The Irrational Health Beliefs Scale and health behaviours in a non-clinical population

Lukáš Pitel[1,2] and Eva Ballová Mikušková[2]

[1]Hull York Medical School, University of Hull, United Kingdom

[2]Institute of Experimental Psychology, Centre of Social and Psychological Sciences, Slovak Academy of Sciences, Bratislava, Slovakia

Corresponding author: Eva Ballová Mikušková, expsebal@savba.sk.

Abstract

To date, there has been inconclusive evidence on the predictive ability of health-related cognitive distortion, as measured by the Irrational Health Belief Scale (IHBS), regarding health behaviours (HBs). The aims of our study were to provide a validation of the Slovak translation of the IHBS and to assess the relationship of the IHBS with a wide range of HBs, as well as the predictive ability of the IHBS regarding HBs over and above other health-related psychological constructs. A total of 448 students attending mostly Slovak universities completed the IHBS, the Multidimensional Health Locus of Control Scale, the Big Five Inventory-2, the Positive and Negative Affect Scale and the Bratislava Health Behaviours Questionnaire. The internal consistency and temporal stability of the Slovak version of the IHBS were confirmed. The IHBS correlated moderately with medical adherence but was unrelated to substance use and an unhealthy diet. The association of cognitive distortion with the sum score of HBs was only weak, albeit statistically significant. The IHBS had weak but significant incremental power. However, two health locus of control

dimensions as well as negative emotionality were more strongly related to HBs than cognitive distortion in that multivariate model.

Key words: health beliefs, health behaviour, cognitive distortion, personality, Irrational Health Beliefs Scale

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Introduction

The ability to evaluate medical information in combination with one's experiences and beliefs could relate to future health behaviour: the misunderstanding of medical information and distorted experiences with medicine could result in inappropriate or harmful health behaviour, self-care and medical decisions (Christensen et al., 1999). Health behaviour seems to be affected by the ability to evaluate medical information, experiences with medicine (Christensen et al., 1999) as well as by cognitive distortion (Barbacariu, 2014; Boström & Rössner, 1990; Čavojová et al., 2020; Christensen et al., 1999; Farrington et al., 2018; Johnson et al., 2018; Saint-Victor & Omer, 2013). Ultimately, the inappropriate or harmful health behaviour of individuals may have not only individual consequences (Sieurin et al., 2009) but also an adverse social and economic impact, such as a disrupted economy and increased public health expenses.

For several decades, health behaviour prediction has been a priority in Health Psychology research. One of the most widely used theoretical frameworks in health behaviour prediction is the Health Belief Model (Rosenstock, 1966). This multidimensional model involves perceived susceptibility, perceived severity, health motivation, perceived benefits and perceived barriers. The initial Health Belief Model theories implicitly assumed that health-related decisions, resulting in health behaviours, are made rationally and did not consider the effect of distorted cognitions and irrational beliefs.

Taking this limitation into account, Christensen et al. (1999) explored whether irrational or distorted health-related thinking was related to health behaviour. They developed the Irrational Health Beliefs Scale (IHBS) to assess individual differences in the tendency to engage in health-related cognitive distortions. To present day, studies have provided little explanation or few empirical findings on how exactly these irrational health beliefs – or health-related cognitive distortions – develop. Nevertheless, Arnáez et al. (2019) found on

a small sample of Spanish university students that the IHBS scores of the students were unrelated to those of their mothers, but correlated positively with their fathers' scores. Moreover, Fulton et al. (2011) found that irrational health beliefs were positively associated with health anxiety.

When considering health-related cognitive distortion as a predictor, Christensen et al. (1999) found cognitive distortion associated with adverse health behaviours in a healthy and in a clinical population. This association was independent of negative affect and trait conscientiousness. Bartz and Olson (2002) performed a study similar to that by Christensen et al. (1999), but using an alternative measure of neuroticism (NEO PI-R). In their study, the IHBS did not contribute any unique variance over and above neuroticism, conscientiousness, and health locus of control. Knäuper et al. (2004) found the IHBS score to be associated with the health locus of control, but not with health behaviour. Finally, in Australia, Trankle and Haw (2009) failed to confirm the results of the study by Christensen et al. (1999), albeit on a much smaller sample size: in a multivariate model, the IHBS did not predict health behaviour over and above neuroticism, conscientiousness, health locus control, and positive and negative affect. To sum up, a review of previous studies measuring the relationship between IHBS and health behaviours revealed ambiguous conclusions: thus far, all three subsequent studies have failed to support the initial findings of Christensen et al. (1999).

