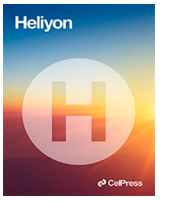
Heliyon 10 (2024) e27751

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Validation of the brief version of the Susceptibility to Persuasion-II scale and evaluation of measurement invariance across age and gender in the Canadian general population

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ARTICLE INFO

Keywords:
Measurement invariance
Susceptibility to fraud
Age
Gender
Confirmatory factor analysis

ABSTRACT

Measurement tools that can assess personality traits rendering people more susceptible to engagement with and compliance in scams can help identify at-risk populations. The brief, 30-item version of the Susceptibility to Persuasion-II (StP–II–B) scale is a recently developed instrument for assessing 10 personality traits that play a role in scam compliance; however, psychometric evidence supporting the use of this scale is limited. This study aimed to validate the StP–II–B by examining its internal consistency reliability, factor structure, as well as age- and gender-related measurement invariance with a sample of 1287 Canadians aged 16 years and older. Confirmatory factor analysis supported a 10-factor structure identified in previous research. Good internal consistency reliability was obtained for each of the 10 subscales. This 10-factor structure was found to be invariant across age and gender at configural, metric, and scalar levels, suggesting that the StP–II–B was conceptualized in the same way across age and gender and that meaningful comparisons of factor scores could be made. Age and gender differences were found in most factors, with younger individuals and men scoring higher than older individuals and women. This study supports the use of the StP–II–B as a valid and reliable scale for measuring personality traits associated with scam compliance in the Canadian general population and offers insights into age and gender cohorts that may be at higher risk of scam victimization.

1. Introduction

Fraud is a universal phenomenon and a major societal concern, costing the global economy approximately $5.127 trillion USD every year [1]. It involves deceptive and illegitimate marketing activities that do not result in any product or service of real value [2]. In exploration of individual's susceptibility to such deceptive practices, a common pattern of a three-stage progression to becoming a fraud victim, termed scam compliance, has been suggested [3,4]. Firstly, the potential victim must find the fraudulent offer enticing and plausible. Secondly, if the potential victim perceives the offer plausible and that it might lead to personal gain, they will respond favourably to the offer; and thirdly, they will lose money or something of value as a result.

Social psychologists have postulated that there are certain common personality traits that could render people more susceptible to

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https://doi.org/10.1016/j.heliyon.2024.e27751
Received 10 October 2023; Received in revised form 20 January 2024; Accepted 6 March 2024
Available online 12 March 2024

engagement with fraud and help facilitate compliance in scams [2,3]. While many studies on the relationship between personality traits and scam compliance have been conducted through the lens of the Big Five model (i.e., agreeableness, conscientiousness, extraversion, neuroticism, and openness to experience) [5–8], others have focused on specific personality traits targeted by fraudsters, using influence and persuasion techniques, to deceive potential victims [2,4,9]. Building on this work, Modic et al. [10] developed a brief 30-item Susceptibility to Persuasion-II (StP–II–B) scale to assess 10 personality traits that have shown to play a role in scam compliance, based on social psychological and consumer behaviour theories. Each trait is assessed in a respective subscale with three items rated on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). The following provides a brief definition for the traits in the context of scam compliance.

