Chapter #5

VALIDATION OF THE CZECH VERSION OF THE INSOMNIA TYPE QUESTIONNAIRE (ITQ)

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ABSTRACT
Insomnia is one of the most common health problems patients face today. Nowadays, there are many diagnostic methods aiming to diagnose sleep disorders and insomnia from different aspects, mostly based on sleep characteristics such as sleep duration, time before falling asleep or early morning awakening, etc. Previous studies have shown that the characteristics of insomnia may not be limited to sleep but may be based on more permanent features of the patient's personality and life history. Researchers have identified significant heterogeneity in the clinical and biomarker characteristics of insomnia leading to subtypes without sufficient validity. The Dutch Insomnia Type Questionnaire aims to identify robust subtypes and thus reduce heterogeneity among insomnia. The aim of our research is to adapt the Insomnia Type Questionnaire into the Czech sociocultural environment and verification of its psychometric characteristics and mapping of subtypes of insomnia. Our research sample consisted of 1051 participants who completed ITQ online. The results of the internal consistency analysis indicated predominantly high internal consistency across scales. The obtained variables were included in the cluster analysis, which showed the presence of five different insomnia subtypes. The subtypes were largely equivalent to the subtypes in the original research.

Keywords: insomnia, sleep, insomnia type questionnaire, subtyping.

1. INTRODUCTION

We can approximately determine insomnia prevalence in the population, which varies according to the diagnostic criteria used. We know that insomnia is to some extent heritable and we can identify genes that increase the risk for developing symptoms (Hammerschlag et al., 2017). Despite all the knowledge we have about insomnia, it can still be difficult to characterize it in a unified way because its picture is inconsistent in different domains, e.g., with respect to cognition, mood, personality, life history, imaging, etc. This diversity of manifestations suggests that there could be yet undefined subtypes of insomnia, each with its own specific profile of characteristics.

The identification of insomnia subtypes could be a potential benefit for clinical practice, as it could allow the selection of high-risk individuals for early preventive intervention. Reducing previously unrecognized insomnia heterogeneity through subtyping can then help elucidate the mechanisms of insomnia and the development of personalized insomnia treatment.

2. BACKGROUND

Previous efforts to define the different types of insomnia have been defined in a top-down fashion, focusing exclusively on sleep characteristics. Categories such as initial, intermediate, late, and mixed insomnia emerged, based on the most common patient complaints. The most widely used classification of subtypes distinguishes between sleep onset insomnia/difficulty initiating sleep (SOL/DIS), wake after sleep onset/difficulty maintaining sleep (WASO/DMS) and early morning awakening (EMA). This classification was used by Bjorøy, Jørgensen, Pallesen and Bjorvatn (2020) who divided insomnia into seven subtypes based on type of sleep difficulty reported: sleep onset insomnia (SOL-insomnia), sleep maintenance insomnia (WASO-insomnia), early morning awakening insomnia (EMA-insomnia) and combinations of these. They found that there are major differences between the insomnia subtypes, both regarding demographics, but also in terms of how the complaints may affect daily life. These common sleep problems are also reflected in some psychometric scales estimating the severity of problems, such as the Insomnia Severity Index (ISI) which has been shown to be a valid and reliable clinical tool to assess perceived sleep difficulties and to detect changes during treatment (Bastien, Vallières, & Morin, 2001). Hohagen et al. (1994) investigated the temporal stability of these subtypes of insomnia in a longitudinal study design. The results of this study indicate that subdividing insomnia into sleep-onset insomnia, sleep-maintaining insomnia and EMA probably may not be a useful tool for assessment of diagnosis for clinical and scientific purposes. The different patterns of insomnia showed low stability in the course of 4 months.

A different perspective on insomnia subtyping offers study of Vgontzas and Fernandez-Mendoza (2013). They found, that increased levels of cortisol and catecholamines were observed in those insomniacs with objective short sleep duration but not in those with "normal" sleep duration. These findings led to the hypothesis that there are two types of insomnia—the first associated with physiological hyperarousal (i.e., short sleep duration and activation of the stress system), and the second not associated with physiological hyperarousal or activation of the stress system (Vgontzas & Fernandez-Mendoza, 2013).

