Validation of the Utrecht Work Engagement Scale (UWES) in the Czech Republic

Heveri Martin1, Lukas Novak1, Iva Polackova Solcova1,2, & Peter Tavel1

1 Palacky University Olomouc - Social Health Institute

2 The Czech Academy of Sciences, Institute of Psychology, Prague, Czech Republic

Author note

The authors made the following contributions. Heveri Martin: Conceptualization, Writing - Original Draft Preparation, Writing - Review & Editing; Lukas Novak: Writing - Review & Editing,, Writing - Original Draft Preparation, Writing - Review & Editing, statistical analysis; Iva Polackova Solcova: Writing - Review & Editing; Peter Tavel: Writing - Review & Editing.

Correspondence concerning this article should be addressed to Lukas Novak, Univerzitni 244/22, 771 11, Olomouc, Czech Republic. E-mail: [lukas.novak@oushi.upol.cz](mailto:lukas.novak@oushi.upol.cz)

Abstract

Introduction

One or two sentences providing a **basic introduction** to the field, comprehensible to a scientist in any discipline.

Two to three sentences of **more detailed background**, comprehensible to scientists in related disciplines.

One sentence clearly stating the **general problem** being addressed by this particular study.

Methods

Sample of 707 employees (Age: M = 43.65, SD = 10.08, Females: 38.47%) recruited from different companies in the Czech Republic was used for purpouses of this study. Neuroticism, extraversion, self-efficacy, spirituality, chronic health diseases and frequency of health risk behavior were measured.

Results

Higher UWES total score was reported in professional workers, chief workers and in people with higher vocational school or university. The confirmatory factor analysis (CFA) supported the original three-factor solution: χ2 (24) = 75.373; p < 0.001; CFI = 0.999; TLI = 0.999; RMSEA = 0.058; SRMR = 0.021. Measrement equivalence suggested that on configural, metric, scalar and strict level, the UWES assess work engagement invariantly between males and females. The UWES had an excelent internal consistency (α = 0.96, McDonald’s ω = 0.96) and its convergent validity was supported by positive association with extraversion, self-efficacy and by negative association with neuroticism. Logistic regression revealed that higher score in the UWES was associated with lower chance of developing skin diseases and pain of unclear origin. There was no association of the UWES and health risk behaviours such as smoking, alcohol drinking or illegal drug use.

Conclusion

Two or three sentences explaining what the **main result** reveals in direct comparison to what was thought to be the case previously, or how the main result adds to previous knowledge.

One or two sentences to put the results into a more **general context**.

Two or three sentences to provide a **broader perspective**, readily comprehensible to a scientist in any discipline.

*Keywords:* keywords

*Word count:* X

Validation of the Utrecht Work Engagement Scale (UWES) in the Czech Republic

# 1 Introduction

Based on theoretical assumptions and previous empirical evidence ([Chan, Ho, Ip, & Wong, 2020](#ref-Chan_Ho_Ip_Wong_2020)) we expected significant positive association between self-efficacy and UWES total score (Hypotheses x).

# 2 Methods

## 2.1 Participants

From the survey (*n* = 1662), we excluded participants being either without work (*n* = 187), pensioners (*n* = 468) or those who did not answer a question regarding economical status (*n* = 223) resulting in 784 participants. To increase data quality, we removed subjects finishing the survey in a short period of time i.e. < 15 minutes (*n* = 6). The survey typically lasted > 30 minutes. We also excluded respondents answering discrepantly to quality check items (*n* = 71). These items included information about weight, height and age. Tolerance in these control questions was set on 2 kilograms, 2 centimeters, and 2 years respectively. After removal of these subjects, the final number of participants was 707 (Age: *M* = 43.65, *SD* = 10.08, Females: 38.47%).

## 2.2 Measures

### 2.2.1 Utrecht Work Engagement Scale (UWES).

### 2.2.2 Daily Spiritual Experience Scale (DSES).

Internal consistency of the DSES was excellent: Cronbach’s = 0.96 95% CI[0.95 - 0.97] and McDonald’s = 0.96 95% CI[0.95 - 0.97].

### 2.2.3 General Self Efficacy Scale (GSES).

Internal consistency of the GSES was excellent: Cronbach’s = 0.95 95% CI[0.94 - 0.95] and McDonald’s = 0.95 95% CI[0.94 - 0.95].