- Positive attitudes towards advertising: Defined as an individual's predisposition to respond positively to advertising, this trait has been long recognized as an important mediator of brand attitudes and purchase intentions [11]. Those with a more positive attitude towards advertising are more inclined to go along with a marketing offer.
- Social influence: Higher scores on this subscale indicate a stronger desire for social inclusion and peer approval. This trait is a key factor in scam compliance as illustrated by the use of advertising that promotes inclusion and engagement by particular social groups [12].
- Need for uniqueness and avoidance of similarity: Consumer behavioural studies have shown that scarcity increases a product's perceived uniqueness and subsequently promotes purchase intentions [13,14]. The perceived uniqueness of products can be used to increase an individual's self-perceptions of uniqueness [15]. Those who value uniqueness are more likely to find a fraudulent offer attractive if it is presented as a unique or scarce opportunity.
- Sensation seeking: This trait refers to an individual's need for novel, intense experiences and the willingness to take risks for such experiences to achieve optimal arousal [16]. A high sensation seeker is more likely to fall for a scam, as the advertised gain or benefit may elicit an arousal response.
- Risk preferences: Individuals scoring higher on this subscale have a higher tendency to engage in rewarding, yet risky activities or behaviours [17]. It is reasonable to infer that individuals who interact with fraudsters have lower risk aversion.
- Lack of premeditation: Premeditation refers to an individual's tendency to think and reflect on the probable consequences of a decision before making that decision [18]. Those lacking premeditation are more likely to fall prey to scams, as they will engage without significant critical analysis.
- Lack of self-control: Lower self-control has been shown to increase the odds of fraud victimization [19], partially due to the potential victim being less able to regulate their emotional responses, which consequently affects their rational decision-making [3].
- Need for cognition: Individuals with higher scores on this subscale tend to engage in and enjoy effortless cognitive activities, whereas those with lower scores tend to actively seek out and evaluate information to make sense of events [20]. When facing a fraudulent offer, those scoring higher will be less concerned with making a cognitive effort in analyzing the value of the claims made in a scam.
- Need for consistency: This trait refers to an individual's desires to be consistent within one's own behaviour, to appear consistent to others, and for others to be consistent [21]. Fraudsters may exploit this trait by persuading victims to respond favorably to a small request (requiring no or little money) to make them more willing to react to a large request or demand, as individuals who value consistency will be less likely to change their minds [2].

While the StP–II–B has been used to study scam compliance in various contexts, such as Internet fraud [10], auction fraud [22], investment fraud [23], and health scams [12], available validity evidence for this scale is limited to the initial validation by the scale developers. Using a general population sample of 278 Americans and Indians, they reported a good fit of the pre-specified 10-factor model and adequate reliability with Cronbach's α ranging from 0.75 to 0.91 for the subscales [10]. Nevertheless, relying solely on a single validation study is insufficient to establish a strong body of evidence supporting the use of a scale [24]; hence, the StP–II–B needs to be validated with other samples.

In addition to reliability and factor structure, another important piece of validity evidence is age- and gender-related measurement invariance (MI). Items in the StP–II–B may not always be interpreted in the same way across different demographic groups. For instance, some work indicates that a greater tendency to engage in and enjoy effortful thinking is associated with better cognitive functioning [25]. This means that older adults might answer Need for Cognition items based on their cognitive ability rather than based on their intrinsic motivation for intellectually and cognitively challenging activities. As a result, the observed age differences may not reflect true trait-level differences but artifacts of differential interpretations. It is therefore important to test MI across age and gender, ensuring that the measured constructs have the same structure or meaning across groups and that scores obtained from the scale can be meaningfully compared between these groups [26].

While not examined with the StP–II–B, studies using other personality scales have extensively reported age and gender differences in impulsivity and related traits. For instance, large cross-national studies found that risk-taking propensity generally decreases with age in adulthood [27,28], with men exhibiting higher risk-taking tendencies [29]. Similar and consistent findings have reported for related constructs, where sensation seeking declines with age and is higher in men [30,31] and self-control is higher among older adults and women [32,33]. While there are reported gender differences in lack of premeditation, with men having higher levels [30,34], age does not appear to have an effect [30]. In contrast, literature on demographic differences in the remaining traits assessed by the StP–II–B, including need for uniqueness, avoidance of similarity, social influence, need for consistency, and positive attitudes towards advertising, is limited, especially outside the realm of consumer psychology. Many of these studies include small sample sizes [35–38], with some even lacking comprehensive quantitative analysis [39]. How these traits differ across gender and adulthood in the

specific context of scam compliance, where products and offers are fraudulent, remains to be explored.

Therefore, using a large dataset collected from the Canadian general population, this study had three aims. The first aim was to examine the internal consistency reliability of the StP–II–B. The second aim was to evaluate age- and gender-related MI of the StP–II–B, with the third aim seeking to explore age and gender differences in 10 StP–II–B traits following the establishment of MI. This work provides insights into the demographic differences regarding understudied personality traits related to scam compliance and stronger evidence for the applicability of the StP–II–B.

