



Associations of UPPS-P negative urgency and positive urgency with ADHD dimensions: Moderation by lack of premeditation and lack of perseverance in men and women

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ARTICLE INFO

Keywords:

ADHD
UPPS-P model
Moderation
Men
Women

ABSTRACT

The study examined how dimensions of Whiteside and Lynam's (2003) UPPS-P model of impulsivity (lack of premeditation, lack of perseverance, negative urgency, and positive urgency) were associated directly and interactively with the attention-deficit/hyperactivity disorder (ADHD) dimensions of inattention and hyperactivity/impulsivity in men and women separately. A total of 550 adults (men = 147, women = 403), ages ranging from 18 to 65 years, from the general community completed questionnaires covering the study variables. For women, there was support for the additive model for the prediction of inattention, and both inattention and hyperactivity/impulsivity were predicted by lack of premeditation $\times$ positive urgency. For men, inattention was predicted by lack of premeditation $\times$ negative urgency, and lack of premeditation $\times$ positive urgency. In all instances, low levels of premeditation reduced the relationships between the urgency dimensions and ADHD dimensions. The theoretical and clinical implications of the findings are discussed.

1. Introduction

Whiteside and Lynam (2003) have proposed a multidimensional model of impulsivity that includes impulsivity traits for (i) sensation seeking (tendency to seek out novel and thrilling experiences); (ii) lack of premeditation (tendency to act without thinking); (iii) lack of perseverance (inability to remain focused on a task that can be long, boring, or difficult); (iv) negative urgency (the tendency to rash action while under extreme negative emotions); and (v) positive urgency (the tendency to rash action while in an intense positive mood). Corresponding to the names for these dimensions, this model is generally referred to as the UPPS-P model.

1.1. UPPS-P model: measures and relevance to emotional and cognitive impulsivity

Lynam et al. (2006) developed the 59-item Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency Impulsive Behavior Scale (UPPS-P) to measure the five impulsive personality traits in the UPPS-P model. From this, Cyders et al. (2014) developed a shorter 20-

item version (S-UPPS-S) to measure the five impulsivity dimensions. In line with the theory, the proposed factor structure for S-UPPS-P and UPPS-P is a five-factor oblique model, with the five aforementioned impulsivity dimensions. Based on conventional fit indices for confirmatory factor analysis (CFA) models (e.g., Hu & Bentler, 1998), researchers have claimed robust support for this model (e.g., D'Orta et al., 2015; Fossati et al., 2016).

Several researchers have distinguished between emotional impulsivity and cognitive impulsivity, or reflexive and reflective impulsivity, respectively (Carver & Johnson, 2018). In brief, emotional impulsivity reflects an automatic tendency to react impulsively arising from heightened emotional states that are associated with bottom-up processing (Carver & Johnson, 2018; Whiteside & Lynam, 2001). In contrast, cognitive impulsivity is a tendency to react impulsively arising from difficulties in cognitive processing (e.g., poor selective attention, response selection, and planning) that are associated with top-down processing (Carver & Johnson, 2018; Martel & Nigg, 2006; McRae et al., 2012; Whiteside & Lynam, 2001). A close examination of the items in the different UPPS-P questionnaires shows that items in both the negative and positive urgency dimensions tap emotion-based rash

Abbreviations: ADHD, attention-deficit/hyperactivity disorder; CSS, Current Symptom Scale; HY/IM, hyperactivity/impulsivity; IA, inattention; S-UPPS-P, Short Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency; UPPS-P, Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency.

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<https://doi.org/10.1016/j.paid.2023.112125>

Received 10 July 2022; Received in revised form 7 February 2023; Accepted 8 February 2023

Available online 17 February 2023

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actions (e.g., "When I'm very happy, I have trouble controlling myself", and "When I'm in a bad mood, I act without thinking). As such, these dimensions can be considered as measuring emotional impulsivity. In contrast, items for lack of premeditation and lack of perseverance tap effortful engagement in cognitions (e.g., "Before doing something, I think about it a lot", and "I usually think in a careful, organized way"). Therefore, they can be viewed as measuring cognitive impulsivity. Interestingly, in the UPPS-P literature, the emotion-based positive and negative urgency dimensions together have been referred to as urgency, and the cognitive-based lack of premeditation and lack of perseverance dimensions together has been referred to as low conscientiousness (Billieux et al., 2012; Cyders et al., 2014; D'Orta et al., 2015; Dugré et al., 2019). The major aim of the current study was to examine how these emotion-based and cognitive-based impulsivity dimensions are associated additively and interactively with inattention and hyperactivity/impulsivity.

