**Supplementary File 1**

**Binary Logistic Regression**

Binary logistic regression is used to identify a model to predict (1) Behavior Regulation Index (BRI) and (2) Metacognitive Index (MI) from a priori identified variables that have been identified to affect executive functioning (pain intensity, pain interference, anxiety, depression, body mass index [BMI], education and history of participating in contact sports).

**Behavior Regulatory Index**

The following tables presents results of binary logistic regression predicting BRI without selection showing unadjusted parameter estimates.

| **Analysis of Maximum Likelihood Estimates** |
| --- |
| **Parameter** |  | **DF** | **Estimate** | **StandardError** | **WaldChi-Square** | **Pr > ChiSq** |
| **Intercept** |  | 1 | 161.4 | 102.3 | 2.4858 | 0.1149 |
| **Contact Sport** | **0** | 1 | -96.7225 | 57.3854 | 2.8409 | 0.0919 |
| **Contact Sport** | **1** | 0 | 0 | . | . | . |
| **Education** |  | 1 | 21.8355 | 12.9325 | 2.8508 | 0.0913 |
| **BDI\_b** | **0** | 1 | 43.5718 | 27.4013 | 2.5285 | 0.1118 |
| **BDI\_b** | **1** | 0 | 0 | . | . | . |
| **BAI\_b** | **0** | 1 | 152.5 | 88.7105 | 2.9543 | 0.0857 |
| **BAI\_b** | **1** | 0 | 0 | . | . | . |
| **Age** |  | 1 | 3.8145 | 2.2397 | 2.9007 | 0.0885 |
| **BMI\_c** |  | 1 | 4.4505 | 2.6617 | 2.7958 | 0.0945 |
| **Pain Intensity** |  | 1 | 4.4143 | 3.4834 | 1.6059 | 0.2051 |
| **Pain Interference** |  | 1 | 11.8225 | 6.9765 | 2.8717 | 0.0901 |

| **Unadjusted Odds Ratio Estimates** |
| --- |
| **Effect** | **Point Estimate** | **95% WaldConfidence Limits** |
| **Sport 0 vs 1** | <0.001 | <0.001 | >999.999 |
| **Education** | >999.999 | 0.030 | >999.999 |
| **BDI\_b 0 vs 1** | <0.001 | <0.001 | >999.999 |
| **BAI\_b 0 vs 1** | >999.999 | <0.001 | >999.999 |
| **Age** | 0.022 | <0.001 | 1.778 |
| **BMI\_c** | 85.669 | 0.465 | >999.999 |
| **Pain Intensity** | 82.623 | 0.090 | >999.999 |
| **Pain Interference** | <0.001 | <0.001 | 6.367 |

Our next step is to run the same model with all variables using backward selection at selection entry and exclusion level at p=0.05. The following tables present results of this model. Pain interference, anxiety and BMI were significant predictors of BRI, where as all others were sequentially removed.

| **Analysis of Maximum Likelihood Estimates** |
| --- |
| **Parameter** |  | **DF** | **Estimate** | **StandardError** | **WaldChi-Square** | **Pr > ChiSq** |
| **Intercept** |  | 1 | -10.4989 | 6.1431 | 2.9209 | 0.0874 |
| **BAI\_b** | **1** | 1 | 5.0268 | 1.9435 | 6.6898 | 0.0097 |
| **BAI\_b** | **1** | 0 | 0 | . | . | . |
| **BMI\_c** |  | 1 | 0.4769 | 0.2304 | 4.2835 | 0.0385 |
| **Pain Interference** |  | 1 | 2.898 | 0.1399 | 6.0830 | 0.0136 |

| **Odds Ratio Estimates** |
| --- |
| **Effect** | **Point Estimate** | **95% WaldConfidence Limits** |
| **BAI\_b 0 vs 1** | 152.451 | 3.379 | >999.999 |
| **BMI\_c** | 1.611 | 1.026 | 2.531 |
| **Pain Interference** | 1.412 | 1.073 | 1.8587 |

| **Summary of Backward Elimination** |
| --- |
| **Step** | **EffectRemoved** | **DF** | **NumberIn** | **WaldChi-Square** | **Pr > ChiSq** | **VariableLabel** |
| **1** | **Pain Intensity** | 1 | 7 | 1.6059 | 0.2051 | Pain Intensity |
| **2** | **BDI\_b** | 1 | 6 | 1.3326 | 0.2483 | BDI\_b |
| **3** | **Education** | 1 | 5 | 0.8070 | 0.3690 | Education |
| **4** | **Sport** | 1 | 4 | 1.2653 | 0.2607 | Sport |
| **5** | **Age** | 1 | 3 | 2.8430 | 0.0918 | Age |