A review study by Benjamins et al. (2017) showed that the characteristics of insomnia need not be limited to sleep. Through a meta-analysis of previous research, they attempted to show that some subtypes of insomnia sufferers may differ from those who do not experience sleep difficulties, especially in terms of demographic characteristics, mental and physical health, the impact of childhood trauma, life events, fatigue, sleepiness, overexcitability, hyperactivity, also with regard to lifetime sleep history, chronotype, depression, anxiety, moods, quality of life, ability to regulate emotions, coping strategies, etc. The researchers hypothesized that clearer subtypes of insomnia disorder could emerge if they were developed with a bottom-up design, and were based on an analysis of the data collected, with a multidimensional set of stable, biologically based insomnia-related characteristics. Previous genome-wide association studies (Hammerschlag et al., 2017; Jansen et al., 2019) suggested that insomnia was genetically more closely associated with mood, personality, and life satisfaction attributes than with sleep-related phenotypes. Blanken et al. (2019) set out to investigate whether insomnia manifests in different subtypes that are reflected in a multidimensional pattern of stable characteristics such as life history, traits of positive and negative affect, and personality.

The Dutch Insomnia Type Questionnaire (Blanken et al., 2019) aims to identify robust subtypes and thus reduce heterogeneity among insomniacs. When developing the questionnaire, the authors set two main conditions, firstly they wanted the ITQ to be

applicable to the general population and therefore included the Insomnia Severity Index (ISI) so that individuals showing features of insomnia could be identified. Secondly, the authors wanted the ITQ to contain as few items as possible. The questionnaire was developed using a large sample (N=4,322) of which 2,224 individuals met the ISI score (cut of score 10) for insomnia. The remaining individuals served as a control group. The results of the questionnaire were then validated on an independent sample (N=251). Both samples showed clinical relevance (developmental etiology, health risks, response to pharmacological and non-pharmacological treatments, and neurophysiological markers) for each subtype. A follow-up phase was also conducted for the questionnaire, in which 215 participants from the original cohort of 2224 insomniacs were re-administered the ITQ. Individuals were followed up after 4.8 years (SD=1.6) and were found to have a 0.87 probability of retaining their original subtype. The questionnaire identifies 5 subtypes of insomnia: highly anxious, moderately anxious but sensitive to rewards (with intact reactions to pleasant emotions), moderately anxious insensitive to rewards, moderately anxious with higher reactivity (to the environment and life events), moderately anxious with low reactivity. Subtyping was stable over time, clinically relevant, and biologically meaningful.

3. OBJECTIVES

The aim of this article is to validate the psychometric characteristics of the Czech adaptation of the Insomnia Type Questionnaire (Blanken et al., 2019) and to map insomnia subtypes in the Czech population.

4. METHODS

The ITQ consists of 14 questionnaires looking at various personality characteristics that are likely to contribute to the development of insomnia. Namely: ISI (Insomnia severity index), CTQ (Childhood Trauma Questionnaire), FSS (Fatigue severity scale), FIRST (Ford Insomnia Response to Stress Test), PSAS (Pre-Sleep Arousal Scale), ACS (Action Control Scale), BISBAS (Behavioral Inhibition/Activation Scale), MIPIP (Mini-IPIP), PI (Perfectionism Inventory), RPA (Response to Positive Affect), RRS (Ruminative Response Scale), PANAS (Positive and negative affect scale), SHS (Subjective Happiness Scale), TEPS (Temporal Experience of Pleasure Scale). Original questionnaire is part of the supplement of Blanken et al. (2019). An automated scoring script for the Insomnia Type Questionnaire can be found online: https://tfblanken.shinyapps.io/itqapp/.

The entire ITQ battery has been translated using standard double translation into Czech language. Subsequently, the adequacy of the translation was assessed by independent assessors. The resulting final version was then used for data collection. Items of our questionnaire were the same as the original test. Data was collected using an online questionnaire that was distributed via social media. The collection was open to both males and females and the only requirement for participation in the research was that probands were of legal age and had access to the internet. The selection of respondents was casual non-random. Respondents were recruited either by direct approach (in person, private messages) or indirectly through social media posts and reshares.