Other studies using the IHBS measured its relationship to medical adherence in clinical samples (Anderson & Emery, 2014; Fathabadi et al., 2019; Hammonds et al., 2015), and all of them found irrational health beliefs to be positively related to poor adherence. However, evidence on the relationship between the IHBS and health behaviours in non-clinical samples is inconclusive. Those available (e.g. Bartz & Olson, 2002; Christensen et al., 1999; Trankle & Haw, 2009) did not even differentiate between specific behaviours but rather worked only with the overall health behaviours scores (mostly consisting of items from the domains of

nutrition, exercise, relaxation, safety, substance use, and health promotion). Up to the present day, only one available study (Knäuper et al., 2004) compared IHBS scores to a health behaviour measure other than (the currently quite outdated) Personal Lifestyle Questionnaire (Brown et al., 1983).

Yet another gap in the current research is the lack of any evidence from non-English speaking countries on the ability of the IHBS to predict health behaviours other than medical adherence. To the best of our knowledge, the IHBS has been tested only on American (Bartz & Olson, 2002; Christensen et al., 1999), Canadian (Trankle & Haw, 2009) and Australian samples (Trankle & Haw, 2009) in this regard.

The aims of our study were to fill these gaps by: (1) providing an initial validation of the Slovak translation of the IHBS by testing its psychometric properties and its relationship to instruments identical or similar to those used in the validation of the original English version (Christensen et al., 1999); (2) assessing the relationship of the IHBS with various individual health behaviours as well as their sum score in Slovakia, a Central European country; and (3) assessing the ability of the IHBS to predict the overall health behaviours score over and above other psychological constructs previously linked to health behaviours: negative emotionality, conscientiousness, affect and the health locus of control. Thus the present study can be regarded as a conceptual replication of one part of the study by Christensen et al. (1999).

Methods

Participants and study design

Data were collected online via Google Forms among students attending mostly Slovak universities in March and April 2018. Of the 477 participating students, 29 did not pass the trap questions (see the Measures section for more details) and were excluded from the

analyses. Final analyses were performed on the remaining 448 cases (*M* = 22.8 years; *SD* = 3.2 years; 71.7% women). The areas of their major study subjects were distributed as follows: 21.0% Natural Sciences and Mathematics; 19.4% Humanities, Media and Law; 14.3% IT, Architecture and Mechanics; 12.9% Pedagogics, Primary Teaching and Teaching without specifying the study subjects; 11.4% Medicine and Healthcare; 10.3% Economics and Management; 10% Psychology; and 0.7% missing information or incomprehensible.

The participants were recruited by e-mailing lists from one Slovak university and one academic faith-based association, as well as by announcements on various Facebook groups dedicated to students of Slovak universities. In order to keep the male-to-female ratio at least remotely similar to the validation study of the original IHBS version (Christensen et al., 1999), participation was restricted to men only during the last days of data collection. This, however, managed to mitigate the ratio only marginally at this point. Of those participants who submitted their e-mail addresses, 10% were drawn by a pseudorandom number generator and given vouchers worth 30 euro as incentives, exchangeable for goods in various chain stores.

All participants completed the Irrational Health Beliefs Scale, the Multidimensional Health Locus of Control Scale, the Big Five Inventory-2, the Positive and Negative Affect Scale and the Bratislava Health Behaviours Questionnaire. In May 2018 – about six weeks after collecting data on most participants – all final participants who submitted contact information (N = 389) were asked by e-mail to perform a retest online, with no material incentives offered, and 105 of them completed the Irrational Health Beliefs Scale again, 100 of whom passed all the trap questions (*M* = 22.9 years; *SD* = 2.8 years; 76.0% women).

Data were collected on a voluntary basis. All participants were provided with informed consent.

Instruments

Cognitive distortion was measured using the Irrational Health Belief Scale (IHBS; Christensen et al., 1999). The original scale consists of 20 brief vignettes describing appraisals of specific health situations and experiences and a subsequent hypothetical rationalization of unhealthy behaviour. An example IHBS item: "During a routine check-up, your doctor emphasizes the importance of exercise and eating right to prevent health problems. You notice that the doctor is quite overweight. You think to yourself, 'If good eating habits and exercise were really important, he would lose weight himself.'"

Five response options are provided measuring the degree of agreement or disagreement with the rationalizations, ranging from "not at all like I would think" to "almost exactly like I would think", resulting in the assigning of scores from 1 to 5 accordingly for each vignette. A higher score indicated more cognitive distortion.

Health locus of control dimensions were measured using the Multidimensional Health Locus of Control scales (MHLC; Wallston et al., 1978). The internal, powerful others and chance health locus of control subscales from the MHLC were applied as measures of patients' beliefs regarding control over their health outcomes. Each subscale consists of six items, with six possible responses on a Likert scale, ranging from "strongly disagree" to "strongly agree".

Negative emotionality and Conscientiousness were measured using the negative emotionality ("Neuroticism" in the previous versions of the scale) and conscientiousness scales from the Big Five Inventory–2 (BFI-2; Halama et al., 2020), a measure of the five-factor model of personality. Each scale consists of 12 items, with five possible responses on a Likert scale, ranging from "disagree strongly" to "agree strongly".

