To test the stability of the centrality indices, we re-estimated the network after deleting participants from the sample and tested whether the order of the symptoms' strength and betweenness remained stable. For this purpose, correlations between the centrality order for the full sample and the subsequent sub-samples are used. For each subsample size (e.g., 80% of the initial sample), 1,000 subsamples were randomly selected, providing bootstrapped 95% confidence intervals (interval between the 2.5^{th} to the 97.5^{th} quantiles). If the order is very similar when using 50% of the participants, it is considered as being stable (Epskamp et al., 2016). Based on these bootstraps, we also computed correlation stability coefficients (CS-coefficient) separately for strength and betweenness. This coefficient is the maximum proportion of cases that can be dropped with the correlation between the centrality indices in full dataset and in the subsamples is .7 or higher with a 95% probability. The CS-coefficient should not be lower than .25, and preferably above .5 (Epskamp et al., 2016).

The stability of symptoms' centrality was high, with CS-coefficient = 0.75 for strength and 0.44 for betweenness, and an average correlation of approximately .99 and .85 when the subsample contained 50% of the full dataset (Supplementary figure A3). Therefore, the results are reliable.

Supplementary figure A3. Average correlations between the order of centrality indices for the full dataset and the estimated subsamples



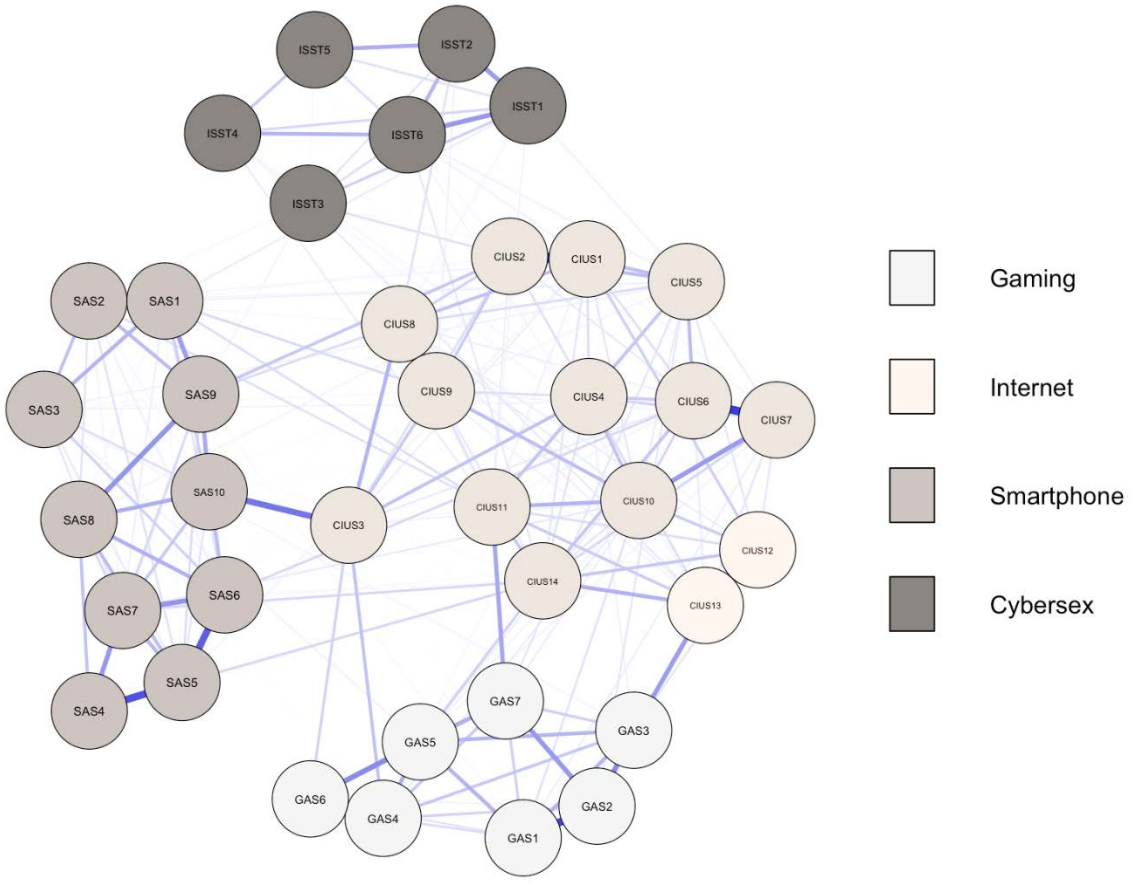
The line indicates the average correlation between centrality indices orders (1,000 estimations for each sample size). The area indicates the range from the 2.5th to the 97.5th quantiles (bootstrapped 95% confidence interval).