The core symptoms of attention-deficit/hyperactivity disorder (ADHD), a neurodevelopmental disorder seen in both children and adults, are inattention and hyperactivity/impulsivity (American Psychiatric Association, 2013). In virtually all theoretical models of ADHD, impulsivity is considered central (Barkley, 1997; Sonuga-Barke, 2003). Theoretically, dual-processing models of ADHD have implicated top-down and bottom-up processing difficulties for inattention and hyperactivity/impulsivity symptoms, respectively (Martel & Nigg, 2006). Given this, it could be argued that the UPPS-P dimensions of negative urgency and positive urgency (i.e., bottom-up driven emotional impulsivity), and lack of premeditation and lack of perseverance (i.e., top-down driven cognitive impulsivity) will have relevance for hyperactivity/impulsivity and inattention, respectively.

1.2. Existing studies of the association of the UPPS-P dimensions with ADHD

To date, several studies involving children (Geurten et al., 2021; Miller et al., 2010; Watts et al., 2020) and adults (Egan et al., 2017; Halvorson et al., 2021; Lopez et al., 2015; Roberts et al., 2014) have examined how ADHD is associated with the impulsivity dimensions in the UPPS-P model. For all past studies involving adults (the age group examined in the current study), both men and women were examined together. The study by Egan et al. (2017) found that compared to controls, adults with ADHD had higher scores for positive urgency, negative urgency, lack of perseverance, and lack of premeditation. Lopez et al. (2015) found higher scores for urgency, lack of perseverance, and lack of premeditation for an ADHD group, compared to a control group. In both these studies, the two groups did not differ in sensation seeking. For a sample of adults with high to moderate drinking problems, Halvorson et al. (2021) found that positive urgency, negative urgency, lack of perseverance, and lack of premeditation correlated positively with overall ADHD. For undergraduate students, Roberts et al. (2014) found that positive urgency, negative urgency, lack of perseverance, and lack of premeditation were correlated positively with inattention, and positive urgency, negative urgency, lack of perseverance, lack of premeditation, and sensation seeking were correlated with hyperactivity/impulsivity. Additionally, being female was correlated negatively with positive urgency, lack of perseverance, and lack of premeditation. In the studies cited. Sensation seeking showed no relation with any of the UPPS-P dimensions.

At a more general level, based on the child temperament model proposed by Eisenberg et al. (1996, 2005), for a group of children and adolescents, Martel and Nigg (2006) found that effortful control (the ability to deliberately modulate emotions and behavior) was related to inattention, and reactive control (automatic modulation of emotion and behavior) was related to hyperactivity/impulsivity. Both effortful control and reactive control were measured using the California Q-sort and the Early Adolescent Temperament Questionnaire, completed by parents; and the ADHD scores were derived from mother reports, based on

structured interviews and ratings completed by teachers. Martel and Nigg interpreted their findings in terms of the dual pathway ADHD model, implicating regulatory control problems as contributors to inattention, and reactive control problems as contributors to hyperactivity/impulsivity. Given the dual-processing models of ADHD, the exploration of the unique associations of UPPS-P dimensions with inattention and hyperactivity/impulsivity separately is a worthwhile undertaking.

1.3. Limitations and omissions in existing findings on the associations of the UPPS-P and ADHD dimensions

There are important limitations and omissions in existing findings on the relations between the UPPS-P and ADHD dimensions. First, given that with one exception (Roberts et al., 2014), all past studies have examined linear relations of the different UPPS-P dimensions with ADHD (inattention and hyperactivity/impulsivity together), existing data on how the UPPS-P dimensions are associated with inattention and hyperactivity/impulsivity separately is limited. Also, as Roberts et al. (2014) examined the association using correlation analysis, we have no data on the unique and additive associations of the UPPS-P dimensions with the ADHD dimensions. Second, no study has examined the possibility of interactive effects of the UPPS-P dimensions on inattention and hyperactivity/impulsivity. Although Martel and Nigg (2006) found no support for the interaction of reactive control and effortful control in the prediction of ADHD, it cannot be ruled out as such an association may exist in adults and/or with other measures of emotional and cognitive impulsivities (such as those in the UPPS-P model). Third, although gender is differentially associated with UPPS-P dimensions (Roberts et al., 2014) and with ADHD (Arcia & Conners, 1998; Williamson & Johnston, 2015), to date no study has examined the associations of the UPPS-P with ADHD in men and women separately.