### 2.2.4 Big Five Inventory - Neuroticism subscale (BFI\_N).

Internal consistency of the BFI\_N was good: Cronbach’s = 0.87 95% CI[0.86 - 0.89] and McDonald’s = 0.87 95% CI[0.86 - 0.89].

### 2.2.5 Big Five Inventory - Extraversion subscale (BFI\_E).

Internal consistency of the BFI\_E was good: Cronbach’s = 0.85 95% CI[0.84 - 0.87] and McDonald’s = 0.85 95% CI[0.84 - 0.87].

## 2.3 Data analysis

Inspection of histograms and results of the Martia test of multivariate skewness and kurtouses indicated that normality assumption is violated in the UWES items. Moreover, examination of residual plots and result of the Breusch-Pagan test ( = 7.21, *df* = 1, p = 0.007) suggested heteroscedasticity. Thus, methods not requiring parametric assumptions were used. The Little MCAR test provided an evidence that missing values are missing on random. Thus, as there was not a large number of missing values (*n* = 60), incomplete cases were deleted listwise. Factor structure of the instrument was investigated via Confirmatory Factor Analysis (CFA). Original 3 dimensional factor structure was tested along with two and one factor solution, frequently reported across studies - see review of Kulikowski ([2017](#ref-Kulikowski_2017)). Item composition of tested factor solutions can be found in the study of Willmer, Westerberg Jacobson, and Lindberg ([2019](#ref-Willmer_2019)). Kaiser Meyer Olkin (KMO) measure together with Bartlett test of sphericity were applied to assess factorability of the UWES data. Five indices were used to inspect model fit: 1) Mean Square Error of Approximation (RMSEA); 2) Standardized Root Mean Square Residual (SRMR); 3) chi-square test; 4) Comparative Fit index (CFI) and 5) Tucker-Lewis index (TLI). In the first two indices, values below 0.08 reflects an acceptable fit and below 0.05 a good fit ([Civelek, 2018](#ref-civelek2018essentials); [Hoe, 2008](#ref-hoe_issues_2008); [Hooper, Coughlan, & Mullen, 2008](#ref-hooper_structural_2008); [Vandenberg & Lance, 2000](#ref-vandenberg_review_2000)). In the last two indices, values above 0.95 suggest an acceptable fit ([Jackson, Gillaspy Jr, & Purc-Stephenson, 2009](#ref-jackson_reporting_2009)) and above 0.97 a good fit ([Schermelleh Engel, Moosbrugger, & Muller, 2003](#ref-schermelleh_engel_evaluating_2003)). Diagonally Weighted Least Squares estimator (DWLS) on polychoric correlation matrix was used to fit CFA models.

Invariance of a measurement was explored between males and females. Configural, metric, scalar and strict invariance was supported, in the mutigoup CFA if CFA was < 0.01 between invariance models ([Putnick & Bornstein, 2016](#ref-Putnick_Bornstein_2016)). The scale reliability was measured by the McDonald’s and also by the Cronbach’s . Convergent validity was inspected by zero order Spearman rank correlations with self-efficacy, neuroticism and with extroversion. Divergent validity was measured by correlation of the UWES with spirituality.

Due to the non-normal distribution of the data, an association between the chronic health illnesses, health risk behaviour and UWES was calculated using logistic regression. In the logistic models, outcome variable was presence of an individual chronic illness or practise of health risk behaviour. The UWES score was set as a predictor. Education and work position were covariates. Both crude and adjusted effect were estimated. The p-values were corrected by Bonferroni correction.

Comparison between socio-demographic groups in the UWES total and subscale score, was performed by Mann–Whitney U test and by Kruskal–Wallis test. For post-hoc testing, Games-Howell and Dunn test were utilized. In these two tests, effect size was reported in Vargha and Delaney ([Vargha & Delan, 2000](#ref-vargha_critique_2000)). The interpretation of the is as follows: small effect (0.56 - 0.64), medium effect (0.64 - 0.71), large effect (> 0.71). All statistical calculations were conducted in R [Version 4.1.0; R Core Team ([2021](#ref-R-base))]. Primary packages used for analysis included: *lavaan* ([Rosseel, 2012](#ref-R-lavaan)), *papaja* ([Aust & Barth, 2020](#ref-R-papaja)) *psych* ([Revelle, 2021](#ref-R-psych)), *usf* ([Peters, 2021](#ref-R-ufs)).