Positive Affect and Negative Affect were measured by means of the Positive and Negative Affect Scale (PANAS; Watson et al., 1988), which consists of 10 items reflecting negative affect and 10 items reflecting positive affect, with five possible responses on a Likert scale,

ranging from “very slightly or not at all” to “extremely”. Due to our mistake, participants were instructed to rate their affect according to how they felt “generally”, i.e., “ON AVERAGE” (unlike in the original validation study by Christensen et al. (1999), where the instruction referred to how they had felt “over the past few days”).

Overview of the development of the health behaviours measures. Adverse health behaviours were measured with the Bratislava Health Behaviours Questionnaire (BHBQ), a questionnaire developed specifically for the sake of this study. The reasons for the development of the BHBQ were the somewhat obsolete contents, vagueness and/or problematic cross-cultural validity of several items of the Personal Lifestyle Questionnaire (PLQ; Brown et al., 1983), which was used in the study by Christensen et al. (1999). The BHBQ was partially inspired by measures used in the Health Behaviour in School-Aged Children studies by the World Health Organization (Currie et al., 2008). Similarly to the PLQ, the BHBQ items covered a wide range of health behaviours, including substance use, physical activity, sedentary behaviour, medication adherence, safety measures and others. For each item, a specific frequency and/or quantity related to the particular health behaviour was to be selected out of five options (except for the item related to insufficient sleep, which had eight options, subsequently recoded into five categories). While most of the behaviours were measured by a single item, some were measured by a composite score calculated from several items. Thus, the questionnaire comprised 18 questions measuring 12 behaviours. For each health behaviour, one to five points were allocated. Higher scores indicated more adverse health behaviours. Therefore, the possible overall score range was 12 to 60 points.

The instrument had a low internal consistency (Cronbach’s α = .52; McDonald’s ω = .56), which reflects the wide range of behaviours from various health-related domains. Thus, the overall score should be regarded as a cumulation of several, sometimes unrelated, poor health behaviours rather than a unidimensional characteristic. Exploratory factor analysis (Varimax,

not presented) suggested a three-dimensional structure: Factor 1 – substance use and sedentary behaviour; Factor 2 – poor diet and physical activity; and Factor 3 – the remaining miscellaneous behaviours. However, subsequent bivariate analyses revealed that within most factors, the associations between the factor scores and their individual items still varied widely. Therefore, apart from the overall BHBQ score, we found it more appropriate to present these associations by individual behaviours rather than factors. The complete text of the BHBQ and its scoring instructions are presented in Appendix 1.

Finally, two simple trap questions were included in the questionnaire to identify and subsequently filter out respondents who were not paying close attention to survey questions.

Statistical analyses

Confirmatory Factor Analysis (CFA) was conducted using JAMOVI - version 1.2 (2020), testing the unidimensional model of the IHBS. The following indicators were used to assess the overall model fit: Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Standardized Root Mean Square Residual (SRMR), and the Root Mean-square Error of Approximation (RMSEA). Basic frequencies and descriptive statistics as well as Cronbach's α and McDonald's ω were calculated for each scale or index used, as well as corrected item-total correlation of all IHBS behaviours. A test-retest Pearson correlation coefficient was calculated to examine the temporal stability of the IHBS.

Next, Pearson correlation coefficients were calculated for the bivariate relationships between the IHBS scores and the remaining variables, including scores for individual health behaviours from the BHBQ. Finally, a two-step hierarchical regression analysis was conducted to determine the unique contribution of the IHBS to the sum score of health behaviours. In the first step of the equation, all measures were entered which were found to be

significantly associated with the IHBS in the bivariate analyses. In the second step, the total IHBS score was entered.

Results

The CFA brought mixed results: overall, the tested model did not show a very good fit, but did pass the rule-of-thumb thresholds in some of the indicators ($\chi^2 = 373$, $df = 170$, $p < 0.001$, $CFI = 0.802$, $TLI = 0.779$, $SRMR = 0.052$, $RMSEA = 0.052$ with $90\%CI$ [0.045 - 0.059]). The Cronbach's α and McDonald's ω of the IHBS were .76 and .78, respectively, with corrected item-total correlations (*CITC*) for individual items ranging from .17 to .46. The only item with a *CITC* under .20 (item nr. 1) correlated substantially higher with the rest of the scale in the retest (.34); therefore, we decided to keep it as a part of the scale. The mean sum score of the IHBS was 33.9 ($SD = 8.2$). The descriptives and internal consistency indicators of the remaining scales used are presented in Table 1. A test-retest Pearson's correlation of .77 ($p < .001$) was obtained, indicating acceptable temporal stability of the IHBS.