2. Materials and methods

2.1. Sample

This study is a secondary analysis using data from a cross-sectional Canada-wide survey on engagement with risk-associated alternative health practices that was conducted between October 2021 and April 2022. For more details about the project, including data collection and cleaning procedures, please refer to Garrett et al. [40]. Participants were recruited and the survey was administered online through two commercial survey providers (Lucid and Amazon Mechanical Turk) and Twitter. At the start of the survey, participants were informed that submission would imply their consent to participate. A total of 2253 Canadian residents aged 16 years and older were recruited. Ethical review and approval had been obtained from the University of British Columbia's Behavioural Research Ethics Board prior to data collection (in Canada, participants over 16 do not require parental consent to engage in low-risk research). After removing 761 participants who did not pass data quality checks and/or had missing data and 205 participants who completed the French StP–II–B, the final sample consisted of 1287 participants.

Age was originally collected as an ordinal variable with eight categories: 16–19 years, 20–24 years, 25–34 years, 35–44 years, 45–54 years, 55–64 years, 65–74 years, and 75 years or older. Given that the sample size for some groups was too small for analysis, participants were combined into three groups: younger (aged 16–34 years, $n = 464$), middle-aged (aged 35–54 years, $n = 597$), and older (aged 55 years and above, $n = 226$) adults. For gender, participants could either self-describe or select one of the three options (men, women, non-binary). There were 22 participants who identified as non-binary or chose to self-describe, and they were further excluded from the gender-related analysis, resulting in an analyzed sample of 1265 participants (men, $n = 487$; women, $n = 778$). Men were coded as 0 and women as 1 for analysis.

2.2. Data analysis

In the preliminary analysis, confirmatory factor analysis (CFA) was performed to select the best factor structure for testing MI. Second-order factors may exist when there are high inter-correlations among the subscales [41]; however, such correlations were not found in the present study. Analysis on our data revealed predominantly weak correlations among the 10 subscales (Pearson correlation coefficients < 0.4), along with six moderate correlations ($0.4 <$ Pearson correlation coefficients < 0.5) (see Table 1). Still, a hierarchical model which examined whether there was a second-order factor underlying the 10 first-order factors was tested and compared with the original first-order 10-factor model. Given that the hierarchical model had a significantly worse fit to the data ($\Delta\chi^2 = 529.38$, $df = 35$, $p < 0.001$), the original model was considered a more suitable factor structure to proceed with for the subsequent analysis.

Internal consistency reliability of the StP–II–B was evaluated with Cronbach's α for each subscale. MI was evaluated with R version 4.0.4 following a two-step procedure proposed by Brown [42]. For the first step, CFA was conducted to test the 10-factor structure separately for each subgroup (age: younger, middled-aged, and older adults; gender: men and women). The estimation method was Maximum Likelihood. It is commonly recommended to have a sample size of > 200 [43] or maintain a minimum of 20 participants per measured variable [44] to ensure adequate statistical power for CFA. Our sample size met both criteria.

Conventionally, in CFA, good fits of a model to the data are achieved when the following criteria are met: comparative fit index (CFI) > 0.95, root mean square error of approximation (RMSEA) < 0.06, and standardized root mean square residual (SRMR) < 0.08

Table 1
Pearson correlations between the 10 StP–II–B subscales.

	LP	NCS	SS	LS	SI	AS	RP	AA	NCG
NCS	0.09**								
SS	0.15**	0.15**							
LS	0.27**	−0.04	0.22**						
SI	0.42**	0.18**	0.22**	0.25**					
AS	0.31**	0.09**	0.21**	0.27**	0.45**				
RP	0.29**	0.04	0.21**	0.28**	0.42**	0.38**			
AA	0.26**	0.25**	0.20**	0.06*	0.36**	0.19**	0.21**		
NCG	0.48**	0.06*	0.01	0.28**	0.49**	0.38**	0.36**	0.31**	
NU	0.28**	0.25**	0.34**	0.18**	0.36**	0.46**	0.27**	0.33**	0.21**

Note. $^{**}p < 0.01$. $^{*}p < 0.05$. LP = Lack of premeditation; NCS = Need for consistency; SS = Sensation seeking; LS = Lack of self-control; SI = Social influence; AS = Avoidance of similarity; RP = Risk preferences; AA = Attitudes towards advertising; NCG = Need for cognition; NU = Need for uniqueness.