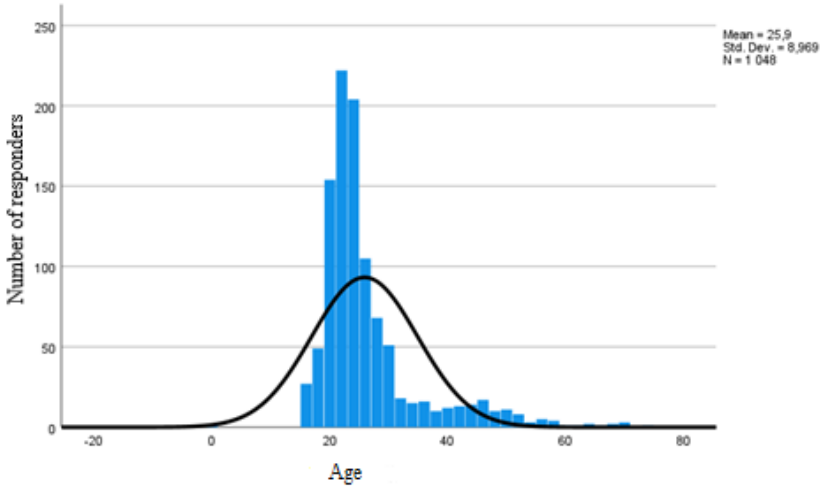
A total of 1,051 respondents completed the questionnaire, including 613 persons in the first wave and 438 persons in the second wave of data collection.

The research sample included a total of 1051 people, of whom 839 were women (79.8%), 211 were men (20.1%) and one respondent who did not indicate gender (0.1%). The largest number of respondents was in the 20-25 age group (N = 607; 57.8%), see Table 1. The age distribution of the population is shown in Figure 1.

Table 1.
Overview of age groups of respondents.

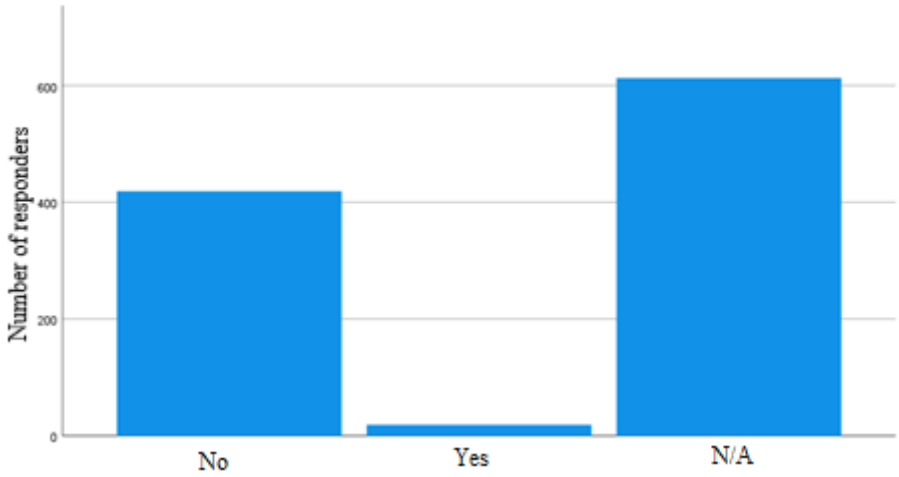
Age	**N**	**%**	**Average**	**Mod**	**Med**
< 20	113	10,8 %	25,9	23	23,0
20 – 25	607	57,8 %			
26 – 30	161	15,3 %			
31 – 35	46	4,4 %			
> 36	121	11,5 %			
unlisted	3	0,3 %			

Figure 1.
Age distribution of the population.



In the second wave of data collection, respondents were also asked whether they took any sleeping pills. The majority of respondents (N = 419; 95.7%) claimed not to take any medication, see Figure 2.

Figure 2.
Graphical representation of responses regarding the use of sleeping pills.



4.1. ITQ Reliability Verification

We checked the internal consistency of the items of the sub-questionnaires that make up the ITQ. These results could contribute to estimating the reliability of the questionnaire. The resulting internal consistency of the items for the Mini-IPIP scale indicated lower reliability of this scale. This could be due to the attempt to measure broad characteristics with only four items. For the FIRST questionnaire, we discarded item 5 ("After watching a scary movie or show") because only a half of probands responded to this item. After discarding this item, the internal consistency value of the FIRST scale did not change. Other results showed relatively high internal consistency across scales.