The IHBS was significantly associated with all scales explored (Table 2): cognitive distortion (IHBS) correlated positively with the chance health locus of control (MHLOC), negative emotionality (PANAS, BFI-2) and adverse health behaviours (BHBQ), and negatively with the internal and powerful others locus of control (MHLOC), positive emotionality (PANAS) and consciousness (BFI-2). The strongest correlations were obtained between the IHBS and the chance health locus of control ($r(446) = .33$, $p < .001$).

The correlation of cognitive distortion (IHBS) with the sum score of the adverse health behaviours was relatively low, albeit statistically significant ($r(446) = .21$, $p < .001$). As for separate health behaviours, cognitive distortion was correlated relatively the strongest with premature discontinuation of medication ($r_s(446) = .45$, $p < .001$). It was also marginally, but

significantly, associated with lack of physical activity, leisure screen time (sedentary behaviour), no use of safety belts, alcohol use when on medication and no preventive dental check-ups. Cognitive distortion was unrelated to a lack of fruits and vegetables consumption, soft drinks consumption, lack of sleep, tobacco smoking, binge drinking and cannabis use.

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A two-step hierarchical regression analysis was conducted to determine the unique contribution of the IHBS to the sum score of health behaviours. In the first step, we entered the total scores of all the remaining scales except for the IHBS. The total IHBS score was entered in the second step. The IHBS was a weak but still significant predictor of health behaviours after we controlled for all other measures: $\beta = .10$, change in $R^2 = .01$, $F(1,439) = 11.37$, $p < .001$. In the final model, the strongest association of adverse health behaviours was with conscientiousness. Also, the associations with the powerful others and chance health locus of control scales and with negative affect were statistically significant in the final model, all of them being stronger than the association with the IHBS (Table 3).

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Discussion

Health behaviour seems to be affected by the ability to evaluate medical information, experiences with medicine (Christensen et al., 1999) as well as by cognitive distortion (Barbacariu, 2014; Boström & Rössner, 1990; Čavojová et al., 2020; Christensen et al., 1999; Farrington et al., 2018; Johnson et al., 2018; Saint-Victor & Omer, 2013). Christensen et al. (1999) found cognitive distortion, measured by the IHBS, to be associated with adverse health

behaviour both in a healthy and a clinical population. However, in subsequent studies, this relationship was reported only in clinical samples regarding medical adherence (Anderson & Emery, 2014; Fathabadi et al., 2019; Hammonds et al., 2015). Therefore, we performed a conceptual replication of the study by Christensen's et al. (1999). Additionally, after testing the psychometric properties of the Slovak translation of the IHBS and the scale's relationships with selected personality constructs, we extended the research by including individual health behaviours, such as substance use, physical exercise or an unhealthy diet.

When exploring the goodness of fit of the unidimensional model of the IHBS by means of CFA, we found the RMSEA and SRMR indicators on levels that are routinely considered as satisfactory in psychometric research. On the other hand, the levels of the CFI and TLI indicators were quite below such thresholds (Hu & Bentler, 1999). It needs to be stressed, however, that "there is little evidence" that these rule-of-thumb cut-offs are appropriate in all contexts, and even the most widespread psychometric measures with high criterion and content validity rarely show adequate CFA fit by these "very restrictive" criteria (Hopwood & Donnellan, 2010, p. 341-342).

Subsequent reliability analysis indicated an overall satisfactory level of internal consistency, even though at least one of the items (Item nr. 1) correlated rather weakly with the rest of the scale. This – along with some informal negative feedback by a few participants due to the length of the scale – indicates that future research might also profit from designing a shortened alternative to this instrument.

The mean total score of the Slovak version of the IHBS was similar, albeit slightly lower, compared to the original study from the USA based on data collected about 20 years before ours. Like in the original study, cognitive distortion was associated with the chance health locus of control, negative emotionality, and adverse health behaviours. In our study, cognitive distortion did correlate positively with the overall sore of adverse health behaviours but was

much weaker than in the study by Christensen et al., 1999. We found powerful others health locus of control, chance health locus of control, and negative emotionality to be stronger predictors of the sum score of adverse health behaviours than cognitive distortion.

We found that IHBS did contribute uniquely to the prediction of the sum score of adverse health behaviours. However, the incremental value of the scale was much smaller than in the validation study of the English version (Christensen et al., 1999). In our case, adding the IHBS score into the model resulted in only a slightly less than one percentage point increase of the overall variance accounted for by the model. From a wider public health perspective, this seems to be a rather negligible effect. In fact, the effect size was even smaller than those found by Bartz and Olson (2002) and Trankle & Haw (2009).