5. Sensitivity analysis

Analyses using all scale items assessing the four technology-mediated conditions are reported below and yielded similar results. The community detection analysis showed five clusters corresponding to the four conditions and with the items CIUS12 and CIUS13 forming a single symptom. These two items corresponded to mood modification.

There were several relationships between the cluster of Internet addiction and other conditions, encompassing 22.5% of the possible between-conditions edges with gaming addiction, 30.7% of the possible between-conditions edges with smartphone addiction, and 22.6% of the possible between-conditions edges with cybersex addiction. In contrast, there were few relationships between other conditions, with 4.3% of the possible between-conditions edges between gaming addiction and smartphone addiction, 2.4% of the possible between-conditions edges between gaming addiction and cybersex addiction, and 6.7% of the possible between-conditions edges between smartphone addiction and cybersex addiction.

Supplementary Figure A4. Network of the scale items assessing Internet addiction, gaming addiction, smartphone addiction, and cybersex addiction: sensitivity analysis



CIUS: Compulsive Internet Use Scale, GAS: Gaming Addiction Scale, SAS: Smartphone Addiction Scale, ISST: Internet Sex Screening Test (see Supplementary Table A2 for codes).

Thicker edges indicate a stronger relationship between symptoms.

Node colors are defined according to the community detection analysis. Items 12 and 13 from the CIUS were a separate cluster.

Items' centrality (and descriptive statistics) are reported in Supplementary Table A2. The highest betweenness were for items corresponding to others' reactions to the specific behaviors for Internet addiction ("Others say you should use Internet less"), gaming addiction ("Others unsuccessfully try to reduce time spent on games"), and smartphone addiction ("Other people tell you that you use your smartphone too much"). For cybersex addiction, "I have made

promises to myself to stop using the Internet for sexual purposes" had the highest betweenness. Strengths were quite similar across all items.

Supplementary Table A4. Descriptive statistics for scale items

Conditions	Codes	Scale items	Mean[1]	Strength[2]	Betweenness[3]
		Compulsive Internet Use Scale			
	CIUS1	Difficulty to stop using Internet when alone	1.25	1.08	21
	CIUS2	Continue to use the Internet despite intention to stop	1.16	1.05	40
	CIUS3	Others say you should use Internet less	0.50	0.89	119
	CIUS4	Prefer to use Internet instead of spending time with others	0.63	0.82	11
	CIUS5	Short of sleep because of Internet	0.91	0.91	10
	CIUS6	Think about Internet, even when not online	0.50	1.06	25
Internet addiction	CIUS7	Look forward the next Internet session	0.68	0.86	10
	CIUS8	Think to use Internet less often	0.96	1.00	91
	CIUS9	Unsuccessful attempts to spend less time on Internet	0.44	0.95	34
	CIUS10	Rush through in order to go on Internet	0.53	1.01	38
	CIUS11	Neglect daily obligations to go on Internet	0.50	0.97	58
	CIUS12	Go on Internet when feeling down	1.02	0.94	21
	CIUS13	Use Internet to escape from sorrows or negative feelings	0.76	1.10	67
	CIUS14	Feel restless, frustrated or irritated when not using Internet	0.45	0.96	81
		Game Addiction Scale			
	GAS1	Think all day long about playing a game	0.77	0.84	1
	GAS2	Play longer than intended	1.38	0.82	12
	GAS3	Play games to forget about real life	0.70	0.87	35
Gaming addiction	GAS4	Others unsuccessfully try to reduce time spent on games	0.31	0.97	56
	GAS5	Feel upset when unable to play	0.30	0.91	24
	GAS6	Have arguments with others over time spent on games	0.21	0.81	0
	GAS7	Neglect important activities to play games	0.39	0.89	27
		Smartphone Addiction Scale			
	SAS1	Miss planned work due to smartphone use	1.61	1.01	39
	SAS2	Have hard time concentrating (in class or at work) due to smartphone use	1.85	0.84	0
	SAS3	Feel pain in the wrists or at the back of the neck while using smartphone	1.43	0.56	0
Smartphone addiction	SAS4	Won't be able to stand not having a smartphone	2.99	0.61	0
	SAS5	Feel impatient and fretful when not holding a smartphone	1.96	1.08	39
	SAS6	Have smartphone in mind when not using it	1.47	0.98	42
	SAS7	Will never give up using smartphone even when daily life is greatly affected by it	1.76	0.89	1
	SAS8	Constantly check smartphone not to miss conversations on Twitter or Facebook	1.94	0.82	19

	SAS9	Use smartphone longer than intended	2.33	1.05	44
	SAS10	Other people tell you that you use your smartphone too much	1.64	0.91	75
		Internet Sex Screening Test			
Cybersex addiction	ISST1	Internet sex has sometimes interfered with certain aspects of my life	0.14	0.64	16
	ISST2	I have made promises to myself to stop using the Internet for sexual purposes	0.21	0.54	62
	ISST3	I sometimes use cybersex as a reward for accomplishing something	0.21	0.34	5
	ISST4	Anxious, angry or disappointed when unable to use cybersex	0.04	0.36	0
	ISST5	I have punished myself when I use the Internet for sexual purposes	0.03	0.36	0
	ISST6	I believe I am an Internet sex addict	0.12	0.66	37

CIUS: Compulsive Internet Use Scale, GAS: Gaming Addiction Scale, SAS: Smartphone Addiction Scale, ISST: Internet Sex Screening Test.