In the next step, we tested the reliability of the scales using the split-half method. Table 2 provides an overview of the results of the internal consistency and split-half reliability analyses.

The value of McDonald's omega for the CTQ scale ($\omega > 1$) could indicate that the items of this scale are over-correlated with each other. This could mean that some of the items in the scale are likely to be redundant.

Table 2.
Verification of reliability as internal consistency of individual scales and split-half reliability.

Scale	Cronbach's α	McDonald's ω	Spearman-Brown Formula	Guttman Split-half coefficient
ACS	0,80	0,79	0,80	0,79
BAS	0,80	0,79	0,75	0,75
SHS	0,87	0,87	0,84	0,84
RPA	0,87	0,86	0,79	0,79
RRS	0,84	0,83	0,82	0,83
MIPIP E	0,84	0,84	0,79	0,79
MIPIP N	0,68	0,68	0,60	0,60
MIPIP A	0,74	0,73	0,66	0,66
PANAS PA	0,80	0,81	0,75	0,75
PANAS NA	0,86	0,86	0,86	0,86
TEPS	0,80	0,79	0,73	0,72
PI	0,86	0,83	0,88	0,88
FIRST	0,82	0,82	0,80	0,78
PSAS	0,91	0,91	0,77	0,77
FSS	0,88	0,88	0,81	0,81
ISI	0,83	0,83	0,77	0,75
CTQ	0,91	1,08	0,87	0,83

4.2. The correlation Analysis of the Variables

Table 3 shows very close positive correlations between action control and the experience of satisfaction, as well as between feelings of happiness, extraversion, positive rumination and positive attunement. A close positive correlation was found between neuroticism, negative attunement, and perfectionistic rumination. Variable severity of insomnia was moderately positively correlated with pre-sleep arousal, fatigue, insomnia as a response to stress, rumination, and humiliation.

Table 3.
Correlations between variables.

	AC	BA	H	PR	D	R	E	A	N	PA	NA	EP	O	PPP	PerR	IRS	PSA	F	IS	CT
AC	1																			
BA	-,19**	1																		
H	,45**	-,36**	1																	
PR	,33**	-,46**	,55**	1																
D	-,42**	,11**	-,49**	-,37**	1															
R	-,43**		-,45**	-,11**	,54**	1														
E	,28**	-,41**	,40**	,30**	-,22**	-,24**	1													
A	-,07*	-,16**	,10**	,12**		,16**	,17**	1												
N	-,52**	,14**	-,59**	-,36**	,48**	,50**	-,28*	,08*	1											
PA	,34**	-,52**	,49**	,58**	-,18**	-,11**	,36**	,11**	-,29**	1										
NA	-,46**	,18**	-,51**	-,29**	,55**	,51**	-,30**		,60**	-,07*	1									
EP	,70*	-,43**	,34**	,40**	-,13**		,22**	,28**	-,09*	,37**	-,12**	1								
O	,22**		,12**	,12**			-,08**	,09**	-,09**	,13**	-,10**	,10**	1							
PPP	-,18**		-,24**	-,13**	,25**	,24**	-,01**		,22**	-,08**	,23**			1						
PerR	-,52**	,07*	-,46**	-,24**	,52**	,54**	-,31**	,09**	,53**	-,15**	,53**		,12**	,42**	1					
IRS	-,35**		-,25**	-,13**	,28**	,30**	-,14**	,19**	,39**		,34**	,11*		,20**	,39**	1				
PSA	-,38**	,12**	-,39**	-,23**	,46**	,47**	-,20**		,43**	-,14**	,52**		-,08**	,26**	,47**	,54**	1			
F	-,41**	,09**	-,33**	-,26**	,31**	,39**	-,24**		,36**	-,25**	,38**		-,10**	,18**	,36**	,21**	,40**	1		
IS	-,29**		-,32**	-,23**	,35**	,35**	-,14**		,32**	-,15**	,34**	-,06*		,22**	,35**	,44**	,61**	,45**	1	
CT	-,10**	,16**	-,26**	-,20**	,18**	,18**	-,14**	-,15**	,14**	-,16**	,23**	-,19**	-,09**	,27**	,16**	,15**	,32**	,17**	,32**	1