As for individual health behaviours, cognitive distortion was related to medical adherence, in line with previous research (Anderson & Emery, 2014; Fathabadi et al., 2019; Hammonds et al., 2015). Nevertheless, for some reason, its relation to diet, substance use (unless combined with medication) and lack of sufficient sleep was found to be practically non-existent, and its relation to the remaining health behaviours explored was only weak to negligible. In our opinion, these findings underscore the necessity of a more nuanced approach to health-related outcomes when exploring their relationships with psychological predictors in general.

A possible reason for the different relationships across the health behaviours may be that in non-clinical populations, behavioural patterns relating to diet, substance use or getting sufficient sleep are often based on “automated” daily habits, while the attitude to medical adherence could be more deliberative, as it only occurs in exceptional circumstances. Therefore, cognitive distortion may have only a very limited potential to influence habits which, in daily life, are often not even subject to much deliberation in the first place.

However, this attempted explanation is purely speculative and needs to be confirmed in further research.

To our knowledge, this is the first study on the relationship between the IHBS and health behaviours from a European country; all previous studies came from native-English-speaking "Western offshoots" (the USA, Canada and Australia). Another strength of our study is its sample size, which was larger than in any of the previous studies on this topic. In order to improve the reliability of the responses, we used trap questions to filter out the participants who did not pay close attention to the survey questions. We also sought to improve the content validity of the health behaviours measure by excluding items previously used in the PLQ that are now outdated or lack scientific evidence of necessarily contributing to better health (e.g. the frequency of updating emergency numbers kept by the telephone, or eating meat and drinking milk). Furthermore, to the best of our knowledge, this is the first study which presented the relationship of the IHBS with a wide range of individual health behaviours rather than just their overall score. This enabled us to reveal a substantial degree of variability in the relationship depending on particular behaviour.

A limitation of our study is that most of our individual health behaviours were measured by only a single Likert-style item of five categories. While single item measures are routinely used in psychological research for assessing health-related outcomes, they may exhibit a low power to detect the effect (Gnambs & Buntins, 2017), especially when their score variance is low. Thus, their correlations with cognitive distortion in our study results should be interpreted with caution. Another limitation is the correlational design of the study which does not allow for causal inferences. Moreover, the sample consisting of solely university students with a majority of women allowed for a valid comparison with previous research on this topic, but the extent to which the results can be generalized to a wider population is questionable. It is highly recommended that similar studies be conducted on more diverse

samples in further research, especially in more vulnerable socioeconomic groups. Last but not least, when dealing with the relationship between health-related constructs and outcomes and personality, normally the exploration of personality traits should not be limited only to conscientiousness and negative emotionality (like we did in our study for the sake of a more direct comparison with the similarly limited models by Christensen et al., 1999, and Trankle and Haw, 2009). In particular, extraversion seems to be associated with certain health behaviours to a similar or even a greater extent than the two previously mentioned traits (Kohút et al., 2020).

For further exploration of convergent and divergent validity of the IHBS, we also recommend including measures of compensatory health beliefs or other cognitive dissonance strategies. In future research, cognitive distortion should also be explored in the broader context of relationships between other cognitive variables and health-related outcomes, i.e., in more complex models. In particular, it could be worth exploring the role of cognitive distortion as a mediator of the relationship with other psychological constructs, such as cognitive capacity or scientific reasoning. Cognitive capacity and scientific reasoning seem to be good predictors of health-related unfounded beliefs (Čavojová et al., 2020; Čavojová & Ersoy, 2019; Saher & Lindeman, 2005): without cognitive capacity, it is difficult to evaluate and understand medical information. Complementary, underdeveloped scientific reasoning could prevent people from distinguishing between scientific and pseudo-scientific information. Future research focused on cognitive distortion as a mediator of the relationship between cognitive capacity or scientific reasoning and adverse health behaviour could further clarify the role of cognitive distortion in health behaviour.

Additional recommendations for further research are the dynamics of cognitive distortions development, their stability over a longer period of time and the dynamics in the relationships that we explored, particularly during health-threatening situations, such as the COVID-19

pandemic. For example, the recent findings propound that epistemically unwarranted (conspiracy) beliefs predict a weaker adherence to guidelines and recommendations regarding protection against COVID-19 (Čavojová et al., 2020; Teovanović et al., 2020).

Conclusion

In the world after the outbreak of the COVID-19 epidemic, the problem of examining irrational beliefs and health-related behaviours is exceptionally acute. Our research found that irrational health beliefs measured by the IHBS have a weakly negative relation to medical adherence in a non-clinical population. However, the instrument showed low or no predictive ability regarding other health behaviours, particularly unhealthy diet and substance use. These may be better predicted by other psychological constructs, such as compensatory health beliefs, rather than cognitive distortion as operationalised by the IHBS.