# 3 Results

## 3.1 Socio-demographic results

Results of the Kruskal-Wallis test followed by the Games-Howell and the Dunn test revealed that there are significant differences in socio-demographic groups in the UWES total and subscale scores: professional workers had significantly higher score in the UWES total and Vigor, Absorption and Dedication subscales scores as compared with workers. Similarly, chief workers reported higher UWES total score and also Dedication and Vigor subscale scores compared with workers (see Table 1). In terms of education, people with higher vocational school or university had significantly higher total and Absorption subscale score as compared with people with non graduation high school or lower education (Table 1). There were not other significant differences between socio-demographic groups. For means and standard deviations of the UWES total and subscale score see online Supplementary table 1.

Table 1:

*Socio-demographic results of the three samples*

| Variables | value | n(%) | UWES\_T | UWES\_D | UWES\_A | UWES\_V |
| --- | --- | --- | --- | --- | --- | --- |
| Work\_position | Worker | 337 (48%) | Professional worker: x2(536)=3.45\*\*, A=0.42 | Professional worker: x2(532)=3.51\*\*, A=0.42 | Professional worker: x2(538)=4.02\*\*\*, A=0.41 | Chief worker: x2(156)=3.6\*\*, A=0.39 |
|  | Worker | 337 (48%) | Chief worker: x2(150)=3.85\*\*\*, A=0.38 | Chief worker: x2(144)=3.57\*\*, A=0.39 | Chief worker: x2(140)=3.57\*\*, A=0.38 |  |
|  | Professional worker | 227 (32%) |  |  |  |  |
|  | Chief worker | 84 (12%) |  |  |  |  |
| Education | Basic school | 22 (3%) |  |  |  |  |
|  | Non graduation high school or lower | 266 (38%) | Higher vocational school or University: x2(434)=2.89\*, A=0.35 |  | Higher vocational school or University: x2(426)=3.74\*\*, A=0.34 |  |
|  | High school | 200 (28%) |  |  |  |  |
|  | Higher vocational school or University | 219 (31%) |  |  |  |  |
| Family\_status | Not in relationship | 116 (16%) |  |  |  |  |
|  | In relationship | 140 (20%) |  |  |  |  |
|  | Married | 324 (46%) |  |  |  |  |
|  | Divorced | 116 (16%) |  |  |  |  |
|  | Widow/Widower | 11 (2%) |  |  |  |  |
| Gender | Male | 435 (62%) |  |  |  |  |
|  | Female | 272 (38%) |  |  |  |  |
| Religiosity | Yes, I am a member of church | 54 (8%) |  |  |  |  |
|  | Yes, but I am not a member of a church | 144 (20%) |  |  |  |  |
|  | No | 352 (50%) |  |  |  |  |
|  | No, I am convinced atheist | 127 (18%) |  |  |  |  |

Table 2:

*Means and standard deviations of the UWES total and subscale scores*

| Variables | value | UWES\_T: M(SD) | UWES\_A: M(SD) | UWES\_D: M(SD) | UWES\_V: M(SD) |
| --- | --- | --- | --- | --- | --- |
| Work\_position | Worker | 37.76 (13.12) | 12.6 (4.54) | 12.67 (4.84) | 12.49 (4.44) |
|  | Professional worker | 41.28 (10.95) | 14.01 (3.76) | 14 (4.11) | 13.26 (3.81) |
|  | Chief worker | 43.08 (10.85) | 14.4 (4.04) | 14.55 (4.17) | 14.13 (3.53) |
| Education | Basic school | 33.68 (14.67) | 11.68 (5.23) | 11.05 (5.03) | 10.95 (4.85) |
|  | Non graduation high school or lower | 38.45 (13.16) | 12.77 (4.68) | 12.96 (4.81) | 12.72 (4.42) |
|  | High school | 39.59 (12.32) | 13.2 (4.3) | 13.39 (4.5) | 13 (4.21) |
|  | Higher vocational school or University | 41.73 (10.56) | 14.23 (3.47) | 14.06 (4.21) | 13.43 (3.62) |
| Family\_status | Not in relationship | 36.63 (12.07) | 12.23 (4.34) | 12.38 (4.46) | 12.02 (4.05) |
|  | In relationship | 40.25 (11.79) | 13.8 (4.11) | 13.62 (4.37) | 12.83 (4.1) |
|  | Married | 40.15 (11.98) | 13.54 (4.12) | 13.47 (4.53) | 13.14 (4.03) |
|  | Divorced | 40.29 (13.52) | 13.13 (4.64) | 13.69 (4.95) | 13.47 (4.52) |
|  | Widow/Widower | 45.5 (12.64) | 14.8 (4.87) | 15.2 (4.66) | 15.5 (3.69) |
| Gender | Male | 39.02 (11.83) | 13.11 (4.12) | 13.21 (4.38) | 12.7 (4.07) |
|  | Female | 40.8 (12.94) | 13.7 (4.51) | 13.66 (4.87) | 13.45 (4.25) |
| Religiosity | Yes, I am a member of church | 40.68 (11.1) | 13.56 (3.86) | 13.8 (4.44) | 13.32 (3.64) |
|  | Yes, but I am not a member of a church | 38.59 (12.71) | 13.09 (4.53) | 12.98 (4.65) | 12.52 (4.23) |
|  | No | 40.11 (12.2) | 13.43 (4.23) | 13.54 (4.5) | 13.14 (4.14) |
|  | No, I am convinced atheist | 39.27 (12.51) | 13.21 (4.32) | 13.18 (4.74) | 12.88 (4.29) |