** < 0,001; * < 0,05
AC = AC = Action Control, BA = Behavioral Activation, H = Feelings of Happiness, PR = Positive Rumination, D = Humiliation, R = Rumination, E = Extraversion, A = Agreeableness, N = Neuroticism, PA = Positive Attunement, NA = Negative Attunement, EP = experiencing satisfaction, O = organized, PPP = experiencing parental pressure, PerR = perfectionistic rumination, IRS = insomnia in response to stress, PSA = pre-sleep arousal, F = fatigue, IS = insomnia severity, CT = childhood trauma

According to the results, there was a close negative relationship between neuroticism, action control and feelings of happiness, and a weakly close relationship between extraversion and neuroticism. Medium-tight negative correlations emerged between behavioral activation, positive rumination, extraversion, and experiencing satisfaction.

Results indicated that there were weakly close negative correlations between insomnia severity, positive attunement, positive rumination, feelings of happiness, and action control. These relationships indicated that the aforementioned variables were unlikely to contribute to the development of insomnia symptoms. Conversely, variables that were strongly positively correlated with insomnia severity, such as pre-sleep arousal, fatigue or rumination, may promote the development of insomnia.

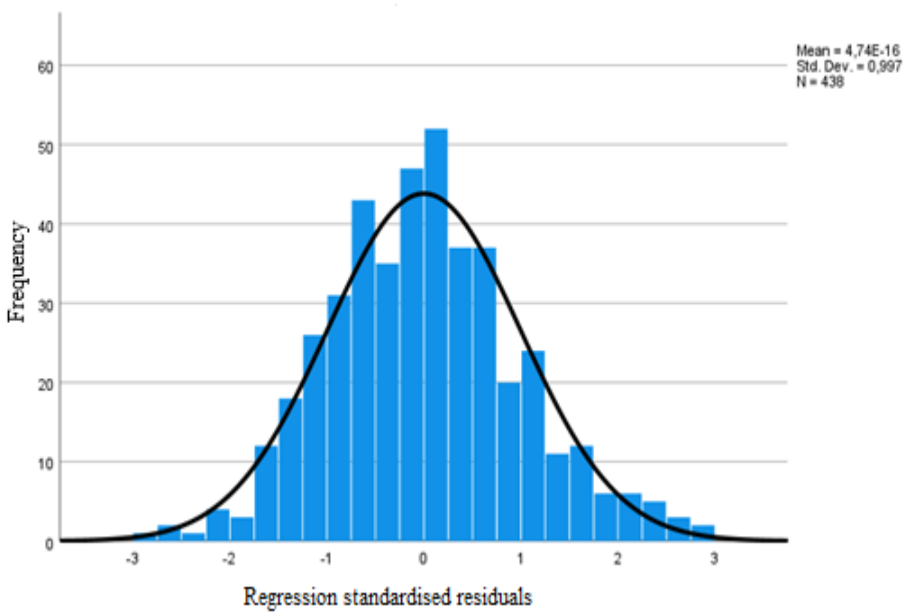
Based on the results of the correlation analysis, we were interested in what a model predicting insomnia severity from the variables pre-sleep arousal, fatigue or insomnia in response to stress would look like. Together, these three predictors explained 48.5% of the variability in insomnia, which was 6.9% more than for pre-sleep arousal as a single predictor. The regression model is summarized in Table 4. The histogram of the residuals suggests an approximately normal distribution of values (see Figure 3).

Table 4.
Regression analysis of predictors of insomnia severity.

	B	***SE*$_B$**	**β**	***P***
MODEL 1:				
PA	,30	,02	,64	< ,001
MODEL 2:				
PA	,27	,02	,58	< ,001
IRS	,42	,04	,13	< ,05
MODEL 3:				
PA	,23	,02	,48	< ,001
IRS	,13	,04	,42	< ,05
F	,14	,02	,26	< ,001

PA = pre-sleep arousal, IRS = insomnia in response to stress, F = fatigue

Figure 3.
Histogram of residues.



4.3. Factor Analysis

By calculating the resulting scores of each questionnaire, we obtained a total of 20 variables for which we were interested in their factorial affiliation. We converted the resulting variables into Z-scores.

By determining the inclusion criterion according to the final ISI score (ISI ≥ 10), we obtained a large group of subjects, which we included in further measurements. Of the 543 persons who met the inclusion criterion, 438 were women (80.7%) and 105 were men. Exploratory factor analysis, a principal components method with non-orthogonal Oblimin rotation, identified five components that explained 58.8% of the variance in the original variables. The factor loadings of each variable are summarized in Table 5.

