


# BMJ Open Cardiovascular disease risk perception in a Hungarian community sample: psychometric evaluation of the ABCD Risk Perception Questionnaire

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## ABSTRACT

**Objectives** Reliable and valid assessment of subjective risk perception is a crucial part of cardiovascular disease (CVD) prevention and rehabilitation. Since the recently developed Attitudes and Beliefs about Cardiovascular Disease (ABCD) Risk Questionnaire complies with these requirements, the aim of the present study was to investigate the psychometric properties of the Hungarian version of the measure.

**Design and setting** Community-based cross-sectional observational study

**Participants** In sum, 410 (M=49.53 years, SD=8.09) Hungarian adults (inclusion criteria: aged 35 and above, not under treatment with a psychiatric disorder) were included in the present study (female: n=277, 67.6%; college or university-level education: n=247, 60.2%).

**Methods** We translated the ABCD Risk Questionnaire into Hungarian and checked its psychometric properties and validity indices.

**Primary outcome measures** Internal consistency, explorative and confirmative factorial validity. Associations with sociodemographic and health-related characteristics, as well as with measures of mental health (depressive symptoms, perceived stress and well-being).

**Results** Exploratory and confirmatory factor analyses supported a three-factor solution, corresponding to the original subscales of Risk Perception, Perceived Benefits and Healthy Eating Intentions, with a moderate correlation between the latent constructs. The respondents' level of knowledge on CVD risk factors was largely independent of their subjective risk perception. The results also provided evidence on the weak-to-medium associations between mental health indices and CVD-related perceptions. Based on the results, a shortened scale version was also suggested.

**Conclusion** This study confirms the factorial structure, internal consistency and validity of the Hungarian version of the ABCD Risk Questionnaire in a non-English-speaking community sample. The ABCD Risk Perception Questionnaire is a parsimonious and psychometrically adequate measure to assess CVD-related attitudes and knowledge in the general population. Further research is needed in socioeconomically more diverse and in clinical samples, as well as in longitudinal intervention studies.

## Strengths and limitations of this study

- It presents the Hungarian language adaptation of a previously validated measuring system, the Attitudes and Beliefs about Cardiovascular Disease Risk Questionnaire.
- It uses a cross-sectional community sample of 410 Hungarian adult respondents.
- It is the first study to provide cross-cultural data on cardiovascular disease-related risk perceptions and knowledge along with correlates in a non-English-speaking sample.
- The associations in it are correlational without the possibility of causal inferences.
- The data on medical conditions are self-disclosed.

## INTRODUCTION

### Cardiovascular disease-related risk and risk perception: general overview

Cardiovascular diseases (CVDs) are the leading cause of death globally, accounting for more than 30% of mortality, therefore, significantly lowering life expectancy<sup>1 2</sup> Approximately half of the CVDs is coronary disease. The number of patients suffering from atherosclerosis is increasing worldwide, and coronary artery disease accounts for more than 50% of mortality.<sup>3</sup> According to the European statistics, more than 34 million disability-adjusted life years (DALYs) are related to the disease group, which is 25% of the all-cause DALYs.<sup>4</sup> CVD accounted for 45% of all-cause mortality in 2016, being responsible for 4 million deaths per year. Coronary artery disease caused 1.8 million deaths, and 1.4 million cases occurred before the age of 75.<sup>4</sup> Since 1970, mortality has been decreasing significantly in Western-Europe, but in Middle and Eastern Europe, this trend began later. Therefore, there is an almost twofold difference between the regions (Bulgaria 62%, France 26%).<sup>5</sup>

Currently, the assessment of several biological and physical risk factors of CVD is possible on a population level. Moreover, these individual markers may be combined into indicators that reliably estimate the absolute risk of an individual's 5-year or 10-year risk of coronary disease and CVD.<sup>6–8</sup> Consequently, several guidelines for preventing CVD suggest the screening for absolute risk being a crucial first step in risk management.<sup>9–11</sup>