[45]. However, these criteria were derived from specific simulations based on Hu and Bentler's [45] models and might not be applicable across other models [46]. Hence, McNeish and Wolf [47] introduced dynamic fit index (DFI) cut-offs, which take into account data and model features, such as sample size, number of items, number of factors and factor loadings, when evaluating model fit. Customized simulation is implemented for each tested model to generate DFI cut-offs, making them more reliable compared to conventional fixed cut-offs [46]. Our study used both fixed criteria and DFI cut-offs obtained through the R package *dynamic* [48] to assess the fit of CFA models.

The 10-factor model was then used as the baseline model to test for three levels of MI (i.e., configural, metric, and scalar invariance) across age and gender. As the least stringent form, configural invariance assesses whether the number of factors remains equivalent and whether the same items consistently load on each respective factor in the compared groups. Metric invariance extends the evaluation to test whether the factor loadings are also equivalent, in addition to the overall factor structure. Scalar invariance further adds the constraints of identical item intercepts (i.e., thresholds) across groups, building upon the constraints of configural and metric invariance. Scalar invariance must be achieved to ensure meaningful group comparisons of mean differences in the latent construct [26]. The second step was to fit these nested models (configural, metric, and scalar models) to the data with multi-group CFA (MGCFA) and to subsequently compare these models based on χ^2 difference tests and changes in fit indices.

Traditionally, the significance of χ^2 tests has been considered a single criterion for identifying violations of MI; namely, there is a significant change in model fit when comparing a more constrained model with a less constrained one [26]. However, χ^2 tests can be overly sensitive, detecting small and unimportant differences as statistically significant, especially when sample sizes are large. Therefore, it has become a common practice to use more robust fit criteria, including alternative fit indices such as CFI, RMSEA, and SRMR, to prevent over-rejection of invariant models in large samples [26]. As recommended by Chen [49], when the total sample size is over 300, measurement non-invariance is indicated by: 1) a decrease in CFI of 0.010 or greater, and 2) an increase in RMSEA of $\geq$ 0.015 or an increase in SRMR of $\geq$ 0.030 for metric invariance and $\geq$ 0.010 for scalar invariance.

With the establishment of MI, demographic differences in the StP–II–B subscale scores (i.e., sum scores by factor) were examined with the SPSS 27.0 statistical software. Independent samples t-tests were conducted to examine differences in StP–II–B personality traits between men and women. Analyses of variance (ANOVAs) were used to determine age differences in StP–II–B personality traits with follow-up Tukey HSD post-hoc tests for between-groups comparisons. As suggested by Eichstaedt et al. [50], Holm's sequential Bonferroni procedure was used to adjust for family-wise error rates and handle the problem of multiple comparisons. Specifically, p values for m comparisons were first ordered from smallest to largest. Then the p value for the ith comparison was adjusted as $p_{i\,|adjusted} = (m - i + 1) \times p_i$, with $i = (1, \ldots, m)$. Starting from the lowest adjusted p value, each $p_{i\,|adjusted}$ would be compared with the significance level (0.05) until the first non-significant comparison was obtained (i.e., $p_{i\,|adjusted} > 0.05$). All subsequent comparisons were non-significant. Accordingly, some p values that were less than 0.05 were no longer considered significant following Holm-Bonferroni correction. All analyses performed in the present study were summarized in Table 2.

3. Results

3.1. Internal consistency reliability of the StP–II–B

Table 3 provides the subscale reliability estimates for our sample and Modic et al.'s [10] sample. Based on Taber [51], our data showed good internal consistency (Cronbach's $\alpha \geq 0.80$) for all subscales, except for sensation seeking that had a relatively low but still acceptable Cronbach's α (0.76), which was in line with Modic et al. [10] overall. The reliability estimates of our sample were either equal to or higher than those of Modic et al.'s [10] sample except sensation seeking.