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Tables

Table 1 *Means, Standard Deviations and Internal Consistency Measures of the Study Variables*

Variable	Possible score range	M	SD	Alpha	Omega
IHBS	20-100	33.92	8.20	.76	.78
Internal HLOC	6-36	26.14	4.77	.71	.74
Powerful Others HLOC	6-36	16.39	5.04	.67	.68
Chance HLOC	6-36	15.94	5.11	.68	.70
PANAS Positive Affect	10-50	33.98	6.27	.81	.82
PANAS Negative Affect	10-50	21.77	7.27	.86	.86
BFI-2 Negative Emotionality	12-60	35.51	10.24	.90	.90
BFI-2 Conscientiousness	12-60	42.03	9.06	.88	.88
Adverse Health Behaviours (BHBQ)	12-60	25.75	5.53	.52	.56
BHBQ – individual behaviours:					
Lack of fruits and vegetables consumption	1-5	3.22	1.30	-	-
Soft drinks consumption	1-5	1.83	1.20	-	-
Lack of physical activity	1-5	2.12	1.38	-	-
Leisure screen time (sedentary behaviour)	1-5	3.12	1.03	-	-
Lack of sleep	1-5	3.02	1.40	-	-
No use of safety belts	1-5	1.38	0.72	-	-
Alcohol use when on medication	1-5	1.34	0.66	-	-
Tobacco smoking	1-5	1.83	1.41	-	-
Binge drinking	1-5	3.08	1.49	-	-
Cannabis use	1-5	1.41	0.99	-	-
No preventive dental check-ups	1-5	1.57	0.93	-	-
Premature discontinuation of medication	1-5	1.84	0.94	-	-

Table 2 *Correlation Matrix of the Study Variables (Pearson's r)*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	IHBS	(1)																			
2	Internal HLOC	-.10	(1)																		
3	Powerful Others HLOC	-.17	.15	(1)																	
4	Chance HLOC	.33	-.15	.13	(1)																
5	PANAS Positive Affect	-.16	.34	-.07	-.11	(1)															
6	PANAS Negative Affect	.23	-.10	.01	.17	-.34	(1)														
7	BFI-2 Negative Emotionality	.20	-.18	-.03	.14	-.47	.76	(1)													
8	BFI-2 Conscientiousness	-.13	.18	-.01	-.07	.38	-.35	-.33	(1)												
9	Adverse Health Behaviours (BHBQ)	.21	-.06	-.13	.16	-.15	.25	.20	-.33	(1)											
10	Lack of fruits and vegetables consumption	.07	-.17	.02	.11	-.20	.14	.12	-.17	.48	(1)										
11	Soft drinks consumption	.08	-.11	-.05	.04	-.09	.10	.09	-.07	.43	.28	(1)									
12	Lack of physical activity	.14	-.16	-.01	.15	-.23	.16	.21	-.18	.36	.28	.12	(1)								
13	Leisure screen time (sedentary behaviour)	.11	-.01	.00	.17	-.14	.22	.23	-.14	.43	.07	.11	.13	(1)							
14	Lack of sleep	.03	.04	.03	.03	-.06	.13	.05	-.12	.31	.08	.08	-.06	-.06	(1)						
15	No use of safety belts	.12	-.04	-.07	.07	-.04	.05	.01	-.02	.28	.02	.04	.00	.07	.07	(1)					
16	Alcohol use when on medication	.12	.01	-.05	.09	.01	.09	.05	-.13	.46	.03	.04	-.02	.22	.06	.12	(1)				
17	Tobacco smoking	-.03	.00	-.14	.01	.06	.09	.05	-.12	.58	.13	.19	.01	.17	.05	.05	.30	(1)			
18	Binge drinking	-.01	.08	-.07	.02	.08	.06	.04	-.14	.52	.07	.01	-.01	.23	.01	.07	.33	.30	(1)		

19	Cannabis use	.01	.12	-.12	-.03	-.04	.03	.03	-.13	.40	-.03	-.02	.02	.14	.03	.12	.27	.26	.27	(1)	
20	No preventive dental check-ups	.14	-.02	-.06	.04	-.08	.08	.00	-.29	.31	.11	.00	.03	.04	.01	.13	.16	.12	.04	.02	(1)
21	Premature discontinuation of medication	.45	-.01	-.14	.11	.01	.03	.04	-.09	.29	.04	.12	.02	.08	.05	.07	.07	.05	.03	.02	.08

Note: All correlation coefficients above .095 were statitically significant at the $p < .05$ level; all those above .125 were statistically significant at the $p < .01$ level.

