Work Addiction and Work Engagement: A Network Approach to Cross-Cultural Data

**Supplemental Materials**

**Method**

**Participants and Procedure**

Compensation for participation varied across samples. In Sample 1 and Sample 3, each individual had a small chance of being awarded a gift card (value of a card equaled 500 NOK in Norway and 50 PLN in Poland) as a form of compensation for participation. In Sample 2, no monetary or other material rewards were given for participation.

Thirteen individuals in Sample 1 and six individuals in Sample 3 reported that they work zero hours per week; therefore, their data were listwise deleted. Additionally, 62 individuals in Sample 1, 22 individuals in Sample 2, and 70 individuals in Sample 4 had missing data on at least one question regarding the symptoms of work addiction or the dimensions of work engagement; their data were also listwise deleted. In Sample 1, the removed observations had lower mean age (*M* = 27.16, *SD* = 7.15) than retained observations (*M* = 29.77, *SD* = 3.93), *t*(59.18) = 3.99, *p* < .001, and did not differ in terms of other sociodemographic characteristics. In Sample 2, the removed observations had a different distribution of the number of children (four individuals had zero children, two individuals had one child, and 14 individuals had 2 children) than the retained observations (see Table 1), χ2(4) = 21.60, *p* < 0.001, and did not differ in terms of other sociodemographic characteristics. In Sample 3, the remove observations more often were male, χ2(1) = 6.60, *p* = 0.010, had different distribution of the number of children (fifty individuals had zero children, two individuals had one child, and five individuals had 2 children), χ2(2) = 9.84, *p* = 0.007, had lower highest level of education (34 individuals had Bachelor’s degree and 24 individuals had Master’s degree), χ2(2) = 7.88, *p* = 0.019, and more often worked part-time, χ2(1) = 4.42, *p* = 0.036, than retained observations (see Table 1). The results of the analysis of contrasts for analyses of variance comparing the three samples are presented in the analytical code.

**Statistical Analyses**

**Alternative Methods of Estimating the Three Networks**

For the sake of comparison, we used two alternative methods for estimating networks in the three samples. The first method was a joint network estimation method similar to the one reported in the manuscript but selecting the tuning parameters of FGL based on information criteria instead of cross-validation. The second method was an individual estimation of the three networks using the bootnet 1.4.7 package (Epskamp et al., 2018) and the EBICglasso method with the threshold parameter equal to TRUE.

**Additional Analyses Regarding Jointly Estimated Networks via Cross-Validation**

We used the bootnet 1.4.7 package (Epskamp et al., 2018) to estimate bootstrapped 95% confidence intervals around edge weights in each network, to plot average correlations between the values of the standard version of node strength of networks sampled with persons dropped and the original sample, to estimate differences between edge weights in each network, and to estimate differences in values of the standard version of the node strength in each network. Moreover, we calculated the average predictability of the symptoms of work addiction, average predictability of the dimensions of work engagement, and reported exact values of predictability for each node in each network.

**Additional Analyses Regarding the Cross-Sample Network**

We estimated the cross-sample network using the bootnet 1.4.7 package (Epskamp et al., 2018) and the EBICglasso method with the threshold parameter equal to TRUE. A layout for visualizations of the cross-sample network and the cross-sample variability network was obtained via averaging the layouts for the three individually estimated networks.

To investigate the stability of the cross-sample network, we used the bootnet 1.4.7 package (Epskamp et al., 2018), using nonparametric bootstrapping and case bootstrapping based on 1000 bootstrap samples. As a measure of network stability, we used the correlation stability coefficient, which represents the maximum proportion of cases that can be dropped, such that with 95% probability, the correlation between original centrality measures and centrality of networks based on subsets is .70 or higher. The correlation stability coefficient higher than .50 is regarded as an indicator of good stability, and the correlation stability coefficient higher than .25 is regarded as an indicator of acceptable stability (Epskamp et al., 2018). Additionally, we estimated bootstrapped 95% confidence intervals around edge weights in the cross-sample network, plotted average correlations between the values of the standard version of node strength of networks sampled with persons dropped and the original sample, estimated differences between edge weights in the cross-sample network, and estimated differences in values of the standard version of the node strength in the cross-sample network.

We estimated node centrality based on the node strength. A standard version of the node strength is a metric equal to the sum of absolute values of all edges of a given node to all other nodes. We argue that the standard version of the node strength could poorly identify bridge nodes when tightly connected clusters of nodes are weakly connected with each other. Therefore, we created a modified version of the node strength which should better capture bridge nodes in this special case. The modified version of the node strength is a metric equal to the sum of absolute values of all edges of a given node to all other nodes which represent different psychological phenomenon (e.g., for absorption, this is the sum of absolute values of all edges which absorption has with work addiction symptoms).

To estimate the predictability of nodes, we used the mgm 1.2-11 package (Haslbeck, 2019), which estimates predictability based on individually estimated networks. For continuous data (dimensions of work engagement), node predictability indicates the percentage of variance explained by all of its neighbours (*R*2). For ordinal data (symptoms of work addiction), node predictability indicates how much a node can be predicted by all of its neighbours, beyond what is trivially predicted by the marginal distribution of this node (for a detailed explanation, see Haslbeck & Waldorp, 2018).

**Results**

**Alternative Methods of Estimating the Three Networks**

The three networks estimated individually for the three samples are visualized in Figure S1. The three networks estimated jointly (via information criteria) for the three samples are visualized in Figure S2.

**Additional Analyses Regarding Jointly Estimated Networks via Cross-Validation**

The three correlation matrices used to estimate the jointly estimated networks (via k-fold cross-validation) and the three edge weights matrices of the three jointly estimated networks (via k-fold cross-validation) are available in the folder ‘exact\_values.’ The bootstrapped 95% confidence intervals around edge weights in each network are visualized in Figure S3 (all supplemental figures are available in the folder ‘supplemental\_figures’). The average correlations between the values of the standard version of node strength of networks sampled with persons dropped and the original sample are visualized in Figure S4. The differences between the edge weights in each network are visualized in Figure S5. The differences between the values of the standard version of the node strength in each network are visualized in Figure S6. The Average predictability of symptoms of work addiction equaled 22.9% in Network 1, 27.5% in Network 2, and 29.4% in Network 3 (marginals accounted for 42.9%, 34.1%, and 37.9%, respectively). The average predictability of dimensions of work engagement equaled 67.9% in Network 1, 59.2% in Network 2, and 59.8% in Network 3. The exact values of node predictability of each node in each network are available in the folder ‘exact\_values’.

**Additional Analyses Regarding the Cross-Sample Network**

The correlation matrix used to estimate the cross-sample network and the edge weights matrix of the cross-sample network are available in the folder ‘exact\_values’. The bootstrapped 95% confidence intervals around edge weights of the cross-sample network are visualized in Figure S7. The average correlations between the values of the standard version of node strength of networks sampled with persons dropped and the original sample are visualized in Figure S8. The differences between the edge weights in the cross-sample network are visualized in Figure S9. The differences between the values of the standard version of the node strength in the cross-sample network are visualized in Figure S10. Average predictability in the cross-sample network equaled 36.4%. The average predictability of symptoms of work addiction in the cross-sample network equaled 23.9% (marginals accounted for 37.6%). The average predictability of dimensions of work engagement in the cross-sample network equaled 65.6%. The exact values of node predictability in the cross-sample network are available in the folder ‘exact\_values.’