3.2. Measurement invariance of the StP–II–B across age and gender

Table 4 shows model fit statistics for CFA and MGCFA. Empirical fit index values for each subgroup were compared against their corresponding DFI cut-offs with level-2 hypothetical misspecifications (i.e., two cross-loadings being omitted from the 10-factor model) and the fixed cut-offs. CFA results showed that all tested models met both fixed and dynamic criteria, although the CFI for the younger group was slightly smaller and the SRMR for the middle-aged group was slightly larger compared to their DFI cut-offs (CFI: 0.962 vs 0.965; SRMR: 0.044 vs 0.042). Hence, the 10-factor model was considered well-fitting for each separate sample and thus can be used as the baseline model for MGCFA. More details about the tested models, including covariance matrices of the StP–II–B factors

Table 2
A list of statistical analyses conducted in the present study.

Analysis Type	Descriptions
Correlation analysis	Explore the relationships among the StP–II–B subscales and the relationships between these subscale scores and age and gender
Descriptive analysis	Calculate means and standard deviations of age and gender groups on each StP–II–B subscale
Confirmatory factor analysis (CFA)	Test the factor structure of the StP–II–B
Multi-group confirmatory factor analysis (MGCFA)	Test measurement invariance across age and gender
Independent samples t-test	Examine gender differences in the StP–II–B subsacles
Analysis of variance (ANOVA)	Examine age differences in the StP–II–B subsacles

Table 3
Cronbach's α for the 10 StP–II–B subscales in two samples.

Subscales	Item Number	α[a]	α[b]
Lack of premeditation	3	0.86	0.85
Sensation seeking	3	0.76	0.78
Lack of self-control	3	0.80	0.80
Need for cognition	3	0.85	0.83
Risk preferences	3	0.95	0.91
Need for consistency	3	0.83	0.81
Avoidance of similarity	3	0.90	0.88
Need for uniqueness	3	0.88	0.75
Attitudes towards advertising	3	0.87	0.80
Social influence	3	0.91	0.90

[a] Cronbach's α for the current study sample.
[b] Cronbach's α for Modic et al.'s (2018) sample (n = 278).

Table 4
Model fit statistics for CFA in each subgroup and for MGCFA.

Model		*df*	CFI	DFI CFI	RMSEA	DFI RMSEA	SRMR	DFI SRMR
Age-CFA								
Younger adults	649.343*	360	0.962	0.965	0.042	0.043	0.045	0.050
Middle-aged adults	648.983*	360	0.976	0.968	0.037	0.044	0.044	0.042
Older adults	524.333*	360	0.961	0.955	0.045	0.052	0.055	0.061
Age-MGCFA								
Configural model	1822.659*	1080	0.969		0.040		0.045	
Metric model	1861.217*	1120	0.969		0.039		0.046	
Scalar model	1962.094*	1160	0.966		0.040		0.047	
Gender-CFA								
Men	622.103*	360	0.972	0.972	0.039	0.041	0.043	0.046
Women	722.918*	360	0.974	0.965	0.036	0.045	0.042	0.045
Gender-MGCFA								
Configural model	1345.021*	720	0.973		0.037		0.041	
Metric model	1380.311*	740	0.973		0.037		0.042	
Scalar model	1471.235*	760	0.970		0.038		0.042	

*$p < 0.001$.

for different age and gender groups, can be found in Supplementary Tables 1 and 2

As for age, the configural, metric, and scalar models all showed a good fit to the data. As shown in Table 5, the differences in the CFI, RMSEA, and SRMR indicated no significant change in model fit from the configural model to the metric model (ΔCFI = 0.000, ΔRMSEA = −0.001, ΔSRMR = 0.001) and from the metric model to the scalar model (ΔCFI = −0.003, ΔRMSEA = 0.001, ΔSRMR = 0.001). Similarly, the configural, metric, and scalar models had a good fit to the data for gender. Based on the differences in the three fit indices, there was no significant change in model fit from the configural model to the metric model (ΔCFI = 0.000, ΔRMSEA = 0.000, ΔSRMR = 0.001) and from the metric model to the scalar model (ΔCFI = −0.003, ΔRMSEA = 0.001, ΔSRMR = 0.000). These results suggested that the 10-factor structure of the StP–II–B was invariant across age and gender at configural, metric, and scalar levels.