Table 3 *Summary of Hierarchical Regression Analysis of Self-Reported Health Behaviours (BHBQ) in Undergraduates*

		β	S.E.	β 95% C.I.		R^2 change
				Lower	Upper	
Step 1						.16***
	Internal HLOC	.05	.05	-.05	.14	
	Powerful Others HLOC	-.16***	.05	-.25	-.07	
	Chance HLOC	.15*	.05	.06	.23	
	PANAS Positive Affect	-.02	.05	-.13	.08	
	PANAS Negative Affect	.15*	.07	.02	.29	
	BFI-2 Negative Emotionality	-.04	.07	-.18	.10	
	BFI-2 Conscientiousness	-.28***	.05	-.37	-.18	
Step 2						.01*
	IHBS[1]	.10*	.05	0.00	0.19	
	Overall model					.17***

Note: p < .05*; p < .01**; p < .001***

Appendix 1: Bratislava Health Practices Questionnaire (BHPQ): instruction, list of items and scoring

Part 1: Bratislava Health Practices Questionnaire - English Translation

Below are several questions in regard to your normal behaviour. Please mark YOUR CURRENT CONDITION in the reply. WE ARE ASKING ABOUT YOUR REAL CONDITION – not what condition you consider as appropriate or what condition you wish to be in.

1. On average, how often do you eat FRESH (RAW) FRUIT OR VEGETABLES? Fruit or vegetable juices don't count. We are asking about the overall daily amount of 150 g (ca. one apple):

/ Once a week or less

/ 2-3 times a week

/ 4-6 times a week

/ Overall approximately one such serving a day

/ Several such servings a day

2. On average, how many times a week do you drink SWEET DRINKS (coke, sodas, very sweet coffee or tea) or undiluted fruit juices? We are asking about the overall daily amount of 500 ml (ca. two glasses):

/ Once a week or less

/ 2-3 times a week

/ 4-6 times a week

/ Overall approximately one such serving a day

/ Several such servings a day

3. During a normal week, how often do you participate in INTENSIVE PHYSICAL ACTIVITY? We are asking about AT LEAST CA. 15 MINUTES of activity that SIGNIFICANTLY increases your breathing and pulse (jogging, soccer, intensive workout, mountain biking, …):

/ Less than once a week

/ Once a week

/ Twice a week

/ 3-4 times a week

/ 5-7 times a week

4. During a normal week, how often do you participate in LESS INTENSIVE PHYSICAL ACTIVITY? We are asking about AT LEAST CA. 30 MINUTES of activity that SLIGHTLY increases your breathing and pulse (brisk walking, dance, volleyball, gardening, …):

/ Less than once a week

/ Once a week

/ Twice a week

/ 3-4 times a week

/ 5-7 times a week

5.-7. On average, how many hours a day do you dedicate to the following activities ON WORKING DAYS?

5. Watching TV or movies

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

6. Making phone calls, chatting, texting, etc.

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

7. Using a computer or smartphone for other leisure activities (following social networks or watching short YouTube videos, browsing web pages, computer/video games, etc.):

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

8.-10. On average, how many hours a day do you dedicate to the following activities ON WEEKEND?

8. Watching TV or movies

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

9. Making phone calls, chatting, texting, etc.

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

10. Using a computer or smartphone for other leisure activities (following social networks or short YouTube videos, browsing web pages, computer games, etc.):

/ Less than 30 minutes a day

/ 30 – 59 minutes

/ Between 1 and 2 hours

/ 2-3 hours

/ 4 hours or more

11. During a regular 7-day week, how often do you sleep AT LEAST 7 HOURS a night or day?

0x / 1x / 2x / 3x / 4x / 5x / 6x / 7x

12. When travelling by car, do you use safety belts?

/ Never

/ Seldom

/ Sometimes yes, sometimes no

/ Yes, usually

/ Yes, always

13. When the doctor orders you to refrain from drinking alcohol while using prescription drugs, do you drink any alcohol?

/ No alcohol during that time

/ No, only exceptionally and just a small amount

/ Sometimes yes, sometimes no

/ Usually I drink

/ Yes, I drink, I never heed this restriction

14. How often do you smoke cigarettes or other tobacco products?

/ I don't smoke

/ Few times a year

/ Few times a month

/ Few times a week

/ Daily

15. In the LAST 12 MONTHS, how many times did you drink at least 4 (for a woman) or 5 (for a man) ALCOHOLIC DRINKS IN A ROW, i.e. in the course of several hours? Note: 1 drink = 0.5 litre glass of beer, or 0.2 litre glass of wine, or ca. 0.05 litre glass of hard liquor:

/ Never

/ Once

/ 2-3 times

/ 4-10 times

/ More than 10 times

16. In the last 12 months, how many times did you smoke marihuana or hashish?

/ Never

/ Once

/ 2-3 times

/ 4-10 times

/ More than 10 times

17. Since becoming a legal adult, on what occasion do you see a DENTIST?

/ Never

/ Only when a toothache lasts for a long time and other means are ineffective, going to the dentist is a last resort. Otherwise, I don't go.

/ Only when I have a toothache. Otherwise, I don't go.

/ I try to go for regular check-ups at least once a year, but I have missed an appointment in some years.