Moreover, since both long-term prevention and effective treatment require the active cooperation of the population concerned (eg, the at-risk subgroups of a society, CVD patients, etc), one's perceived risk of CVD turned out to be a central psychological construct that may affect health behaviour maintenance and change. Individual CVD risk perception—be it accurate or an underestimation or overestimation—depends on several factors. In general, knowledge about the widely promoted risk factors for CVD, such as higher age, stress, smoking, obesity, high blood pressure as compared with one's own characteristics may form the basis of the individual risk perception.<sup>12 13</sup> To adopt a healthy lifestyle and habits that are conducive to health, such as diet, exercise, smoking and alcohol consumption, people first have to understand the importance of CVD risk.<sup>13</sup> As Webster and Heeley<sup>14</sup> note, 'many patients have insufficient knowledge about CVD-related risk factors and often tend to have a dichotomous understanding of risk rather than understanding risk as a continuum.' (p. 54.) Moreover, people 'also tend to compare themselves to others who are worse off than themselves when judging their personal risk rather than another average person like themselves.' (p. 54). Concerning the evaluation processes behind subjective risk perception, several intrapersonal characteristics were proposed, including health literacy, anxiety level and optimism. Given its subjective nature, CVD risk perception is in an ambiguous relationship with objective risk as assessed by physiological markers, most frequently, by the Framingham Risk Score. While about 40% of the general population underestimate their risk for developing CVD, 20% overestimate it.<sup>14 15</sup> The potential consequences of underestimation (ie, the perceived risk being substantially lower than the objective risk) may be especially dangerous for the health trajectory of the individual since it may contribute to the adoption or upholding of unhealthy behaviours and thus to the premature development of CVD. Moreover, excessive overestimation, when the perceived risk is substantially higher than the objective risk, may also cause a significant psychological burden.<sup>15</sup>

### Assessment of CVD risk perception

The reliable and valid assessment of subjective risk perception is a crucial part of CVD prevention and rehabilitation. In the recent decades, several measures were used for this reason. Many studies use simple single-item questions.<sup>16 17</sup> Recently, Woringer *et al* asserted that while many validated measures assess knowledge on and perceptions of CVD, as well as intention to change CVD-related

behaviour separately,<sup>18–20</sup> only a few validated questionnaires aim at CVD risk awareness incorporating all of these concepts.<sup>21</sup>

### The Attitudes and Beliefs about Cardiovascular Disease Risk Perception Questionnaire

In order to overcome several drawbacks of the previously existing measurement approaches, Woringer *et al*<sup>21</sup> ran an extensive scale development procedure. They aimed to develop a validated measure of CVD risk that had satisfactory validity and could be reliably applied to assess patients' awareness of CVD risk among participants of the National Health Service Health Check Programme.<sup>22</sup> The resulting Attitudes and Beliefs about Cardiovascular Disease (ABCD) Risk Questionnaire consists of three scales: Perceived Risk of Heart Attack/Stroke assesses the respondent's own risk perception concerning their probability of developing a CVD; Perceived Benefits and Intentions to Change scale, and Healthy Eating Intentions scale. The authors also added a fourth scale, named Knowledge of CVD Risk and Prevention, which aims to capture the respondents' objective knowledge level concerning basic facts on CVD.

### CVD in Hungary and the need for reliable measures

There is a decreasing tendency in Hungary in all-cause mortality, but CVD-related death is still 173%–158% higher than in the EU15 countries (refer author note), according to the data from.<sup>23</sup> CVD-related death was 54.6% of all-cause mortality in females, and 44% in males in 2015.<sup>23</sup> As a frame of the study, we ran this investigation as part of the National Heart Programme. The Hungarian version of the ABCD Risk Questionnaire was to be applied in an ongoing study of a community-based survey, the so-called Budakalász Health Survey, which aims at developing a series of a community-level model programmes for CVD prevention in a town (Budakalász) in the central region of Hungary.<sup>24</sup> While it has been long-established that effective prevention planning requires the assessment of perceived CVD risk, we could not find any reliable measures that could be applied for this population.

### The present study

The aim of the present study was to develop and psychometrically investigate a Hungarian version of the ABCD Risk Questionnaire. We expected that the results would confirm the internal structure of the adapted tool in a Hungarian adult, non-clinical sample. Moreover, we expected that the results would provide further evidence on CVD-related perceptions and notions in association with sociodemographic and psychological characters. As a distant aim of the study, we sought to provide a sound tool for further studies in CVD-related behaviours in Hungary, and also to contribute to the cross-cultural applicability of the measure. To the best of our knowledge, there is no short and well-validated questionnaire available in Hungarian, which would offer satisfactory content and

face validity, and would be suitable for examining CVD risk awareness. Moreover, this will be among the first studies to validate ABCD in a different language version.