1.4. Aims and predictions in the study

Given existing limitations and omissions, this study aimed to examine how aspects of emotional impulsivity (negative urgency and positive urgency) and cognitive impulsivity (lack of premeditation and lack of perseverance), as measured by the S-UPPS-P, are associated additively and interactively with inattention and hyperactivity/impulsivity in men and women separately, using regression analysis models. In his respect, the current study goes beyond that of Martel and Nigg (2006), in that it examined (1) an adult sample, reporting results separately for men and women; (2) the relationships (including additive and interaction effects) of top-down and bottom-up impulsivity dimensions with inattention and hyperactivity/impulsivity separately, and (3) for constructs that are measuring trait impulsivity directly. Based on findings reported by Roberts et al. (2014) we expected that both emotional impulsivity and cognitive impulsivity dimensions would be associated positively with inattention and hyperactivity/impulsivity (additive effect). In the absence of existing data, we made no predictions for interaction effects. This study was not preregistered.

2. Method

2.1. Participants

A total of 550 (males = 147, females = 403) adults (ages ranging from 18 to 65 years) from the general community participated in the study. The mean age (*SD*) of all participants together was 32.72 (12.83) years. Supplementary Table S1 shows the sample characteristics of the men and women participants in the study. It indicates that the majority of participants for both gender groups had secondary or university education, were employed, and were in some sort of relationship. The mean (*SD*) of men and women for age were 33.63 (12.91) and 33.38 (12.80), respectively, and they did not differ significantly, $t(df = 548) =$

1.004, ns. In all, 7 (4.8 %) men and 10 (2.5 %) women indicated that were diagnosed with ADHD previously. No additional information for their ADHD status (including medication status) was available.

2.2. Measures

2.2.1. Current Symptom Scale (CSS; Barkley & Murphy, 1998)

The Current Symptom Scale (CSS; Barkley & Murphy, 1998) was used to obtain ratings for ADHD symptoms. The 18 ADHD symptoms in the CSS are comparable to the diagnostic symptoms in DSM-5. These symptoms are also the same in DSM-IV and DSM-IV-TR. Participants indicate the frequency of symptoms over the previous six months on a four-point Likert scale (0 = *never or rarely*, 1 = *sometimes*, 2 = *often*, 3 = *very often*). Thus, higher scores represented greater ADHD severity. The CSS was scored to yield a total inattention symptoms score (based on its 9 inattention items), and a total hyperactivity/impulsivity symptoms score (based on its 9 inattention items). In the present study, Cronbach's alpha values for inattention and hyperactivity/impulsivity dimensions were 0.90 and 0.82, respectively, in both men and women.

2.2.2. Short Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency (S-UPPS-P; Cyders et al., 2014)

The Short Urgency-Premeditation-Perseverance-Sensation Seeking-Positive Urgency (S-UPPS-P; Billieux et al., 2012) was used to measure the five different dimensions of impulsivity (i.e., sensation seeking, lack of premeditation, lack of perseverance, negative urgency, and positive urgency) in the UPPS-P model. The S-UPPS-P has 20 items, with four items for each of the five impulsivity dimensions. Each item is rated in terms of participant agreement or disagreement over the last 6 months. Ratings range from 1 (*agree strongly*) to 4 (*disagree strongly*), with higher scores indicating more impulsivity. In the present study, Cronbach's alpha values for sensation seeking, lack of premeditation, lack of perseverance, negative urgency, and positive urgency in men were 0.82, 0.84, 0.85, 0.79 and 0.74, respectively. For women, they were 0.85, 0.84, 0.90, 0.85 and 0.73, respectively.