/ At least once a year – even when I don't have any dental problems, I go for regular check-ups.

18. When you receive a prescription, do you follow the doctor's instructions and take the medicine till the end, even when you are already feeling well?

/ Never

/ Seldom

/ Sometimes yes, sometimes no

/ Yes, usually

/ Yes, always

Part 2: Bratislava Health Practices Questionnaire - Scoring

The overall BHPQ score is calculated as the sum score of the scores for the twelve behaviours (score range: 12-60 points) according to the table below:

Behaviour	**Item(s) nr.**	**Scoring**
Lack of fruits and vegetables consumption	1	/Once a week or less: 5 pts. /2-3x a week: 4 pts. /4-6x a week: 3 pts. /Overall approximately one such serving a day: 2 pts. /Several such servings a day: 1 pt.
Soft drinks consumption	2	/Once a week or less: 1 pt. /2-3x a week: 2 pts. /4-6x a week: 3 pts. /Overall approximately one such serving a day: 4pts. /Several such servings a day: 5pts.

Lack of physical activity	3, 4	A composite score from two items (intensive and moderate physical activity), both treated as of equal value: /At least 4x a week altogether: 1 pt. (i.e., 5-7 a week & any response; or 3-4 & 3-4; or 3-4 & 2; or 3-4 & 1, in any order) /At least 3x a week, but less than 5x: 2 pts. (i.e., 3-4 & >1; or 2 & 2; or 2 & 1, in any order) /At least 2x/week, but less than 4x: 3 pts. (i.e., 2 & >1; or 1 & 1, in any order) /At least once a week, but less than 2x: 4 pts. (i.e., 1 & >1, in any order) /Both kinds of physical activity reported as "less than once a week": 5 pts.
Screen time, not work-related (sedentary behaviour)	5 to 10	A composite score from six items pertaining to three categories of activities (watching TV; computer and phone use for communication; computer and smartphone use for other leisure activities): 1. Recode each response into the approximate number of hours per day in the context of all five options: 0 for "Less than 30 minutes a day"; 0.75 for "30 – 59 minutes"; 1.5 for "Between 1 and 2 hours"; 2.75 for "2-3 hours"

		(given that the upper limit could be rounded up to 3.5 hours); and 4.5 for “4 hours or more”. 2. Based on (1.), calculate the overall number of hours per day: multiply the values of items 5, 6 and 7 by 5/7 (weekdays); multiply the values of items 8, 9 and 10 by 2/7. Subsequently, calculate the sum scores of these 6 multiplied values. 3. Allocate the points for the sum scores from (2.) accordingly: /0-1.5 hours: 1 pt. /1.51-3 hours: 2 pt. /3.01-6 hours: 3 pts. /6.01-10.5 hours: 4 pts. /> 10.5 hours: 5 pts.
Lack of sleep	11	/0-2x a week: 5 pts. /3-4x a week: 4 pts. /5x a week: 3 pts. /6x a week: 2 pts. /7x a week: 1 pt.
No use of safety belts	12	/ Never: 5 pts. / Seldom: 4 pts. / Sometimes yes, sometimes no: 3 pts.

		/ Yes, usually: 2 pts.
		/ Yes, always: 1 pt.
Alcohol use when on medication	13	/ No alcohol during that time: 1 pt.
		/ No, only exceptionally and just a small amount: 2 pts.
		/ Sometimes yes, sometimes no: 3 pts.
		/ Usually I drink: 4 pts.
		/ Yes, I drink, I never heed this restriction: 5 pts.
Tobacco smoking	14	/ I don't smoke: 1 pt.
		/ Few times a year: 2 pts.
		/ Few times a month: 3 pts.
		/ Few times a week 4 pts.
		/ Daily: 5 pts.
Binge drinking	15	/ Never: 1 pt.
		/ Once: 2 pts.
		/ 2-3 times: 3 pts.
		/ 4-10 times: 4 pts.
		/ More than 10 times: 5 pts.
Cannabis use	16	/ Never: 1 pt.
		/ Once: 2 pts.
		/ 2-3 times: 3 pts.

		/ 4-10 times: 4 pts. / More than 10 times: 5 pts.
Lack of preventive dental check-ups	17	/ Never: 5 pts. / Only when a toothache lasts for a long time and other means are ineffective, going to the dentist is a last resort. Otherwise, I don't go: 4 pts. / Only when I have a toothache. Otherwise, I don't go: 3 pts. / I try to go for regular check-ups at least once a year, but I have missed an appointment in some years: 2 pts. / At least once a year – even when I have no dental problems, I go for regular check-ups: 1 pt.
Premature discontinuation of medication	18	/ Never: 1 pt. / Seldom: 2 pts. / Sometimes yes, sometimes no: 3 pts. / Yes, usually: 4 pts. / Yes, always: 5 pts.