## METHODS

### Sample and procedure

The sample was collected using the online survey tool LimeSurvey between October and December 2018. Approval by the ethics commission of the Council of the Health Sciences (ETT-TUKEB, 53056-2/2018/EKU) was obtained prior to the study. The online research form was propagated by BA and MA psychology students of the University of Szeged in their online social networks (primarily through Facebook posts and personal email-lists) as part of their student research work. Moreover, the study was part of the National Heart Programme at Semmelweis University. The inclusion criteria were: being a Hungarian citizen aged 35 and above, and not being under treatment with a psychiatric disorder. During the assessment process, the participants were sufficiently informed about the general topic of the study, and they gave their informed consent in accordance with the Declaration of Helsinki before launching the online questionnaire form.

In sum, 1393 potential respondents opened the online survey site and presumably read the information sheet while 766 of them voluntarily gave the informed consent and started the assessment. In sum, 559 participants completed the online survey, meaning that 207 respondents quitted the assessment, great majority of them shortly after the start. During the data processing, 48 respondents who were below 35 had to be excluded, since the online questionnaire system also accepted respondents who were younger than 35 years. Moreover, another 101 participants had missing responses that could not be imputed (eg, health status responses). We run a logistic regression analysis to estimate the predictors of being excluded due to missing data. The probability of being female and older was higher in the missing data subsample (OR 2.54, 95% CI 1.40 to 4.60 and OR 0.962, 95% CI 0.937 to 0.989). In sum, 410 entries could be included in the present analyses, being 35 or older and having complete data for the variables in the analyses.

Participants who were included had a mean age of around 50 years ( $M=49.53$ ;  $SD=8.09$ ) with a range from 35 to 76 years. About two-thirds of the respondents were female (67.6%,  $n=277$ ). The largest part of the sample consisted of respondents with college or university-level education (60.2%,  $n=247$ ), followed by high school graduates (25.4%,  $n=104$ ) and participants with elementary-level education (14.4%,  $n=59$ ).

### Measures

#### The Hungarian version of the ABCD Risk Questionnaire

First, independent forward translation of the ABCD Risk Questionnaire was performed by three professionals who are experts in health psychology. Second, a consensual

Hungarian version was reached after extended discussions among the translators and the principal investigator. A bilingual translator, who was blind to the original English version, translated the temporary Hungarian version back into English. A professional medical expert compared this back-translated English version with the original version of the ABCD Risk Questionnaire and proposed a final version that was sufficiently close to the original. A final expert board consisting of the researchers and translators discussed the translation process and the suggested final version, created an approved version for field testing.

The ABCD Risk Questionnaire consists of 18 items in total. Eight items measure CVD risk perceptions, seven items refer to perceived benefits of healthy lifestyle habits and three assess intentions towards healthy eating habits. Answer options are presented on a 4-point scale and range from <sup>1</sup> 'strongly disagree' to <sup>4</sup> 'strongly agree.'

The knowledge scale consists of eight statements about CVD risk (eg, 'Walking and gardening are considered as types of exercise that can lower the risk of having a heart attack or stroke.') with response options of 0=false and 1=true, indicating whether the respondent agrees or disagrees with the statement. All items are coded according to the predefined true/false categorisation of the statements. Agreement with true statements and disagreement with false statements is scored 1. Values are summed to create a summary score that can range from 0 to 8, where higher values indicate higher CVD-related knowledge.

### Other measures

The sociodemographic variables included in the analyses from the complex test battery of the survey focused to the respondent's age and educational attainment (having vs not having postsecondary education).

### Health status and health behaviour

To estimate the participants' subjective health status, the following question was applied: 'In general, how would you rate your health status (1=very bad, 2=bad, 3=average, 4=good, 5=excellent)?'. Considering the low frequency of certain answers, responses were dichotomised to reflect the following categories: average or worse<sup>1-3</sup> versus good or excellent.<sup>4,5</sup> We also assessed the self-indicated prevalence of CVDs in the respondents. In sum, 148 respondents (36.1%) indicated the prevalence of one or more of the following symptoms: flutter, cardiac arrhythmia, atrial fibrillation, any other CVD or hypertension. Respondents gave account on their smoking behaviour (312 s's, 76.1% non-smokers, 96 s's, 23.4 smokers, 2 s's missing).