3.3. Age and gender differences in the StP–II–B

The descriptive statistics and results of ANOVA post-hoc tests and independent samples t-tests are presented in Tables 6 and 7, respectively. ANOVAs on the StP–II–B subscale scores indicated significant differences ($p < 0.001$) in all 10 personality traits across age except for need for consistency ($F(2, 1284) = 0.31, p = 0.74$). As summarized in Table 6, 19 out of 30 comparisons were significant with post-hoc tests. Notably, younger adults scored significantly higher than middle-aged and older adults in sensation seeking, risk preferences, social influence, lack of self-control, need for cognition, and lack of premeditation. In other words, younger adults were

Table 5
MI testing for the StP–II–B across age and gender.

Model comparison	$\Delta\chi^2$	Δ*df*	*p*	ΔCFI	ΔRMSEA	ΔSRMR
Age						
Metric vs. Configural	38.558	40	0.535	0.000	−0.001	0.001
Scalar vs. Metric	100.87	40	< 0.001	−0.003	0.001	0.001
Gender						
Metric vs. Configural	35.290	20	< 0.05	0.000	0.000	0.001
Scalar vs. Metric	90.924	20	< 0.001	−0.003	0.001	0.000

Table 6
Correlations, descriptive statistics, and post-hoc results for age differences in StP–II–B subscale scores.

Factors	Correlations between Age and Factors	Mean (SD)			Post-hoc Tests		
		Younger (n = 464)	Middle-aged (n = 597)	Older (n = 226)	Comparison 1 Sig.[a]	Comparison 2 Sig.[b]	Comparison 3 Sig.[c]
Lack of premeditation	−0.10**	10.68 (4.14)	9.65 (4.05)	9.17 (4.33)	**< 0.001**	**< 0.001**	0.297
Sensation seeking	−0.21**	13.73 (4.50)	12.49 (4.51)	11.05 (4.47)	**< 0.001**	**< 0.001**	**< 0.001**
Lack of self-control	−0.19**	11.32 (4.57)	10.35 (4.27)	9.11 (4.12)	**< 0.001**	**< 0.001**	**< 0.001**
Need for cognition	−0.11**	9.76 (4.23)	8.92 (4.23)	8.34 (4.00)	**0.004**	**< 0.001**	0.180
Risk preferences	−0.16**	7.36 (5.00)	6.33 (4.71)	5.31 (3.80)	**0.001**	**< 0.001**	0.015
Need for consistency	0.02	14.61 (3.44)	14.77 (3.19)	14.67 (2.96)	0.718	0.969	0.929
Avoidance of similarity	−0.17**	9.88 (4.39)	9.36 (4.15)	7.75 (3.85)	0.105	**< 0.001**	**< 0.001**
Need for uniqueness	−0.16**	12.72 (4.18)	11.96 (4.06)	10.96 (4.01)	0.008	**< 0.001**	0.005
Attitudes towards advertising	−0.06*	13.11 (4.36)	12.13 (4.27)	12.19 (3.91)	**< 0.001**	0.021	0.981
Social influence	−0.19**	9.86 (4.59)	8.51 (4.25)	6.92 (3.86)	**< 0.001**	**< 0.001**	**< 0.001**

Note. *$p < 0.05$. **$p < 0.01$.
P values obtained from post-hoc tests were manually adjusted with the Holm's sequential Bonferroni procedure and those that were significant after correction were bolded.
[a] *P* values for comparisons between younger and middle-aged adults.
[b] *P* values for comparisons between younger and older adults.
[c] *P* values for comparisons between middle-aged and older adults.

Table 7
Correlations, descriptive statistics and independent samples *t*-test results for gender differences in StP–II–B subscale scores.