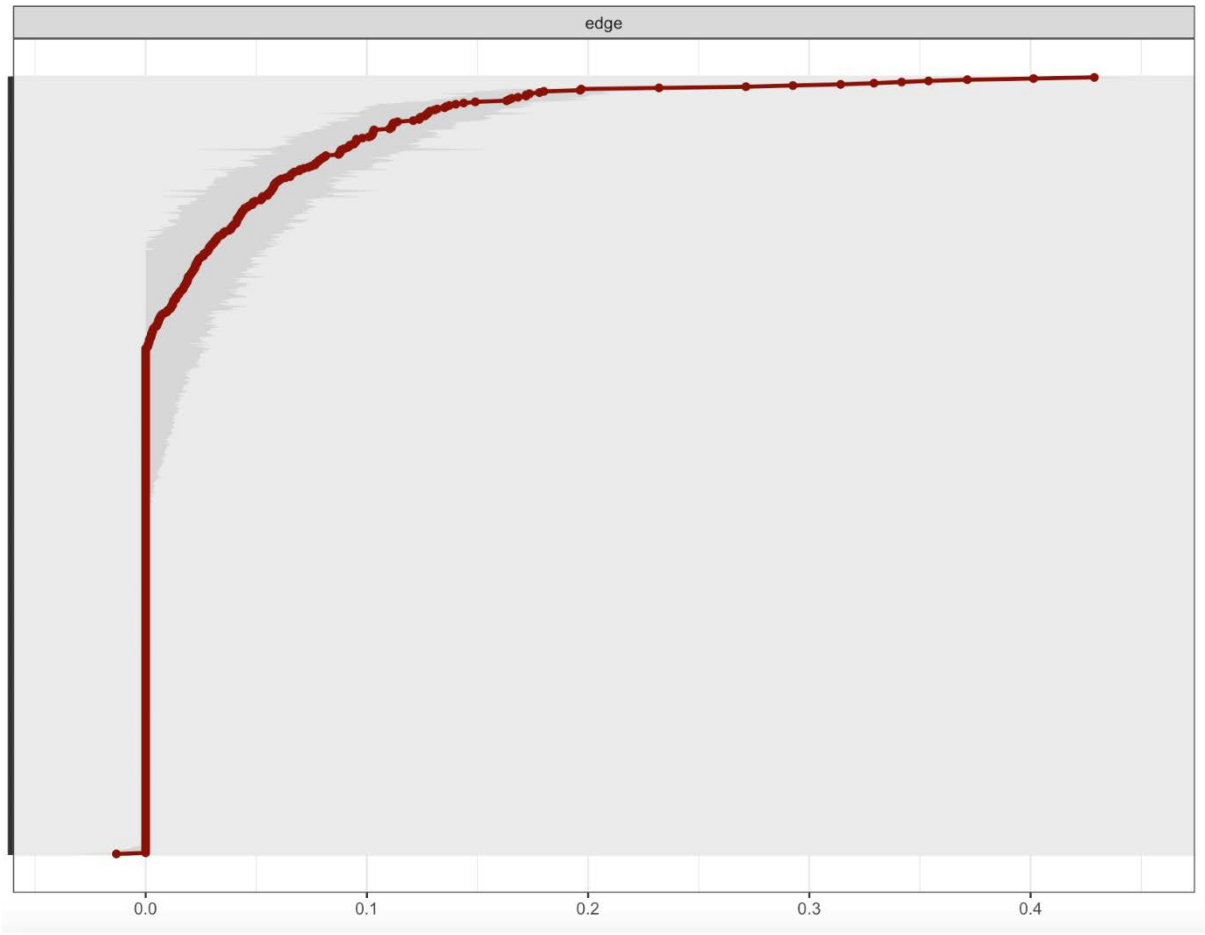
[1] Relative frequencies are given for cybersex addiction.

[2] Sum of the absolute values of the positive edges that connected a symptom to all the other symptoms.

[3] Number of the shortest paths connecting two symptoms that go through the symptom in question.

Finally, regarding model accuracy, Figure A3 showed 95% confidence intervals for all positive edges of the network. Some edges had overlapping confidence intervals, so interpreting edges' strength should be done cautiously.