One question assessed the intensity of exercising in the everyday lives of the respondents with the question 'How many days did you do intense exercise in the last week?' (intense exercise meaning the exertion of considerable force for at least 10 min with increased pulse rate and increased breathing frequency).



### Measures to study the convergent validity

Other measures than the ABCD Risk Questionnaire were also used to allow for a more detailed study of the association of CVD-related attitudes with measures of mental health.

We used the nine-item shortened version of the Beck Depression Inventory (BDI-S, 9 items)<sup>25</sup> that was developed for health surveys. The items present severe symptoms of depression (the sample item is 'I have lost all of my interest in other people.') and their presence in the last 2 weeks was rated on a 4-point Likert-scale (from 1=not at all present to 4=very much present). A higher sum of the item scores represents more severe depressive symptoms in the respondent's daily life. Cronbach's alpha was 0.849 for BDI-S, indicating a good internal consistency of the scale.

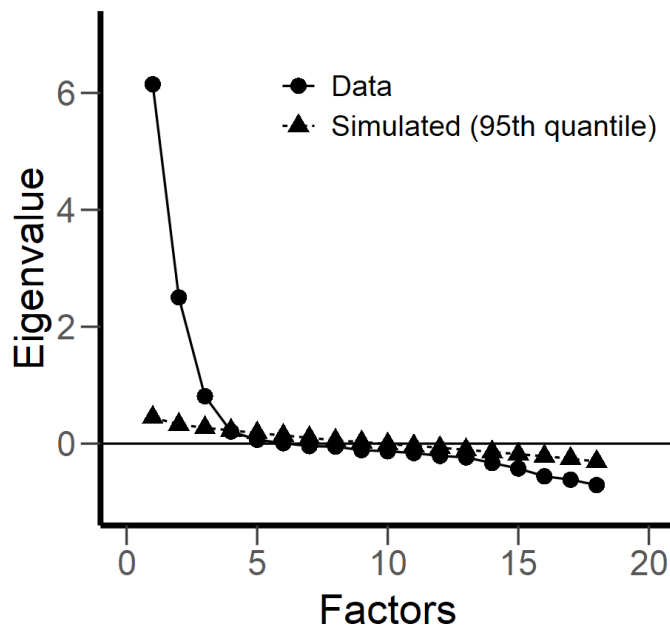
Perceived stress was measured using the abbreviated, four-item version of the Perceived Stress Scale.<sup>26</sup> The subjective level of unpredictability and uncontrollability within the last 2 weeks was measured on a 5-point scale (from 1=never to 5=very often; sample item: 'In the last month, how often have you felt that you were unable to control the important things in your life?'). A total score is obtained by summing the score of the items with higher scores indicating higher level of stress. Internal consistency was adequately high in the sample (Cronbach's alpha=0.806).

Well-being was measured via the five-item WHO Well-being Index.<sup>27 28</sup> Items assess the presence of positive mood states (the sample item is 'I was cheerful and happy.') in the past 2 weeks on a 4-point Likert-type scale (1=not at all true, 4=completely true). Item scores are summed up to form a total score, representing the subjective level of emotional well-being. Internal consistency of the scale was satisfactorily high in the sample (Cronbach's alpha=0.845).

Moreover, we also used a single question about subjective CVD-related risk that was routinely used in CVD-related studies. The question read 'What do you think the risk of you getting any kind of CVD within the next 10 years is?' with the answer options 0=low risk (n=177, 43.2 %), 1=medium risk (n=190, 46.3 %) and 3=high risk (n=43, 10.5 %).

### Statistical analyses

Exploratory and confirmatory factor analyses (EFA and CFA) were conducted by the freeware statistical package Jamovi (V.1.0.5). Model fit of the confirmatory factor analysis was evaluated based on a series of indices; the  $X^2$  test (non-significant results indicating adequate fit), the Tucker-Lewis and Comparative Fit Indexes (TLI and CFI, respectively; values between 0.90 and 0.95 indicate acceptable fit, while values greater than 0.95 suggest good fit) and the root mean square error of approximation (RMSEA; values below 0.08 indicate an acceptable fit, while values below 0.05 indicate a good fit).<sup>29</sup> All other statistical computations, including bivariate Pearson correlation coefficients and group comparisons (t-tests



**Figure 1** Scree plot of the exploratory factor analysis.

and one-way analysis of variances), were carried out using the software package SPSS V.23.