*Note.* SD = standard deviation, M = mean, UWES\_T = Utrecht Work Engagement Scale - Total score, UWES\_A = Utrecht Work Engagement Scale - Absorption subscale, UWES\_D = Utrecht Work Engagement Scale - Dedication subscale, UWES\_V = Utrecht Work Engagement Scale - Vigor subscale

## 3.2 Confirmatory Factor Analysis

Bartlett test ( (36) = 5,565.42, p < .001) as well as KMO (0.96) revealed that UWES data are sufficiently correlated to perform CFA. In the first step, original-three factor model was fitted. Results indicated a good fit of this three dimensional solution (see Figure 1, Table 2). Modification indices did not suggested high change in in case of releasing constrains between UWES items. Factor loadings () in the three factor solution were high as were correlations between the three factors (see Figure 1). Correlation between residuals in manifest variables was low: *r* = 0.05. In the second step, two factor model was tested: results suggested that two-dimensional model yields lower model fit as compared to the original-three factor model (see Table 2). This was supported by the significant difference test with Satorra Bentler correction: (2) = 81.12; p < .001. Factor loadings of the two factor model were high ranging from: 0.82 to 0.92. Finally, fit of unidimensional solution was assessed: overall, this model had the worst goodness of fit indices values and factor loadings ( = 0.80 - 0.92) as compared with the two and the three factor model (see Table 2). The difference test suggested lower fit of unidimensional solution as compared with the three factor solution: (3) = 132.99; p < .001. In the last step, hierarchical model of the UWES was assessed: after model was fitted, CFA parameters yielded no change as compared with the original-three factor model suggesting that the original factor model would be more parsimonious solution. Taken together, this results supports superiority the original-three factor model over two and one factor solution in terms of fit with the data.