Table 5.
Factor distribution of variables.

	Component				
	1	**2**	**3**	**4**	**5**
Perfectionistic rumination	,792	-,148		,298	,463
Negative affect	,789	-,191	,131		,418
Neuroticism	,780	-,306			,394
Rumination	,757				,454
Humiliation	,752	-,210			,388
Happiness	-,691	,599	-,192	,104	-,331
Control of action	-,667	,348	,191	,225	-,414
Positive attunement	-,210	,816		,189	-,190
Behavioral activation	,122	-,787	,139		
Positive rumination	-,357	,747	-,138	,195	-,241
Experiencing pleasure		,606	-,484	,145	,109
Extraversion	-,370	,584	-,101	-,283	-,159
Childhood trauma	,192	-,159	,651		,433
Agreeableness		,251	-,628	,111	,195
Experiencing parental pressure	,426		,464	,198	,284
Organization				,904	
Severity of insomnia	,382	-,113	,159		,838
Pre-sleep arousal	,573	-,129	,149		,788
Insomnia in response to stress	,451		-,156	,203	,737
Fatigue	,457	-,220	-,123	-,132	,626

Extraction method: principal component analysis
Rotation method: Oblimin with Kaiser criterion

The factor analysis yielded five components that divide the outcome variables into their respective groups. The first component is strongly characterized by clinging thinking, neuroticism, rumination, and overall negative attitudes. It is negatively correlated with feelings of happiness and control of action (activity). Symptoms of insomnia in this case may be related to the experience of stress, increased fatigue, but also increased pre-sleep arousal. We have labeled it generally as "Negative Experiencing" for the purpose of further analysis.

According to the factor structure, the second component corresponds to experienced feelings of happiness, positive attunement and positive clinging. It is positively correlated with extraversion and very closely negatively correlated with behavioral activation and weakly correlated with neuroticism. We have labeled it as "Positive Experiencing."

The third component shows a strong association with childhood traumatization and experienced parental pressure. Negative moderate relationships were found in relation to agreeableness, experiencing satisfaction, feelings of happiness and positive rumination. We labeled this component as "Childhood trauma, parental pressure."

The fourth component, named "Organization, Perfectionism", is characterized by high organization and control of activities. It may also be related to experiencing feelings of happiness, friendliness, positive rumination, and overall positive attunement.

The fifth component is characterised by very close relationships between severity of insomnia, pre-sleep arousal, and fatigue, as well as moderately close positive relationships of perfectionistic rumination, humiliation, and overall negative attunement. There were weakly close positive relationships with agreeableness and experienced pleasure.

Correlational analysis showed that the components were barely correlated or negatively correlated with each other, supporting the assumption that they could be separate categories of variables representing a particular group of characteristics. An overview of the analysis of the tightness of the relationships between the components is provided in Table 6.

Table 6.
Correlation between the obtained five components.

Component	1	2	3	4	5
1	1,000	-,247	,050	,037	,496
2	-,247	1,000	-,135	,118	-,091
3	,050	-,135	1,000	-,003	,019
4	,037	,118	-,003	1,000	,005
5	,496	-,091	,019	,005	1,000

4.4. Cluster Analysis

Using factor analysis, we obtained five groups of variables. These groups of variables were tested by cluster analysis, which showed that respondents could be classified into five different groups, or subtypes, based on their responses and characteristics. We compared these subtypes with the results of the original research.

We named the obtained groups on the basis of their predominant characteristics:

1) Subtype 1: traumatized with higher levels of control
2) Subtype 2: tired with low level of control
3) Subtype 3: happy with traits of perfectionism
4) Subtype 4: highly stressed and unhappy
5) Subtype 5: highly organised with higher levels of control

For the obtained subtypes, we observed their demographic characteristics. In subtype 1, 105 individuals were represented, 13.4% of whom were women and 37.1% men. The average age of this group of persons was around 23 years. The largest group of probands was subtype 3 with 142 followed by subtype 2 with 109 probands. Conversely, the smallest number of subjects (n = 89) represented the fifth subtype. In subtypes 1 and 5, males outnumbered females.