### Patient and public involvement

No patients were involved in the research design and conception of this research study.

## RESULTS

### Factorial structure and internal consistency

#### Factorial validity

To explore the factorial structure of the ABCD Risk Questionnaire, we ran an EFA using Maximum Likelihood extraction method with Varimax rotation. The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity demonstrated that data was adequate for factor analysis (0.895 and 4838.3, respectively, at  $p < 0.0001$ ). We determined the adequate number of factors according to the Scree plot and the parallel analysis (PA) (see figure 1). PA is based on the calculation of eigenvalues of randomly generated multiple data matrices, which have the same number of variables and cases as the original raw data set. Subsequently, differences between randomly generated and empirically found eigenvalues are tested and a significantly higher random dataset eigenvalue indicates the cut-off point for true factor numbers.

Based on these calculations, a three-factor solution emerged for the data set. This three-factor solution accounted for 58.24% of the total variance (see factor loadings in table 1). The pattern of factor loadings indicates that the three factors correspond to the original subscales (Risk Perception, Benefit Finding and Healthy Eating Intentions). All items loaded on their corresponding factor were equal to or higher than the absolute value 0.482, except for item 1.

**Table 1** Factor loadings of the exploratory factor analysis

Item no	Factor 1	Factor 2	Factor 3	Uniqueness
5	<b>-0.558</b>	0.09	0.044	0.679
6	<b>0.792</b>	-0.129	0.026	0.356
11	<b>0.861</b>	-0.086	-0.096	0.242
12	<b>0.791</b>	-0.07	-0.013	0.369
13	<b>0.92</b>	-0.131	-0.055	0.134
14	<b>0.847</b>	-0.162	-0.086	0.249
15	<b>0.9</b>	-0.125	-0.052	0.171
18	<b>0.891</b>	-0.172	-0.037	0.176
1	-0.025	0.256	0.293	0.848
7	-0.059	<b>0.71</b>	0.11	0.48
8	-0.08	<b>0.722</b>	0.072	0.467
9	-0.108	<b>0.824</b>	0.158	0.285
10	0.196	<b>-0.481</b>	-0.114	0.717
16	-0.114	<b>0.653</b>	0.053	0.558
17	-0.159	<b>0.653</b>	0.233	0.494
2	0.142	-0.115	<b>-0.482</b>	0.734
3	0.016	0.086	<b>0.956</b>	0.079
4	0.021	0.194	<b>0.724</b>	0.438

The applied rotation method is varimax. Factor loadings with absolute values higher than 0.3 are in bold

The results of the EFA corresponded to the original three-factor structure of the ABCD Risk Questionnaire. This structure was further tested using CFA to determine its level of fit with the actual data. The results indicated that model fit was acceptable ( $\chi^2=453,0$ ,  $df=132$ ,  $p<0.001$ ,  $CFI=0.933$ ,  $TLI=0.922$ ,  $RMSEA=0.077$ , 90% CI (0.069 to 0.085)). The three latent factors were set to covariate in the model. Standardised covariances ranged from  $-0.073$  ( $p=0.186$ ) between factor 1 and factor 3, to  $-0.323$  and  $0.298$  ( $ps <0.001$ ) between factor 1 and factor 2, and factor 2 and factor 3, respectively.

For comparison purposes, we examined whether this factorial structure could be improved by imposing further residual covariates in the model ( $\chi^2=281,0$ ,  $df=128$ ,  $p<0.001$ ,  $CFI=0.968$ ,  $TLI=0.962$ ,  $RMSEA=0.054$ , 90% CI (0.045 to 0.063)). Again, the three latent factors were set to covariate in the model. Standardised covariances ranged from  $-0.073$  ( $p=0.186$ ) between factor 1 and factor 3, to  $-0.363$  and  $.328$  ( $ps <0.001$ ) between factor 1 and factor 2, and factor 2 and factor 3, respectively. In sum, these results confirmed the factorial structure of the ABCD Risk Questionnaire; moreover, they provided support for its structural validity (see [table 2](#)).