Factors	Correlations between Gender and Factors	Mean (SD)		Independent Samples T-tests		
		Men (n = 487)	Women (n = 778)	*df*	t	Sig.[a]
Lack of premeditation	−0.07**	10.36 (4.12)	9.68 (4.17)	1263	2.83	**0.005**
Sensation seeking	−0.16**	13.64 (4.39)	12.03 (4.60)	1263	6.20	**< 0.001**
Lack of self-control	−0.11**	11.16 (4.49)	9.97 (4.29)	1263	4.70	**< 0.001**
Need for cognition	−0.06*	9.43 (4.22)	8.98 (4.21)	1263	1.85	0.065
Risk preferences	−0.19**	7.74 (5.17)	5.79 (4.29)	1263	7.26	**< 0.001**
Need for consistency	−0.01	14.78 (3.20)	14.67 (3.25)	1263	0.55	0.580
Avoidance of similarity	−0.06*	9.62 (4.33)	9.05 (4.20)	1263	2.31	0.021
Need for uniqueness	−0.01	12.09 (4.07)	12.02 (4.21)	1263	0.30	0.767
Attitudes towards advertising	−0.05*	12.89 (4.39)	12.33 (4.15)	1263	2.29	0.022
Social influence	−0.16**	9.73 (4.54)	8.15 (4.27)	1263	6.27	**< 0.001**

Note. *$p < 0.05$. **$p < 0.01$.
[a] *P* values obtained from independent samples t-tests were manually adjusted with the Holm's sequential Bonferroni procedure and those that were significant after correction were bolded.

more inclined to experience new sensations and take risks and easier to be influenced by social pressure, had lower self-control, and disliked thinking about complex problems and considering future consequences. The younger group also had a greater positive attitude about advertising than the middle-aged group and demonstrated a higher need for pursuing uniqueness and avoiding similarity than the older group. When comparing middle-aged adults with older adults, we found that the middled-aged group scored higher on sensation seeking, lack of self-control, avoidance of similarity, and social influence.

In terms of gender, independent samples t-tests found significant differences in five out of 10 personality traits, with men scoring higher on sensation seeking, risk references, social influence, lack of self-control, and lack of premeditation.

4. Discussion

The StP–II–B, specifically designed to assess 10 personality traits associated with scam compliance, appears to hold good potential for research and practical applications to help identify at-risk individuals. With the lack of existing psychometric evidence supporting the use of this scale in populations outside of those studied by the scale developers, the first part of the study examined its psychometric

properties in a Canadian general population sample. Consistent with original findings, the StP–II–B demonstrated a 10-factor structure and good internal consistency reliability was obtained for each of the subscales. Additionally, for the first time, this 10-factor structure was found to be invariant across age and gender at configural, metric, and scalar levels, supporting meaningful comparisons of factor scores among different age and gender groups.

Age and gender differences in the StP–II–B personality traits were examined following the establishment of MI. Despite some non-significant age group comparisons (11 out of 30 comparisons), a consistent trend with levels decreasing with age across the 10 traits was observed. The only exception was need for consistency, which showed no significant difference. Contrary to conventional wisdom that older adults are more vulnerable to deception, our results suggest that younger adults are more susceptible to influence and persuasion techniques employed by fraudsters and thus at a greater risk of falling victim to fraudulent activities such as false advertising and deceptive investment schemes. Our findings are similar to Mueller et al.'s [23] study, which reported higher scam susceptibility in the younger group with the use of the StP–II–B and a 5-item Susceptibility to Scam Scale. Using different psychometric scales, Nolte et al. [52] also reported higher levels of sensation seeking and negative urgency (a form of impulsive behaviour) and greater responsiveness to non-sensical information in younger adults. These results may partially be explained by greater emotional understanding in older adults [23]. Emotional understanding is the ability to understand, appraise, and use emotions to direct one's thinking and actions and is recognized as one aspect of emotional intelligence [53]. In addition, one study found older adults were more suspicious of experimental phishing attacks than their younger counterparts [54]. This finding is supported by another experiment reporting that younger adults were not necessarily more accurate than their older counterparts in correctly categorizing fraudulent and legitimate emails, and that older adults adopted a "high-suspicion" strategy to over-label emails as fraudulent [55]. As aging has been found to be associated with increases in real-world experience with scams and with changes in behaviour and lifestyle habits that make one less vulnerable to fraud (e.g., decreased consumption) [56], such accumulated wisdom could facilitate older adults to make more thoughtful decisions.

