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

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Abstract

Introduction

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

*Keywords:* keywords

*Word count:* X

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# 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).

# Methods

## 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). This resulted 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%).

## Measures

### Utrecht Work Engagement Scale (UWES).

### 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].

### 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].

### 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].

### 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].

## Data analysis

Inspection of histograms and results of the Mardia test of multivariate skewness and kurtosis indicated that the 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.

The instrument’s factor structure was investigated via Confirmatory Factor Analysis (CFA) to test a comprehensive range of models from the literature. We first tested the original correlated three-factor model (Vigor, Dedication, Absorption) and a competing one-factor model (Schaufeli, Bakker, & Salanova, 2006). However, as many studies report strong intercorrelations among the three dimensions, suggesting they may represent a single higher-order construct (Fong & Ng, 2012), we also specified and tested a hierarchical (second-order) model (Domínguez-Salas et al., 2022). Further analyses included tests of alternative two-factor solutions (e.g., Chaudhary, Rangnekar, & Barua, 2012), a partial bi-factor model (de Bruin & Henn, 2013), and several modified three-factor models incorporating correlated error terms (e.g., Simbula et al., 2013). The Kaiser-Meyer-Olkin (KMO) measure and Bartlett’s test of sphericity were first applied to confirm the data’s suitability for factor analysis. 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 4.4.1; 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)).

# Results

## 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) | 12.7 (4.84) | 12.49 (4.44) |
|  | Professional worker | 41.28 (10.95) | 14.01 (3.76) | 14.0 (4.11) | 13.26 (3.81) |
|  | Chief worker | 43.08 (10.85) | 14.4 (4.04) | 14.6 (4.17) | 14.13 (3.53) |
| Education | Basic school | 33.68 (14.67) | 11.68 (5.23) | 11.1 (5.03) | 10.95 (4.85) |
|  | Non graduation high school or lower | 38.45 (13.16) | 12.77 (4.68) | 13.0 (4.81) | 12.72 (4.42) |
|  | High school | 39.59 (12.32) | 13.2 (4.3) | 13.4 (4.50) | 13 (4.21) |
|  | Higher vocational school or University | 41.73 (10.56) | 14.23 (3.47) | 14.1 (4.21) | 13.43 (3.62) |
| Family\_status | Not in relationship | 36.63 (12.07) | 12.23 (4.34) | 12.4 (4.46) | 12.02 (4.05) |
|  | In relationship | 40.25 (11.79) | 13.8 (4.11) | 13.6 (4.37) | 12.83 (4.1) |
|  | Married | 40.15 (11.98) | 13.54 (4.12) | 13.5 (4.53) | 13.14 (4.03) |
|  | Divorced | 40.29 (13.52) | 13.13 (4.64) | 13.7 (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) | 13.2 (4.38) | 12.7 (4.07) |
|  | Female | 40.8 (12.94) | 13.7 (4.51) | 13.7 (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) | 13.0 (4.65) | 12.52 (4.23) |
|  | No | 40.11 (12.2) | 13.43 (4.23) | 13.5 (4.50) | 13.14 (4.14) |
|  | No, I am convinced atheist | 39.27 (12.51) | 13.21 (4.32) | 13.2 (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

## Confirmatory Factor Analysis

Bartlett test ( (36) = 6,322.72, p < .001) as well as KMO (0.96) revealed that UWES data are sufficiently correlated to perform factor analysis. Next, a series of CFAs were conducted to determine the optimal factorial structure of the UWES-9 for the Czech sample. Initial models based on standard one-factor, two-factor, hierarchical, and correlated three-factor structures demonstrated poor fit to the data. For instance, the standard three-factor model yielded an RMSEA of 0.12, which was substantially higher than its dynamically-generated Level-0 cutoff of 0.03, indicating a significant degree of misfit and the need for a more nuanced model.

This led to the testing of modified three-factor models to account for sources of local misfit. Two primary models were retained for a final, decisive comparison. The first, a Replicated Errors model, was specified based on the most consistent findings in the international literature. This model included correlated errors between items 1 and 2 (Vigor) and items 8 and 9 (Absorption), a modification independently identified across several validation studies (e.g., Domínguez-Salas et al., 2022; Simbula et al., 2013).

The second, a Three-Factor Model with Within-Factor Correlated Errors, included the same two correlations plus an additional error covariance between items 3 and 4 (Dedication). This more complex model was tested to confirm whether any remaining misfit in the “Replicated Errors” model could be systematically explained by this additional theoretically-grounded correlation (Zecca et al., 2015). The purpose of this test was to ensure that the most parsimonious model was selected only after confirming that a more complex—but still justifiable—model did not provide a statistically superior explanation of the data.