### Reliability

The factorial solution provided support for the original subscales of the questionnaire. Therefore, for these subscales, we calculated internal consistency estimates of reliability in the form of Cronbach's alpha coefficients. The alpha estimates were 0.945, 0.822 and 0.756 for the

**Table 2** Factor loadings of the confirmatory factor analysis

Factor	Item no	Std. estimate	SE	95% CI	
				Lower	Upper
Factor 1	<b>2</b>	<b>0.443</b>	0.043	0.359	0.527
	<b>3</b>	<b>-0.746</b>	0.04	-0.824	-0.668
	<b>4</b>	<b>-0.614</b>	0.039	-0.691	-0.537
Factor 2	1	0.216	0.035	0.147	0.285
	<b>7</b>	<b>0.496</b>	0.037	0.423	0.568
	<b>8</b>	<b>0.410</b>	0.029	0.353	0.468
	<b>9</b>	<b>0.593</b>	0.033	0.527	0.658
	10	-0.436	0.04	-0.515	-0.358
	16	0.329	0.029	0.272	0.386
	17	0.504	0.033	0.44	0.568
	Factor 3	5	0.461	0.04	0.383
	6	-0.603	0.032	-0.666	-0.541
	<b>11</b>	<b>-0.724</b>	0.032	-0.788	-0.661
	12	-0.635	0.035	-0.703	-0.567
	<b>13</b>	<b>-0.744</b>	0.03	-0.802	-0.686
	14	-0.689	0.032	-0.751	-0.627
	<b>15</b>	<b>-0.739</b>	0.031	-0.799	-0.679
	<b>18</b>	<b>-0.724</b>	0.03	-0.782	-0.666

All standardised estimates (factor loadings) are significant at  $p<0.001$  level.

Items that are suggested for a shortened scale version are in bold.

Risk Perception, the Perceived Benefits and the Healthy Eating Habits subscales, respectively, indicating good to excellent internal consistency of the subscales. The knowledge subscale indicated somewhat poorer internal consistency with an alpha estimate of 0.504 for the eight items. The descriptive statistics of the subscales along with bivariate associations with basic demographic characteristics is provided in [table 3](#).

### Convergent and divergent validity

To evaluate the convergent and divergent validity of the ABCD Risk Questionnaire, we examined associations with measures of depressive symptoms and physical and mental well-being (see [table 4](#)). Bivariate correlations were typically significant while they were in the low to medium range. Moreover, they indicated that higher risk perception was associated with lower self-rated health and well-being, and also with the higher prevalence of depressive symptomatology and perceived stress. The opposite pattern was present for the Perceived Benefits and Healthy Eating Intentions subscales, although the strength of associations ranged lower for the latter. Knowledge scores had no significant relationship with any of the studied characteristics. The pattern of the presented associations indicate that the CVD-related perceptions as measured by the ABCD Risk Questionnaire are distinct constructs that can be differentiated from mental health indices, even though they are also related to them.

**Table 3** Group comparisons of the subscales

	N (%)	ABCD Risk Questionnaire			
		Risk Mean (SD)	Benefits Mean (SD)	Eating Mean (SD)	Knowledge Mean (SD)
Total sample	410	2.16 (0.60)	3.22 (0.48)	2.55 (0.68)	5.76 (1.55)
Gender					
Male	127 (31.0%)	2.24 (0.61)	3.24 (0.45)	2.47 (0.67)	5.80 (1.61)
Female	277 (67.6%)	2.12 (0.60)	3.22 (0.50)	2.59 (0.68)	5.73 (1.53)
t-test		1.80*	0.33	-1.69*	0.42
Education					
Basic	59 (14.4%)	2.28 (.57)	3.09 (.46)	2.69 (.62)	5.23 (1.72)
Medium	104 (25.4%)	2.14 (.53)	3.15 (.44)	2.56 (.56)	5.83 (1.67)
High	247 (60.2%)	2.13 (.63)	3.29 (.49)	2.52 (.73)	5.85 (1.43)
F-test		1.46	5.99**	1.39	3.93*
Family status					
Living in family	109 (26.6%)	2.14 (.58)	3.20 (.49)	2.51 (.70)	5.57 (1.57)
Living alone	299 (72.9%)	2.17 (.61)	3.23 (.48)	2.57 (.67)	5.82 (1.54)
t-test		-0.52	-0.59	-0.81	-1.43
Smoking status					
Non-smoking	312 (76.1%)	2.13 (.60)	3.23 (.47)	2.53 (.69)	5.79 (1.56)
Smoking	96 (23.4%)	2.25 (.59)	3.19 (.51)	2.64 (.63)	5.60 (1.52)
t-test		-1.83*	0.84	-1.34	0.72
CVD present					
No	260 (63.4%)	1.99 (0.54)	3.28 (0.49)	2.57 (0.70)	5.80 (1.56)
Yes	148 (36.1%)	2.44 (0.59)	3.13 (0.46)	2.52 (0.64)	5.69 (1.60)
t-test		-7.92***	2.90**	0.69	0.69
Perceived CVD risk level (one item)					
Low	177 (43.2%)	1.78 (0.42)	3.30 (0.49)	2.59 (0.69)	5.68 (1.51)
Medium	190 (46.3%)	2.32 (0.49)	3.17 (0.47)	2.54 (0.67)	5.78 (1.56)
High	43 (10.5%)	2.99 (0.48)	3.13 (0.48)	2.46 (0.65)	5.98 (1.68)
F-test		143.10***	4.23*	0.76	0.68