Of note, our findings that younger adults score higher on need for uniqueness, avoidance of similarity and social influence than their older counterparts are consistent with the previous literature [57]. The greater desire to create a unique self and social image of younger individuals could be explained by the massive socioeconomic development and the increasing trend of individualism around the world over the past few decades [58]. It has been observed in a cross-cultural study that older individuals endorse communal values to a greater extent and individualistic values to a lesser extent than younger individuals [59]. Furthermore, young adults may require greater need for social acceptance and have heightened susceptibility to social influence due to their brains being particularly attuned to the social world during this developmental period [60]. Overall, our findings are aligned with the Optimal Distinctiveness Theory that two competing needs for differentiation and assimilation are often simultaneously sought [61,62]. Achieving uniqueness allows for public recognition and self-enhancement in the social setting, while conforming to social norms helps to obtain social approval and group belongingness [63]. Finally, the finding that younger individuals have greater positive attitudes towards advertising is supported by some prior studies [64,65]. This is not surprising given they have grown up in the digital age in which users are confronted with an information and advertising bombardment.

Intriguingly, a consistent pattern of men scoring higher than women was observed in all StP–II–B personality traits, although only five of them achieved statistical significance. Apart from social influence, the remaining four were related to risk taking and impulsivity (i.e., lack of premeditation, lack of self-control, sensation seeking, and risk preferences). These findings align with two meta-analyses of a variety of psychological and behavioural measures of impulsivity, which included a total of 150 and 277 studies, respectively, that reported a higher tendency for sensation seeking, risk taking and impulsivity in men [29,31]. These characteristics might result from gender socialization. Men are traditionally socialized to adhere to masculine gender norms, such as risk taking, dominance, pursuit of status, and winning, making them more prone to displaying impulsive and risky behaviours [66,67]. In contrast, women may feel pressured to be more cautious and risk averse [68].

Some limitations should be considered when interpreting the findings of this study. First, the recruitment of the studied sample did not rely on random sampling, but rather on convenience sampling. As participants were selected based on their willingness to participate and accessibility to the Internet, such a non-probability sampling technique may limit sample representativeness and generalizability of the findings. The distribution of age and gender groups was also not balanced due to this sampling method. Furthermore, the age groups were aggregated, which may mask more nuanced age-related differences. Second, while internal consistency reliability, factor structure, and age- and gender-related MI of the StP–II–B were examined, other types of validity evidence are still lacking. Additional psychometric evidence, especially convergent and discriminant validity, and criterion-related validity should be evaluated in future studies to further support the use of this scale.

5. Conclusion

This study establishes that the StP–II–B measures the construct consistently across different age and gender groups, indicating that any observed differences in StP–II–B subscale scores among age and gender groups can be attributed to genuine variations in the construct of interest rather than measurement bias based on age or gender and enabling meaningful comparisons. Our results also indicate that there exist age and gender differences in personality traits assessed by the StP–II–B. From a practical standpoint, these findings offer valuable insights into age and gender cohorts that may be at higher risk of fraud victimization. This information has significant implications for the development and implementation of prevention programs aimed at reducing the risk of fraud victimization among diverse populations.

Ethics statement

Ethical approval was obtained from the University of British Columbia's Behavioural Research Ethics Board (#H19-01790) before data collection, and all participants provided online written informed consent. At the start of the survey, participants were informed the data was anonymous and submission of the survey indicated their consent to participate, and this was reiterated at the end of the survey prior to submission.

Funding statement

Bernie Garrett received an Insight Grant (#435-2019-0190) in 2019 from the Social Sciences and Humanities Research Council of Canada that supported this work. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Data availability statement

The deidentified dataset from this study is openly available from the Borealis data repository at: https://doi.org/10.5683/SP3/KPJIX3.

CRediT authorship contribution statement

Xuyan Tang: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation. **Joyce S.T. Lam:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Bernie Garrett:** Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Bernie Garrett reports financial support was provided by the Social Sciences and Humanities Research Council of Canada. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

The authors would like to acknowledge Dr. David Modic of Cambridge University's Computer Laboratory for his assistance and use of the StP–II–B scale as well as Richard Musoke for his contributions to data preparation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e27751.

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