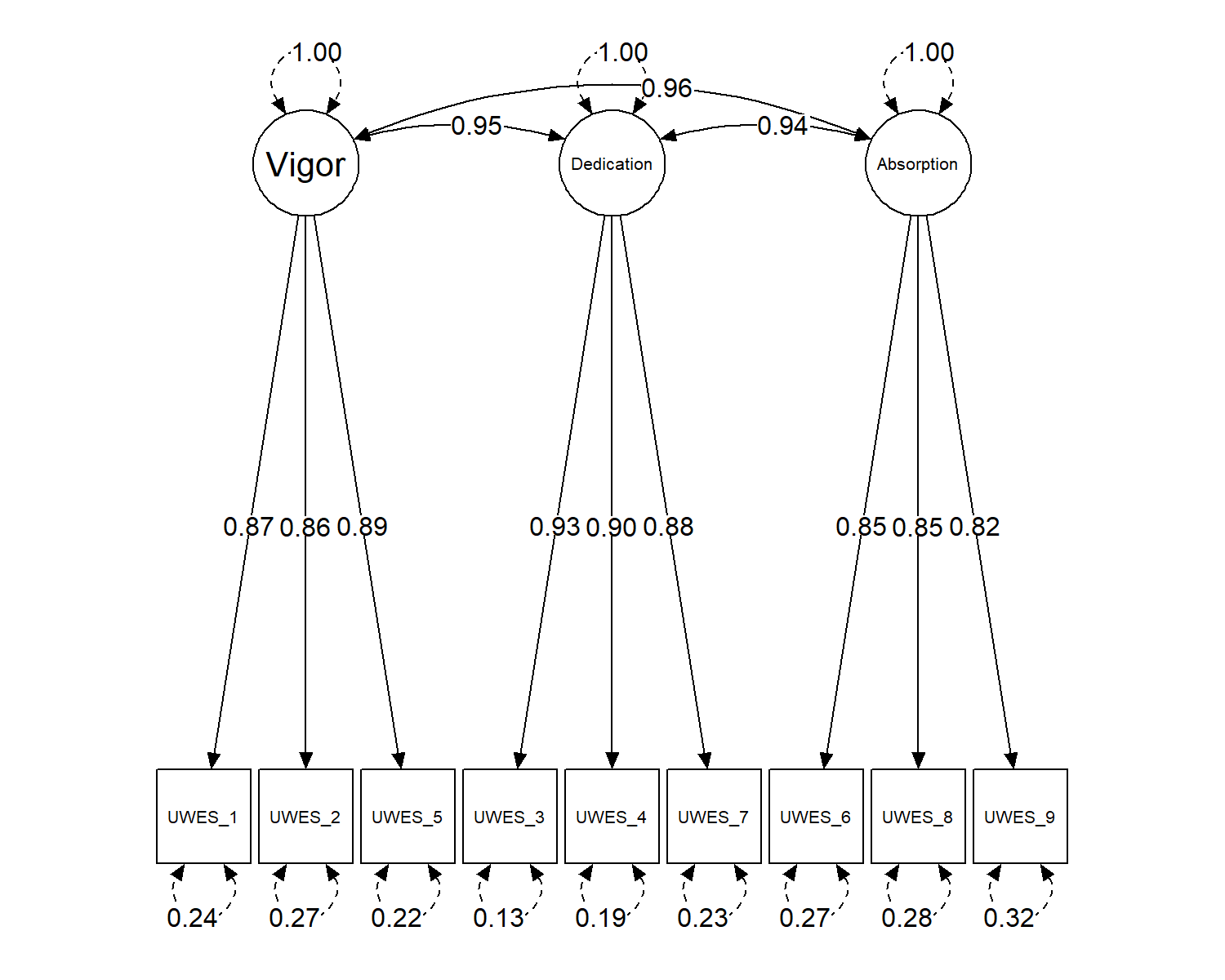


Figure : *Figure* *1.*  SEM plot of the UWES three factor solution with factor loadings and item residuals.

Table 3:

*Fit statistic of the models tested in CFA*

| Tested model | x2 | df | p-value | CFI | TLI | RMSEA | SRMR |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Hierarchical factor model | 75.373 | 24 | p < .001 | 0.999 | 0.999 | 0.058 90% CI (0.043-0.072) | 0.021 |
| One factor model | 124.37 | 27 | p < .001 | 0.999 | 0.998 | 0.075 90% CI (0.062-0.088) | 0.026 |
| Two factor model | 105.906 | 26 | p < .001 | 0.999 | 0.999 | 0.069 90% CI (0.056-0.083) | 0.024 |
| Three factor model | 75.373 | 24 | p < .001 | 0.999 | 0.999 | 0.058 90% CI (0.043-0.072) | 0.021 |

*Note.* x2 = chi-square, df = degrees of freedom, CFI = Comparative Fit Index, TLI = Tucker-Lewis index, RMSEA = Root Mean Square Error of Approximation , CI = Confidence Interval, SRMR = Standardized Root Mean Square Residual

## 3.3 Item statistic and reliability

Internal consistency of the UWES total score was excellent: Cronbach’s = 0.96 95% CI[0.96 - 0.96] and McDonald’s = 0.96 95% CI[0.96 - 0.96]. When assessing the internal consistency of the UWES subcales, the highest values yielded Dedication subscale: Cronbach’s = 0.93 95% CI[0.92 - 0.94] and McDonald’s = 0.93 95% CI[0.92 - 0.94] followed by the Vigor subscale: Cronbach’s = 0.90 95% CI[0.89 - 0.91] and McDonald’s = 0.90 95% CI[0.89 - 0.91]. The lowest internal consistency was observed in the Absorption factor: Cronbach’s = 0.88 95% CI[0.86 - 0.89] and McDonald’s = 0.88 95% CI[0.86 - 0.89]. The Table 3 illustrates statistics of UWES items. In general, correlations between these items and item-total correlations were high. The lowest item-total correlation had item 9.