N=410 for the total sample; variables not summing up to 410 (100%) have missing values.

\*P<0.05, \*\*p<0.01, \*\*\*p<0.001

ABCD, Attitudes and Beliefs about Cardiovascular Disease; CVD, cardiovascular disease.

Interestingly, the Knowledge subscale—capturing the objectively proven level of reliable knowledge on CVDs and the related risk factors—was only related to the behavioural aspects of risk prevention; that is, to scores on the Perceived Benefits and Healthy Eating Intentions subscales, and did not correlate with perceived risk. Moreover, the only characteristic that showed significant connection to knowledge level was education, with respondents with primary education being somewhat less informed about CVD risk factors.

### Short version

We also tested the reliability of a short version of the ABCD Risk Questionnaire. Based on the factor loadings of the CFA as well as the meaning of the items, we selected four items on Risk Perception, and three items

on the Perceived Benefits (see [table 2](#) for the indication of the items). The original three items of the Healthy Eating Habits subscale were retained for the short version, too. The two shortened scales of Risk Perception and Perceived Benefits provided evidence on excellent internal consistency (Cronbach's alphas 0.953 and 0.817, respectively); moreover, they correlated sufficiently well with their original versions ( $r=0.942$  and  $.909$ ,  $ps < 0.001$ , respectively).

### DISCUSSION

In the present study, we run a cross-sectional validation study in a non-representative Hungarian adult sample, and examined the replicability of a three-factor structure

**Table 4** Bivariate associations of the subscales

	ABCD Risk Questionnaire			
	Risk	Benefits	Eating	Knowledge
ABCD-Risk				
ABCD-Benefits	-0.215***			
ABCD-Eating	-0.070	0.336***		
ABCD-Knowledge	0.053	0.224***	0.143**	
Age	0.011	-0.042	0.014	-0.073
SRH	-0.451***	.243***	0.059	0.049
Intense exercising	-0.103*	.204***	.147**	-0.046
BDI-S	0.409***	-0.219***	-0.129**	-0.085
Perceived stress	0.317***	-0.207***	-0.131**	-0.066
WHO-WB5	-0.365***	0.228***	0.195***	0.027

\* $P < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

ABCD, Attitudes and Beliefs about Cardiovascular Disease; BDI-S, Beck Depression Inventory – Short form; SRH, self-rated health; WHO-WB5, WHO Well-being Index.

and the psychometric properties of the ABCD Risk Questionnaire.<sup>21</sup> Using exploratory and confirmative factor analyses, we confirmed the original factor structure of the questionnaire, comprising Risk Perceptions, Benefits of Exercising, and the pursuit of Healthy Eating Intentions. This study also confirmed that the subscales of the questionnaire have good internal consistency and structural validity for assessing cardiovascular risk perceptions and connected cognitions on health behaviours like exercising and changing eating habits. Additionally, there were significant, but relatively weak internal correlations among the subscales. Higher risk perception was associated with lower benefit finding, but was unrelated to eating intentions, whereas benefit finding and healthy eating intentions correlated positively. This can be interpreted as while people's health behaviour tends to show a consistent pattern with interrelated health-protective attitudes, the subjective estimation of CVD risk is connected primarily to their attitudes towards exercising and not to their eating habits. Unlike the three subscales on subjective experiences and cognitions, the Knowledge subscale aims at assessing the more objective aspects of individual knowledge on CVD risk factors. This subscale proved to be only moderately reliable, indicating that the respondents as a group have rather inconsistent knowledge structure on CVD risk. Obviously, we cannot discard the possibility of responding by chance either. Therefore, the results may reflect the actual level of knowledge only with a considerable amount of error.