2.3. Procedure

Approval for the study was provided by the Human Research Ethics Committee of the University of Ballarat. Recruitment of participants was online over 2 months. Survey Monkey was used for data collection. Participants from the University of Ballarat psychology participant pool received research participation credit, and all others were not offered any incentive to participate.

2.4. Data analysis

All additive and moderation analyses were conducted separately for men and women using SPSS version 22. Initially, for both groups together, missing values were examined, and imputed using the multiple imputation technique provided in this version of SPSS. The additive effects of the predictors (negative urgency, positive urgency, lack of premeditation, and lack of perseverance) on the criterion variables (total scores for inattention and hyperactivity/impulsivity) were examined by regressing the criterion variables (inattention or hyperactivity/impulsivity) on the predictors simultaneously. Age and was also included as covariates in these analyses, as data show decline in impulsivity with age (Liu et al., 2020). We also included sensation seeking to prevent this from confounding our findings.

For moderation, the moderating effect of lack of premeditation and lack of perseverance on the relationships for negative urgency and positive urgency were examined separately. As an example, for the moderation by lack of premeditation on the negative urgency-inattention relation, negative urgency, lack of premeditation, negative urgency

× lack of premeditation were entered simultaneously into the regression analysis. To control for possible confounding effects, age and the other S-UPPS-P dimensions (sensation seeking, lack of perseverance and positive urgency in this example) were also included as covariates in the analysis. In this example, a significant contribution by negative urgency × lack of premeditation is interpreted as support for the moderation effect. When there was support for moderation, the plot for the interaction effect was drawn using the relevant 2-way linear interactions (2-way_linear interaction.xls) excel template provided by Jeremy Dawson (<http://www.jeremydawson.co.uk/slopes.htm>).

3. Results

3.1. Analysis and imputation of missing values

Details of the approach and the results for the missing values analysis and their imputations are presented in the Supplementary (Table S2).

3.2. Preliminary analysis of the factor structure of the S-UPPS-P

Initially, we examined support for the theorized five-factor S-UPPS-P model. We used Mplus Version 7 to compute the conventional fit values for the comparative fit index (CFI) and the root mean square error of approximation (RMSEA). However despite the wide use of conventional fit values, such as those proposed by Hu and Bentler (1998) to evaluate model fit, Marcoulides and Yuan (2017; see also Yuan et al., 2016) have provided evidence that these are not useful for this purpose, and have demonstrated the use of equivalence testing with adjusted fit indexes to evaluate the goodness of fit of CFA models. The conventional fit CFI and RMSEA values for the 5-factor S-UPPS-P were 0.919 and 0.066 for men, and 0.935 and 0.064 for women. Thus, based on Hu and Bentler's (1998) conventional guidelines, there was at least an adequate fit for both gender groups. For men, the adjusted CFI_t and RMSEA_t values from the equivalency testing were 0.857 and 0.081, respectively. For women, they were 0.910 and 0.072, respectively. The adjusted CFI and RMSEA cutoff values derived from equivalence testing indicated a mediocre fit for men and a fair fit for women.

3.3. Additive effects of the UPPS-P dimensions on inattention and hyperactivity/impulsivity

Table 1 shows the results of all the regression analyses for additive effects for men and women. Supplementary Table S3 includes the R^2 , adjusted R^2 , overall F -test and standard error of the estimate for the different regression models, and information on the variance inflation factor (VIF) values that were used to assess multicollinearity. The findings for testing additive effects can also be interpreted in terms of unique association for the S-UPPS-P factors with inattention and hyperactivity/impulsivity in men and women. They indicate that for men, lack of perseverance was associated uniquely and positively with inattention; and negative urgency, lack of perseverance, and sensation seeking were uniquely and positively associated with hyperactivity/impulsivity. For women, negative urgency, positive urgency, lack of premeditation, and lack of perseverance were uniquely and positively associated with inattention, and positive urgency and lack of premeditation were uniquely and positively associated with hyperactivity/impulsivity.

Overall, therefore, considering negative urgency, positive urgency, lack of premeditation and lack of perseverance together, it can be argued that there was support for the additive model for only the prediction of inattention scores in women. Additionally, concerning the covariates, hyperactivity/impulsivity was positively predicted by sensation seeking in men, but not predicted by sensation seeking in women. Age did not contribute in any regression analyses.