From the data obtained additionally using the Pittsburgh Sleep Quality Questionnaire (PSQI), we compiled a summary of the sleep characteristics of the subtypes studied. We focused on sleep induction time and duration, subjectively perceived sleep quality, occurring sleep difficulties, and level of disruption to daily functioning. We observed the least difficulty in any of the domains studied in subtype 5: highly organized with higher levels of control. Conversely, the greatest problems across all sleep characteristics occurred in subtype 2: tired with low levels of control. The shortest sleep durations occurred for those in subtype 4: highly

stressed and unhappy. The longest average sleep duration was observed in subtype 5. The most common sleep-related difficulties reported by the subjects included stress, excessive noise, nightmares, health problems (illness, toothache), physiological manifestations of anxiety (heart palpitations, sweating), natural phenomena (full moon, thunderstorm) and physiological needs (hunger, thirst, urge to go to the toilet). There were also very frequent responses describing various thoughts about work, school or other responsibilities that "can't be got rid of" or that "can't be switched off".

4.5. Validity

To test validity, we compared our results with those of the original research by Blanken et al. (2019), to determine whether the ITQ questionnaire battery could be a reliable indicator of insomnia subtypes.

Evidence 1: The factor structure of the variables showed the relationships we would expect between the variables, which could be seen as one evidence of construct validity of the questionnaire.

Evidence 2: Cluster analysis resulted in the probands being classified into five groups approximately corresponding to the distribution of subtypes in the original research.

5. FUTURE RESEARCH DIRECTIONS

In our research, we looked more closely at the relationships between depression, anxiety, insomnia and other variables. Due to the design of our research, we could not examine the assumed bidirectionality of the relationships of these phenomena. Future research with an appropriate design could focus on examining the reciprocal relationships of these disorders and the influence of other variables on this relationship (e.g., the mediating influence of pre-sleep arousal) to strengthen prevention and intervention options for anxiety, depression, and insomnia.

The results of our research have also suggested the need for greater attention to behavioral activation and inhibition systems in relation to personality characteristics, particularly neuroticism and extraversion. The behavioral activation system may also include other components,

that are related to negative experiencing and impulsivity rather than extraversion and motivational behaviour.

Finally, further research could focus on further exploring the characteristics of insomnia subtypes by running more advanced statistical procedures and looking for differences between the demographic groups of respondents represented in these subtypes. Furthermore, it would be useful to monitor the stability of the defined subtypes over time, e.g. through longitudinal research, to provide further evidence of the validity of this questionnaire battery.

6. DISCUSSION

The aim of this study was to validate the psychometric properties of the Insomnia Type Questionnaire developed by Blanken et al. (2019) which consists of 14 standardized questionnaires. The whole ITQ was translated into Czech language. The Czech version of the ITQ has not yet been standardized or psychometrically validated, which also became the aim of our work. The ITQ questionnaire battery defines subtypes in terms of multidimensional profiles of stable human characteristics. Although these characteristics may not be directly related to sleep, they may underlie the development of insomnia. From a clinical perspective,

subtypes provide targets for improving cognitive, emotional, and behavioral interventions in the treatment of insomnia.

This research is based on data collected by self-report questionnaire method. Evidence on the reliability and validity of this questionnaire was presented in a large sample population of mostly young adults, and the different subtypes of insomnia were defined.

To test validity, we compared our results with those of the original research by Blanken et al. (2019) to determine whether the ITQ questionnaire battery could be a reliable indicator of insomnia subtypes.

The factor structure of the variables showed the relationships we would expect between variables, which could serve as one piece of evidence for construct validity of the questionnaire. Cluster analysis resulted in the probands being classified into five groups approximately corresponding to the distribution of subtypes in the original research, which supported the reliability of our measure.