Bearing this in mind, it is still apparent that risk perception was largely unrelated to the level of CVD risk-related knowledge, along with low and non-significant correlations with behaviour-related subscales. Moreover, higher risk perception was also significantly associated with a

lower level of well-being and a higher level of depressive symptomatology and perceived stress. This can be interpreted that risk perception may mainly represent the affective response to the possibility of a CVD. On the other hand, knowledge on CVD risk and attitudes toward CVD-preventive behaviour are more closely connected to cognitive functioning and volition. This implies that, in order to reach the desired impact, effective health risk communication and preventive interventions have to focus on both affective and cognitive-behavioural aspects of CVD-related individual functioning.

We tested bivariate associations with a series of background variables. Concerning CVD risk perception, respondents with the self-asserted presence of a CVD was the only group that had significantly higher average perceived risk; while neither age, nor gender or smoking status had strong and significant associations with it (male and smoker respondents had a marginally significant higher average). This may be an important warning for CVD prevention, as male gender, age and smoking status are known risk factors for CVD, and these factors are also included in objective measures of CVD risk, such as the Framingham score.<sup>30</sup> In line with our results, studies assessing the objective and subjective levels of CVD risk consistently show that the two kinds of risk rarely converge at the population level.<sup>14 15 21</sup> The possibility that the only factor that may raise the level of subjective CVD risk estimation is the presence of CVD symptoms and occurrences may pose a serious level of health risk for the individual, especially for the elderly. Later studies should address these associations in more detail, whether they are characteristic only for this adult Hungarian community sample or can be generalised to a more general population as well. The consistent and cross-culturally comparable use of ABCD Risk Questionnaire may help investigate these questions.

We also suggested items for a short version of two subscales of the ABCD Risk Questionnaire (Risk Perception and Perceived Benefits) and tested the reliability of these subscales. Both internal consistency estimates and correlation coefficients with the original subscales indicated that the shortened versions can be considered as close and reliable replacements of the more elaborate longer versions. This way, our study provided new possibilities for future survey studies where the brevity of the applied measures may be an important aspect; however, researchers aim to assess CVD risk perceptions with a multi-item questionnaire instead of single risk-perception items (see also ref.<sup>31</sup>.)

### Limitations

Although methodologically sound, the current study has some limitations as well. For example, the study sample was derived from a non-probabilistic online sample, thus, it may be a result of self-selection bias. As we presented, there might have been a biased loss of potential respondents during several steps of the assessment process. Further assessments have to find other means to provide a





more balanced sampling. Second, given that participants were predominantly highly educated and the distribution of other sociodemographic characteristics in the sample differed from nationally representative data as well, the overall generalisation of the results should be treated with care. The present results may be more characteristic to educated respondents who have regular access to online resources, including health information. In contrast, it would be necessary to examine the influence of a broader sociodemographic background on CVD-related attitudes and intentions. Third, the participants were recruited exclusively from the general population without inclusion of a medically diagnosed clinical sample. Future studies are to be designed and realised to assess the reliability and validity of the ABCD Risk Questionnaire in clinical samples. A larger sample of clinically diagnosed CVD patients would also allow for a direct comparison of the factor structure and the basic associations in non-clinical and clinical samples. Fourth, we did not assess data on CVD-related family history of risk factors (such as hypertension, diabetes and hyperlipidaemia) and cardiovascular events. Later studies should explore how knowledge on CVD-related family history may impact personal risk evaluation.<sup>32</sup>

## CONCLUSION

In sum, the results of the presented psychometric investigation suggest that the subscales of the ABCD Risk Questionnaire capture independent aspects of risk perception and health behaviour, and therefore, the measure is acceptable for use in future research with adult Hungarian populations. Nevertheless, sampling bias has to be managed efficiently to prevent unjustified generalisation of the results. Our study may also add to the cross-cultural generalisability of future results obtained with the scale.

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**Author note** EU15 denotes the member countries in the European Union prior to the accession of ten candidate countries on 1 May 2004. The EU15 comprised the following 15 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom. source: <https://stats.oecd.org/glossary/detail.asp?ID=6805>

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