To adjudicate between these nested models, a scaled chi-square difference test was performed. The test revealed no significant improvement in fit for the more complex model with three correlated errors (*χ²*diff(1) = 0.04, *p* = 0.84). Based on the principle of parsimony, the simpler “Replicated Errors” model was selected as the final and most appropriate model.

The fit of this final model was evaluated against dynamically generated fit index cutoffs. The model produced an excellent CFI (0.994) and a low SRMR (0.017). However, the RMSEA (0.102) was considerably higher than its dynamically generated Level-0 cutoff of 0.028, indicating that while the model is superior to all tested alternatives, it still contains a non-trivial degree of misfit. This suggests that while this three-factor structure with modifications for item wording overlap is the best representation of the data, the UWES-9 scale may not perfectly capture the construct of work engagement within this sample. A summary of the fit indices for all tested models is provided in Table 2. Factor loadings () in the Replicated Errors model were high (ranging from: 0.81 to 0.93) as were correlations between the three factors (see Figure 1). Correlation between residuals in manifest variables was low: *r* = range(-0.05 - 0.04). Correlation matrix depicting relationships between item residuals can be found in the Supplementary Material x.

![Figure 1.  SEM plot of the UWES Replicated Errors model with factor loadings and item residuals.](data:application/eps;base64,)

Figure 1: SEM plot of the UWES Replicated Errors model with factor loadings and item residuals.

Table 3:

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| Misspecification | SRMR\_pos\_1 | RMSEA\_pos\_1 | CFI\_pos\_1 | Magnitude\_pos\_1 | sep\_col\_2 | SRMR\_pos\_2 | RMSEA\_pos\_2 | CFI\_pos\_2 | Magnitude\_pos\_2 | sep\_col\_3 | SRMR\_pos\_3 | RMSEA\_pos\_3 | CFI\_pos\_3 | Magnitude\_pos\_3 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Misspecification | Model one\_factor |  |  |  |  | Model two\_factor |  |  |  |  | Model dfi\_two\_factor\_chaudhary |  |  |  |
|  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |
| Level-0 | 0.014 | 0.025 | 0.995 | NA |  | 0.013 | 0.025 | 0.995 | NONE |  | 0.012 | 0.028 | 0.999 | NONE |
| Level-1 | NONE | NONE | NONE | NA |  | NONE | NONE | NONE | 0.174 |  | NONE | NONE | NONE | 0.187 |
| Level-2 | NONE | NONE | NONE | NA |  | NA | NA | NA | NA |  | NA | NA | NA | NA |
| Level-3 | NONE | NONE | NONE | NA |  | NA | NA | NA | NA |  | NA | NA | NA | NA |
| Fitted Model | **0.026** | **0.139** | **0.986** | NA |  | **0.024** | **0.13** | **0.988** | NA |  | **0.022** | **0.122** | **0.99** | NA |
| Misspecification | Model two\_factor\_panthee |  |  |  |  | Model three\_factor |  |  |  |  | Model hierarch\_factor |  |  |  |
|  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |
| Level-0 | 0.012 | 0.028 | 0.999 | NONE |  | 0.013 | 0.026 | 0.995 | NONE |  | 0.012 | 0.035 | 0.999 | NONE |
| Level-1 | NONE | NONE | NONE | 0.19 |  | NONE | NONE | NONE | 0.177 |  | NONE | NONE | NONE | 0.177 |
| Level-2 | NA | NA | NA | NA |  | NONE | NONE | NONE | 0.143 |  | NONE | NONE | NONE | 0.143 |
| Fitted Model | **0.024** | **0.131** | **0.988** | NA |  | **0.021** | **0.117** | **0.991** | NA |  | **0.021** | **0.117** | **0.991** | NA |
| Misspecification | Model dfi\_three\_factor\_corr\_errors\_balducci |  |  |  |  | Model dfi\_three\_factor\_corr\_error\_chaudhary |  |  |  |  | Model three\_factor\_corr\_errors\_Dominguez |  |  |  |
|  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |
| Level-0 | 0.011 | 0.03 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |
| Level-1 | NONE | NONE | NONE | 0.122 |  | NONE | NONE | NONE | 0.178 |  | NONE | NONE | NONE | 0.15 |
| Level-2 | NA | NA | NA | NA |  | NONE | NONE | NONE | 0.144 |  | NONE | NONE | NONE | 0.121 |
| Fitted Model | **0.017** | **0.104** | **0.994** | NA |  | **0.021** | **0.12** | **0.991** | NA |  | **0.017** | **0.102** | **0.994** | NA |
| Misspecification | Model dfi\_three\_factor\_corr\_error\_littman\_ovadia |  |  |  |  | Model dfi\_three\_factor\_seppala |  |  |  |  | Model dfi\_three\_factor\_simbula\_tran |  |  |  |
|  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |
| Level-0 | 0.011 | 0.029 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |
| Level-1 | NONE | NONE | NONE | 0.178 |  | NONE | NONE | NONE | 0.15 |  | NONE | NONE | NONE | 0.15 |
| Level-2 | NONE | NONE | NONE | 0.121 |  | NONE | NONE | NONE | 0.143 |  | NONE | NONE | NONE | 0.121 |
| Fitted Model | **0.018** | **0.101** | **0.994** | NA |  | **0.02** | **0.118** | **0.991** | NA |  | **0.017** | **0.102** | **0.994** | NA |
| Misspecification | Model dfi\_three\_factor\_zecca |  |  |  |  | Model within\_factor\_corr |  |  |  |  | Model replicated\_errors |  |  |  |
|  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |  | SRMR | RMSEA | CFI | Magnitude |
| Level-0 | 0.011 | 0.028 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |  | 0.011 | 0.028 | 0.999 | NONE |
| Level-1 | NONE | NONE | NONE | 0.15 |  | NONE | NONE | NONE | 0.15 |  | NONE | NONE | NONE | 0.15 |
| Level-2 | NONE | NONE | NONE | 0.121 |  | NONE | NONE | NONE | 0.121 |  | NONE | NONE | NONE | 0.121 |
| Fitted Model | **0.017** | **0.104** | **0.994** | NA |  | **0.017** | **0.104** | **0.994** | NA |  | **0.017** | **0.102** | **0.994** | NA |