The next step is to assess collinearity, we performed correlation analysis (Pearson) between the three significant predictors and all three were significantly correlated.

| **Pearson Correlation Coefficients, N = 42Prob > |r| under H0: Rho=0** |
| --- |
|  | **BAI\_b** | **BMI\_c** | **PainInterference** |
| **BAI\_bBAI\_b** | 1.00000 | 0.491040.0010 | 0.480730.0013 |
| **BMI\_cBMI\_c** | 0.491040.0010 | 1.00000 | 0.444170.0032 |
| **PainInterferencePainInterference** | 0.480730.0013 | 0.444170.0032 | 1.00000 |

Our next model will include all significant variables and interaction of significant variables. Results for this model are presented in the following table. All three interaction terms were not significant predictors and their r < 0.8 and were removed from the model.

| **Analysis of Maximum Likelihood Estimates** |
| --- |
| **Parameter** |  | **DF** | **Estimate** | **StandardError** | **WaldChi-Square** | **Pr > ChiSq** |
| **Intercept** |  | 1 | -10.4989 | 6.1431 | 2.9209 | 0.0874 |
| **BAI\_b** | **1** | 1 | 5.0268 | 1.9435 | 6.6898 | 0.0097 |
| **BAI\_b** | **1** | 0 | 0 | . | . | . |
| **BMI\_c** |  | 1 | 0.4769 | 0.2304 | 4.2835 | 0.0385 |
| **Pain Interference** |  | 1 | 2.899 | 0.1399 | 6.0830 | 0.0136 |

| **Odds Ratio Estimates** |
| --- |
| **Effect** | **Point Estimate** | **95% WaldConfidence Limits** |
| **BAI\_b 0 vs 1** | 152.451 | 3.379 | >999.999 |
| **BMI\_c** | 1.611 | 1.026 | 2.531 |
| **Pain Interference** | 1.412 | 1.073 | 1.8587 |

| **Summary of Backward Elimination** |
| --- |
| **Step** | **EffectRemoved** | **DF** | **NumberIn** | **WaldChi-Square** | **Pr > ChiSq** | **VariableLabel** |
| **1** | **BMI\_c\*BAI\_b** | 1 | 5 | 0.0259 | 0.8722 |  |
| **2** | **Pain Interferen\*BAI\_b** | 1 | 4 | 0.1636 | 0.6859 |  |
| **3** | **BMI\_c\*Pain Interferen** | 1 | 3 | 1.3514 | 0.2450 |  |

Hence, our final model only includes the three significant variables. Model fit characteristics of this model are presented below.

| **Association of Predicted Probabilities and Observed Responses** |
| --- |
| **Percent Concordant** | 96.3 | **Somers' D** | 0.926 |
| **Percent Discordant** | 3.7 | **Gamma** | 0.926 |
| **Percent Tied** | 0.0 | **Tau-a** | 0.293 |
| **Pairs** | 272 | **c** | 0.963 |

On cross validation, the accuracy of the model decreases from 0.963 to 0.871.

| **Association of Predicted Probabilities and Observed Responses** |
| --- |
| **Percent Concordant** | 87.1 | **Somers' D** | 0.743 |
| **Percent Discordant** | 12.9 | **Gamma** | 0.743 |
| **Percent Tied** | 0.0 | **Tau-a** | 0.235 |
| **Pairs** | 272 | **c** | 0.871 |

**Metacognition**

The following tables presents results of binary logistic regression predicting MI without selection.