Table 4:

*Item statistic and Polychoric correlations between the UWES items*

| UWES\_1 | UWES\_2 | UWES\_3 | UWES\_4 | UWES\_5 | UWES\_6 | UWES\_7 | UWES\_8 | UWES\_9 | ITC | Skewness | kurtosis | M(SD) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 |  |  |  |  |  |  |  |  | 0.84 | -0.35 | -0.28 | 4.31 (1.48) |
| 0.79\*\*\* | 1 |  |  |  |  |  |  |  | 0.81 | -0.43 | -0.34 | 4.56 (1.49) |
| 0.75\*\*\* | 0.73\*\*\* | 1 |  |  |  |  |  |  | 0.89 | -0.3 | -0.56 | 4.43 (1.59) |
| 0.73\*\*\* | 0.73\*\*\* | 0.84\*\*\* | 1 |  |  |  |  |  | 0.85 | -0.28 | -0.87 | 4.23 (1.71) |
| 0.75\*\*\* | 0.71\*\*\* | 0.82\*\*\* | 0.76\*\*\* | 1 |  |  |  |  | 0.84 | -0.22 | -0.75 | 4.11 (1.65) |
| 0.75\*\*\* | 0.72\*\*\* | 0.74\*\*\* | 0.7\*\*\* | 0.71\*\*\* | 1 |  |  |  | 0.81 | -0.6 | -0.22 | 4.76 (1.54) |
| 0.7\*\*\* | 0.69\*\*\* | 0.82\*\*\* | 0.78\*\*\* | 0.77\*\*\* | 0.7\*\*\* | 1 |  |  | 0.83 | -0.43 | -0.6 | 4.72 (1.66) |
| 0.71\*\*\* | 0.71\*\*\* | 0.73\*\*\* | 0.72\*\*\* | 0.68\*\*\* | 0.73\*\*\* | 0.69\*\*\* | 1 |  | 0.82 | -0.55 | -0.44 | 4.6 (1.63) |
| 0.66\*\*\* | 0.65\*\*\* | 0.72\*\*\* | 0.73\*\*\* | 0.68\*\*\* | 0.67\*\*\* | 0.7\*\*\* | 0.72\*\*\* | 1 | 0.78 | -0.14 | -0.82 | 3.96 (1.66) |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001, M = Mean, SD = Standard Deviation, ITC = Item-total correlation corrected for scale reliability and item overlap

Correlation analysis indicated that there is significant positive association between all UWES subscale and total score and extroversion. The highest correlation was found in the Vigor subscale. In addition, there was significant negative correlation between all UWES subscales and total score with neuroticism. The highest association was also found in the Vigor subscale. Moreover, the UWES total and its all subscales were associated with self-efficacy. The strongest association was observed in the Vigor subscale. Finally, there was no correlation between the UWES composite and subcale score with spirituality with exception of Dedication subscale (see Table 5).

Table 5:

*Correaltion matrix of the UWES, personality characteristics and socio-demographic indicators*

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | M(SD) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. UWES | - |  |  |  |  |  |  |  |  | 39.69 (12.27) |
| 2. UWES\_V | .94\*\*\* | - |  |  |  |  |  |  |  | 12.98 (4.15) |
| 3. UWES\_D | .95\*\*\* | .85\*\*\* | - |  |  |  |  |  |  | 13.38 (4.57) |
| 4. UWES\_A | .93\*\*\* | .82\*\*\* | .83\*\*\* | - |  |  |  |  |  | 13.33 (4.28) |
| 5. BFI\_E | .19\*\*\* | .23\*\*\* | .18\*\*\* | .13\*\*\* | - |  |  |  |  | 24.20 (5.21) |
| 6. BFI\_N | -.19\*\*\* | -.23\*\*\* | -.18\*\*\* | -.12\*\* | -.27\*\*\* | - |  |  |  | 23.02 (5.70) |
| 7. Age | .03 | .06 | .01 | .02 | -.01 | -.10\*\* | - |  |  | 43.65 (10.08) |
| 8. Gender | .07 | .08 | .05 | .07 | .06 | .20\*\*\* | .08\* | - |  | 1.38 (0.49) |
| 9. DSES | .13 | .09 | .17\* | .11 | .09 | -.06 | -.02 | .10 | - | 2.39 (1.10) |
| 10. GSES | .28\*\*\* | .30\*\*\* | .26\*\*\* | .25\*\*\* | .31\*\*\* | -.44\*\*\* | .08\* | -.09\* | .13 | 28.43 (4.95) |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; SD = standard deviation, M = mean, UWES = Utrecht Work Engagement Scale, BFI\_N = Big Five Inventory - Neuroticism subscale, BFI\_E = Big Five Inventory - Extraversion subscale, UWES\_A = Utrecht Work Engagement Scale - Absorption subscale, UWES\_D = Utrecht Work Engagement Scale - Dedication subscale, UWES\_V = Utrecht Work Engagement Scale - Vigor subscale. DSES = Daily Spiritual Experience Scale, GSES = General Self Efficacy Scale

## 3.4 Invariance testing and factor loadings

Results of the measurement equivalence indicated that across tested invariance models (configure, metric, scalar and strict) of the CFI was < 0.01. This findings strongly suggest that the UWES assess working engagement equivalently in males and females (See Table 6).