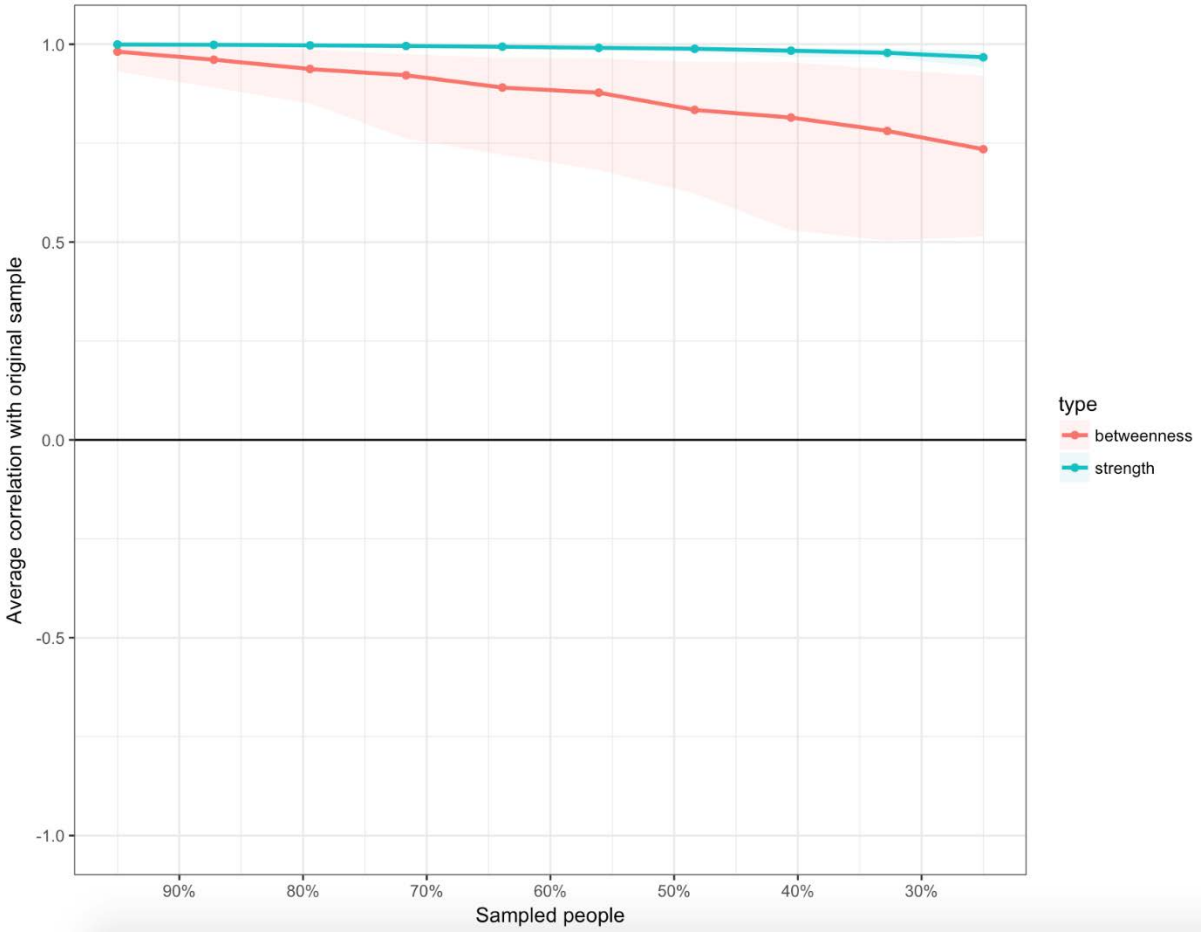
Supplementary figure A5. Bootstrapped confidence intervals of estimated edge-weights of the items network: sensitivity analysis



The line indicates the edge weights estimated in the sample, with each line corresponding to an edge. Edges are ordered from the lowest (bottom) to the highest (top). The area indicates the range from the 2.5th to the 97.5th quantiles (bootstrapped 95% confidence interval using 1,000 estimations). y-axis labels are removed to avoid cluttering. Confidence intervals for these edges are represented in red.

The stability of symptoms' centrality was high, suggesting that centrality results were reliable: CS-coefficient = 0.75 for strength and 0.44 for betweenness, and an average correlation of approximately .99 and .85 when the subsample contained 50% of the full dataset (Figure A4).

Supplementary figure A6. Average correlations between the order of centrality indices' for the full dataset and the estimated subsamples: sensitivity analysis



The line indicates the average correlation between centrality indices orders (1,000 estimations for each sample size). The area indicates the range from the 2.5th to the 97.5th quantiles (bootstrapped 95% confidence interval).