| **Analysis of Maximum Likelihood Estimates** |
| --- |
| **Parameter** |  | **DF** | **Estimate** | **StandardError** | **WaldChi-Square** | **Pr > ChiSq** |
| **Intercept** |  | 1 | -24.6404 | 296.8 | 0.0069 | 0.9338 |
| **Sport** | **0** | 1 | 2.8551 | 3.5763 | 0.6373 | 0.4247 |
| **Sport** | **1** | 0 | 0 | . | . | . |
| **Education** |  | 1 | 4.0101 | 3.0021 | 1.7843 | 0.1816 |
| **BDI\_b** | **0** | 1 | 25.0160 | 296.6 | 0.0071 | 0.9328 |
| **BDI\_b** | **1** | 0 | 0 | . | . | . |
| **BAI\_b** | **0** | 1 | 8.7025 | 7.0252 | 1.5345 | 0.2154 |
| **BAI\_b** | **1** | 0 | 0 | . | . | . |
| **Age** |  | 1 | -0.2016 | 0.1546 | 1.7001 | 0.1923 |
| **BMI\_c** |  | 1 | -0.1609 | 0.3412 | 0.2224 | 0.6372 |
| **Pain Intensity** |  | 1 | 2.7123 | 2.5944 | 1.0930 | 0.2958 |
| **Pain Interference** |  | 1 | 2.322 | 0.4427 | 0.9458 | 0.3308 |

| **Odds Ratio Estimates** |
| --- |
| **Effect** | **Point Estimate** | **95% WaldConfidence Limits** |
| **Sport 0 vs 1** | 17.376 | 0.016 | >999.999 |
| **Education** | 55.151 | 0.154 | >999.999 |
| **BDI\_b 0 vs 1** | >999.999 | <0.001 | >999.999 |
| **BAI\_b 0 vs 1** | >999.999 | 0.006 | >999.999 |
| **Age** | 0.817 | 0.604 | 1.107 |
| **BMI\_c** | 0.851 | 0.436 | 1.662 |
| **Pain Intensity** | 0.864 | 0.193 | >999.999 |
| **Pain Interference** | 0.650 | 0.273 | 1.548 |

Our next step is to run the same model with all variables using backward selection at selection entry and exclusion level at p=0.05. The following tables present results of this model. Pain interference was the only significant predictor of MI, whereas all others were sequentially removed.

| **Analysis of Maximum Likelihood Estimates** |
| --- |
| **Parameter** | **DF** | **Estimate** | **StandardError** | **WaldChi-Square** | **Pr > ChiSq** |
| **Intercept** | 1 | 4.1213 | 1.1312 | 13.2733 | 0.0003 |
| **Pain Interference** | 1 | 3.8715 | 1.0831 | 9.6571 | 0.0019 |

| **Odds Ratio Estimates** |
| --- |
| **Effect** | **Point Estimate** | **95% WaldConfidence Limits** |
| **Pain Interference** | 1.295 | 1.100 | 1.524 |

| **Summary of Backward Elimination** |
| --- |
| **Step** | **EffectRemoved** | **DF** | **NumberIn** | **WaldChi-Square** | **Pr > ChiSq** | **VariableLabel** |
| **1** | **BDI\_b** | 1 | 7 | 0.0071 | 0.9328 | BDI\_b |
| **2** | **Sport** | 1 | 6 | 0.0082 | 0.9277 | Sport |
| **3** | **BMI\_c** | 1 | 5 | 0.4226 | 0.5156 | BMI\_c |
| **4** | **Age** | 1 | 4 | 0.5347 | 0.4646 | Age |
| **5** | **Education** | 1 | 3 | 2.9238 | 0.0873 | Education |
| **6** | **BAI\_b** | 1 | 2 | 3.0989 | 0.0783 | BAI\_b |
| **7** | **Pain Intensity** | 1 | 1 | 2.6888 | 0.1011 | Pain Intensity |

Since there was only one significant predictor, no collinearity analysis was performed. Model fit of this model is presented below.

| **Association of Predicted Probabilities and Observed Responses** |
| --- |
| **Percent Concordant** | 81.2 | **Somers' D** | 0.692 |
| **Percent Discordant** | 12.0 | **Gamma** | 0.742 |
| **Percent Tied** | 6.7 | **Tau-a** | 0.274 |
| **Pairs** | 341 | **c** | 0.846 |

On cross validation, the accuracy of the model decreases from 0.812 to 0.772.



| **Association of Predicted Probabilities and Observed Responses** |
| --- |
| **Percent Concordant** | 75.7 | **Somers' D** | 0.513 |
| **Percent Discordant** | 24.3 | **Gamma** | 0.513 |
| **Percent Tied** | 0.0 | **Tau-a** | 0.203 |
| **Pairs** | 341 | **c** | 0.757 |