Table 6:

*Measurement eqivalence of the UWES between genders*

| Model | x2 | df | p-value | CFI | TLI | RMSEA | SRMR |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Overall model | 75.373 | 24 | p < .001 | 0.999 | 0.999 | 0.058 90% CI (0.043-0.072) | 0.021 |
| Male model | 49.247 | 24 | p = 0.002 | 0.999 | 0.999 | 0.051 90% CI (0.03-0.071) | 0.023 |
| Female model | 52.908 | 24 | p = 0.001 | 0.999 | 0.999 | 0.071 90% CI (0.045-0.097) | 0.026 |
| Configural  model | 102.155 | 48 | p < .001 | 0.999 | 0.999 | 0.059 90% CI (0.043-0.075) | 0.024 |
| Metric  model | 120.691 | 54 | p < .001 | 0.999 | 0.999 | 0.062 90% CI (0.047-0.077) | 0.026 |
| Scalar  model | 129.585 | 96 | p = 0.013 | 1 | 1 | 0.033 90% CI (0.016-0.047) | 0.024 |
| Strict  model | 129.585 | 96 | p = 0.013 | 1 | 1 | 0.033 90% CI (0.016-0.047) | 0.024 |

*Note.* x2 = chi-square, df = degrees of freedom, CFI = Comparative Fit Index, TLI = Tucker-Lewis index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual, CI = confidence interval

## 3.5 Association of the UWES with chronic health ilnesses

Results of the regression analysis revealed that work engagement is significantly related with chronic diseases. Specifically, higher work engagement was significantly related with lower probability of developing skin diseases or eczema (in crude effect) pain of unclear origin (both crude and adjusted effect see Table 6).

Table 7:

*Logistic regression table depicting associations (in odds ratios) between the UWES and chronic diseases*

|  | Skin diseases eczema | Pain of unclear origin | Hypertension | Diabetes | Arthritis |
| --- | --- | --- | --- | --- | --- |
| Crude effect | 0.98\* (0.95, 1.00) | 0.93\*\* (0.89, 0.97) | 1.01 (0.99, 1.03) | 1.00 (0.98, 1.03) | 0.97 (0.95, 1.01) |
| Adjusted effect | 0.98 (0.96, 1.00) | 0.94\*\* (0.90, 0.98) | 1.01 (0.99, 1.03) | 1.01 (0.98, 1.03) | 0.98 (0.95, 1.01) |
|  | Depression/Anxiety | Migraine | Cancer | Thyroid disease | Astma |
| Crude effect | 0.99 (0.96, 1.02) | 1.00 (0.97, 1.03) | 1.00 (0.95, 1.07) | 1.01 (0.99, 1.04) | 0.98 (0.96, 1.00) |
| Adjusted effect | 1.00 (0.97, 1.02) | 1.00 (0.97, 1.04) | 1.00 (0.94, 1.07) | 1.02 (1.00, 1.05) | 0.98 (0.96, 1.01) |
|  | Gastric or duodenal ulcers | Chronic lung disease | Skin diseases eczema | Allergy | Pain in the small pelvis |
| Crude effect | 1.01 (0.95, 1.10) | 0.97 (0.92, 1.02) | 0.98\* (0.95, 1.00) | 0.99 (0.97, 1.01) | 1.00 (0.96, 1.05) |
| Adjusted effect | 1.01 (0.94, 1.10) | 0.97 (0.93, 1.02) | 0.98 (0.96, 1.00) | 0.99 (0.97, 1.01) | 1.01 (0.97, 1.05) |
|  | Ischemic heart disease | Obesity | Stroke | Back pain |  |
| Crude effect | 1.00 (0.93, 1.08) | 0.99 (0.97, 1.01) | 0.95 (0.87, 1.04) | 0.99 (0.97, 1.00) |  |
| Adjusted effect | 0.99 (0.92, 1.07) | 0.99 (0.97, 1.01) | 0.95 (0.86, 1.04) | 0.99 (0.98, 1.01) |  |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001, results are reported in odds ratios; Education and Work position were covariates in adjusted effect; values in brackets refers to 95% confidence interval for odds ratios

# 4 Association of the UWES with health risk behaviour

Results of logistic regression suggested that there is no relationship between work engagement and the smoking, alcohol drinking, drug abuse, coffee drinking or using computer or television for recreation in both crude and adjusted effect. Variable smoking was the most closer to the significance treshold.