In the first group of probands (traumatized with higher levels of control), childhood trauma and low organization were most prominent. This group resembled the subtype 4 slightly distressed and highly reactive used in Blanken et al. (2019). The second group (tired, low control) was characterized by marked disorganization and the experience of both negative and positive feelings. It was characterized by mild sleep difficulties associated with increased arousal and fatigue. This group resembled the subtype 3: moderately distressed, reward insensitive used in Blanken et al. (2019). The third group (happy with traits of perfectionism) was characterized by predominantly positive experiencing, contentment, and some degree of control. It also showed less pronounced perfectionistic tendencies. Similar characteristics were found in the subtype 2: moderately stressed subtype, reward sensitive used in Blanken et al. (2019). The fourth group (highly distressed and unhappy) could be characterised by predominantly negative experiencing and attunement. Sleep difficulties associated with pre-sleep arousal and fatigue were evident and therefore resembled the subtype 1: highly distressed subtype used in Blanken et al. (2019). The last of the resulting cluster analysis subtypes (highly organised with higher levels of control) was characterized by positive attunement, but also by negative rumination, high organization and perfectionism, which predominated. This group could probably correspond to the subtype 5: slightly distressed and low reactive used in Blanken et al. (2019).

In terms of the representation of demographic characteristics such as age and gender, males outnumbered females in subtypes 1 and 5. In the original research, males outnumbered females in subtypes 3 and 5, which was therefore only partially consistent with our findings. Subtype 4 in our research was strongly represented by females (21.9% of females and 8.6% of males), whereas in subtype 1 in the original research, the representation of males and females was fairly balanced (20% of females and 16% of males). The subtypes with the lowest average age were subtypes 1 and 4, where the average age ranged from 22 to 25 years. Conversely, the group with the highest average age was subtype 3 (25 to 28 years), followed by subtype 5, where the average age was up to 27 years. The age distribution in the original subtypes also varied with respect to the population studied. The group with the highest mean age (57 years) was subtype 5, followed by subtypes 3 and 4 with a mean age of 54 years. The youngest group was represented by subtype 2, where the mean age was around 49 years.

The obtained subtypes were also compared with the original groups in terms of sleep problems and other characteristics. The greatest problems were observed in subtype 2, where the subjects described the most significant difficulties in daily functioning, and in subtype 4, which was characterized by the lowest average sleep duration, long falling asleep times, and dissatisfaction with sleep quality. Our observations were consistent with the characteristics of the original subtypes 3 and 1, to which our described subtypes roughly corresponded. The least difficulty with falling asleep and sleep quality occurred in subtype 5, which was not very consistent with the original findings.

In terms of incremental validity, which describes the extent to which a method adds something new to existing methods, there is currently no tool available that maps insomnia subtypes based on biologically based personality traits and life history similar to the ITQ. Therefore, it can be considered as a method that enriches scientific knowledge from a new perspective and offers a different way of observing insomnia than other tools used so far. Given the satisfactory internal consistency of the items of the scales comprising the ITQ battery, the expected factor structure, and the equivalence of the groups we identified with the subtypes of the original research, we can conclude that the psychometric properties of this instrument are good.

Therefore, the limitation may be intentional or unintentional distortion of data by respondents due to fatigue or other subjective factors. Among the limitations, we should mention some errors that occurred during data collection. In the first wave of the survey, which involved 613 respondents, the FIRST scale included eight questions instead of nine. A ninth question was added after the error was discovered. For the PI (perfectionism) scale, responses were incorrectly collected on a 4-point Likert scale instead of a 5-point Likert scale. All errors were corrected before the second wave of data collection.

In the second wave, which involved 438 respondents, the survey was expanded to include the BFI-44 (personality characteristics), PSQI (sleep difficulties), and Zung's SDS (depression) and SAS (anxiety) questionnaires. An error with the online interface of the questionnaire resulted in some questions of the Zung questionnaire being repeated, so respondents had to answer these questions repeatedly, which may have made the questionnaire difficult to complete. This error was rectified on 11/12/2021 when the number of respondents was 1034.

Among the limitations of this research, we could also include the use of cluster analysis instead of latent class analysis, which would have provided more accurate and detailed results about the characteristics of each practice.

The absence of a control group reduce the “power” of the results.

We are not aware that the psychometric properties of the questionnaire have been validated in a different population than in the original study by Blanken et al. (2019).

7. CONCLUSION

The research focuses on the psychometric properties of the Czech version of the ITQ. A large sample population of predominantly young adults is used to demonstrate the reliability and validity of this questionnaire and to define the different subtypes of insomnia. The obtained subtypes corresponded to some extent to the subtypes defined in the original research, although we were not able to describe their detailed characteristics and typical features based on the chosen method. The subtyping of insomnia based on enduring personality traits and patients’ life history may help to improve the quality of treatment and care for patients with insomnia.

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