## 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

## 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 | 73.958 | 24 | p < .001 | 0.984 | 0.975 | 0.072 90% CI (0.053-0.09) | 0.02 |
| Female model | 76.964 | 24 | p < .001 | 0.974 | 0.961 | 0.096 90% CI (0.072-0.12) | 0.022 |
| Configural  model | 150.922 | 48 | p < .001 | 0.98 | 0.97 | 0.081 90% CI (0.067-0.096) | 0.021 |
| Metric  model | 151.875 | 54 | p < .001 | 0.981 | 0.974 | 0.075 90% CI (0.061-0.089) | 0.022 |
| Scalar  model | 162.514 | 60 | p < .001 | 0.98 | 0.976 | 0.073 90% CI (0.059-0.086) | 0.024 |
| Strict  model | 179.228 | 69 | p < .001 | 0.978 | 0.977 | 0.07 90% CI (0.058-0.083) | 0.025 |

*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

## 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

# 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 threshold.

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 (1.0, 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

# Discussion

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# Appendix

Table 9:

*Correlations between residuals of the Replicated Errors factor model*

|  | UWES\_1 | UWES\_2 | UWES\_5 | UWES\_3 | UWES\_4 | UWES\_7 | UWES\_6 | UWES\_8 | UWES\_9 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| UWES\_1 | 0.00 | 0.00 | 0.01 | -0.01 | -0.01 | -0.02 | 0.04 | 0.01 | -0.01 |
| UWES\_2 | 0.00 | 0.00 | -0.01 | -0.02 | 0.01 | -0.01 | 0.03 | 0.02 | -0.02 |
| UWES\_5 | 0.01 | -0.01 | 0.00 | 0.03 | -0.01 | 0.02 | -0.03 | -0.05 | -0.02 |
| UWES\_3 | -0.01 | -0.02 | 0.03 | 0.00 | 0.00 | 0.00 | -0.02 | -0.01 | 0.00 |
| UWES\_4 | -0.01 | 0.01 | -0.01 | 0.00 | 0.00 | -0.01 | -0.02 | 0.01 | 0.03 |
| UWES\_7 | -0.02 | -0.01 | 0.02 | 0.00 | -0.01 | 0.00 | -0.01 | -0.01 | 0.02 |
| UWES\_6 | 0.04 | 0.03 | -0.03 | -0.02 | -0.02 | -0.01 | 0.00 | 0.01 | -0.02 |
| UWES\_8 | 0.01 | 0.02 | -0.05 | -0.01 | 0.01 | -0.01 | 0.01 | 0.00 | 0.00 |
| UWES\_9 | -0.01 | -0.02 | -0.02 | 0.00 | 0.03 | 0.02 | -0.02 | 0.00 | 0.00 |

*Note.* UWES = Utrecht Work Engagement Scale