Table 8:

*Logistic regression table depicting associations (in odds ratios) between the UWES and health risk behaviours*

|  | Smoked | Drunk alcohol | Used illegal drugs | Drunk coffee | Used television or computer for recreation |  |
| --- | --- | --- | --- | --- | --- | --- |
| Crude effect | 1.00 (0.99, 1.02) | 1.00 (0.98, 1.01) | 0.97 (0.92, 1.02) | 1.01 (0.99, 1.02) | 1.01 (0.99, 1.03) |  |
| Adjusted effect | 1.01 (1.00, 1.03) | 1.00 (0.98, 1.01) | 0.98 (0.93, 1.04) | 1.01 (1.00, 1.03) | 1.01 (0.99, 1.03) |  |

*Note.* \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001, results are reported in odds ratios; Education and Work position were covariates in adjusted effect; values in brackets refers to 95% confidence interval for odds ratios

# 5 Discussion

# 6 References

Aust, F., & Barth, M. (2020). *papaja: Create APA manuscripts with R Markdown*. Retrieved from <https://github.com/crsh/papaja>

Chan, E. S. S., Ho, S. K., Ip, F. F. L., & Wong, M. W. Y. (2020). Self-efficacy, work engagement, and job satisfaction among teaching assistants in hong kong’s inclusive education. *SAGE Open*, *10*(3), 2158244020941008. <https://doi.org/10.1177/2158244020941008>

Civelek, E. C. (2018). *Essentials of structural equation modeling* (1 edition). Zea Books.

Hoe, S. L. (2008). Issues and procedures in adopting structural equation modelling technique. *Journal of Applied Quantitative Methods*, *3*(1), 76–83.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modelling: Guidelines for Determining Model Fit. *Electronic Journal of Business Research Methods*, *6*(1), 53–59. Journal Article. <https://doi.org/10.21427/D7CF7R>

Jackson, D. L., Gillaspy Jr, J. A., & Purc-Stephenson, R. (2009). Reporting practices in confirmatory factor analysis: An overview and some recommendations. *Psychological Methods*, *14*(1), 6–23. Journal Article. <https://doi.org/10.1037/a0014694>

Kulikowski, K. (2017). Do we all agree on how to measure work engagement? Factorial validity of utrecht work engagement scale as a standard measurement tool – a literature review. *International Journal of Occupational Medicine and Environmental Health*, *30*(2), 161–175. <https://doi.org/10.13075/ijomeh.1896.00947>

Peters, G.-J. (2021). *Ufs: Quantitative analysis made accessible*. Retrieved from <https://CRAN.R-project.org/package=ufs>

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review*, *41*, 71–90. <https://doi.org/10.1016/j.dr.2016.06.004>

R Core Team. (2021). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from <https://www.R-project.org/>

Revelle, W. (2021). *Psych: Procedures for psychological, psychometric, and personality research*. Evanston, Illinois: Northwestern University. Retrieved from <https://CRAN.R-project.org/package=psych>

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36. Retrieved from <https://www.jstatsoft.org/v48/i02/>

Schermelleh Engel, K., Moosbrugger, H., & Muller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research*, *8*(2), 23–74. Journal article.

Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices, and recommendations for organizational research. *Organizational Research Methods*, *3*(1), 4–70. <https://doi.org/10.1177/109442810031002>

Vargha, A., & Delan, H. D. (2000). A critique and improvement of the CL common language effect size statistics of McGraw and Wong. *Journal of Educational and Behavioral Statistics*, *25*(2), 101–132. Journal article. <https://doi.org/10.2307/1165329>

Willmer, M., Westerberg Jacobson, J., & Lindberg, M. (2019). Exploratory and confirmatory factor analysis of the 9-item utrecht work engagement scale in a multi-occupational female sample: A cross-sectional study. *Frontiers in Psychology*, *10*, 2771. <https://doi.org/10.3389/fpsyg.2019.02771>