Table 1

Results of the regression analyses for additive effects of S-UPPS-P predictors.

	Men		Women	
	IA	HY/IM	IA	HY/IM
Predictors				
Negative urgency	0.197(0.139)	0.495** (0.254)	0.240** (0.220)	0.078(0.047)
Positive urgency	0.336(0.054)	0.166(0.079)	0.452*** (0.103)	0.622*** (0.323)
Lack of premeditation	0.211(0.081)	0.137(0.069)	0.225* (0.098)	0.245* (0.115)
Lack of perseverance	1.167* (0.487)	0.356* (0.183)	0.667*** (0.354)	0.182(0.104)
Covariates				
Age	−0.054(−0.121)	−0.022(−0.060)	−0.021(−0.054)	−0.019(−0.052)
Sensation seeking	0.275(0.119)	0.438** (0.234)	0.064(0.037)	0.118(0.072)

Note. IA = inattention; HY/IM = hyperactivity/impulsivity. Values not in parenthesis and in parenthesis are the unstandardized and standardized beta coefficients, respectively.

*** $p < .001$.

** $p < .001$.

* $p < .05$.

3.4. Moderation analyses

Table 2 shows the results of the moderation analyses for men and women. Supplementary Table S4 shows the R^2 , adjusted R^2 , overall F -test and standard error of the estimate for the different regression models, and information on the VIF. As shown in Table 2, for men, there was significant moderation by lack of premeditation on both the negative agency- inattention and positive agency- inattention relationships. For women, there was significant moderation by lack of premeditation on the positive urgency- inattention and positive urgency- hyperactivity/impulsivity relationships. Supplementary Fig. S1 shows the plots of these interaction effects. As shown, except for the moderation by lack of premeditation on the positive agency- inattention relation, moderation effects were present at lower levels of the moderators. In all cases, the slopes for the moderators at low levels were negative and significant, whereas the slopes for the moderators at higher levels were not significant. The moderation by lack of premeditation on the positive agency-inattention relationship showed a negative significant trend ($p < .10$). These findings indicate that for the relations with moderation effects, lower levels of the relevant moderators (lack of premeditation in all

instances) reduced the relations between the relevant predictors (negative urgency or positive agency) and relevant outcomes (inattention or hyperactivity/impulsivity).

4. Discussion

Our additive effects findings were generally consistent with our predictions and existing data, as previous studies have shown that except for sensation seeking, all the other UPPS-P dimensions are associated with ADHD (Egan et al., 2017; Halvorson et al., 2021; Lopez et al., 2015; Roberts et al., 2014). Our findings also extend existing findings. Unlike past studies that have generally demonstrated correlational associations between the distinct types of impulsivity with ADHD, the current study used multiple regression analysis to demonstrate unique and additive associations. Additionally, our findings demonstrated associations separately for inattention and hyperactivity/impulsivity in men and women. Our moderation findings are also new. Our findings indicated moderation by premeditation (but not perseverance) on the relationship between positive urgency (and not negative urgency) and inattention in men, and positive urgency and inattention and

Table 2

Coefficients of the regression analyses for moderation effects.

	Men		Women	
	IA	HY/IM	IA	HY/IM
Moderations by NU × LP and NU × LPV				
Negative urgency (NU)	−1.21* (0.50)	−0.33(−0.17)	−0.37(−0.21)	−0.59* (−0.35)
Lack of premeditation (LP)	−1.60* (0.62)	−0.72(−0.34)	−0.12(−0.05)	0.00(−0.00)
NU × LP	0.19* (1.14)	0.09(0.66)	0.04(0.29)	0.03(0.23)
Lack of perseverance (LPV)	1.32(0.55)	0.21(0.11)	0.28(0.15)	−0.39(−0.22)
NU × LPV	−0.02(−0.10)	0.01(0.10)	0.04(0.31)	0.06(0.47)
Age	−0.06* (−0.14)	−0.03(−0.07)	−0.02(−0.06)	−0.02(−0.05)
Sensation seeking	0.24(0.10)	0.41** (0.22)	0.06(0.03)	0.11(0.07)
Positive urgency	0.38(0.15)	0.18** (0.09)	0.43*** (0.21)	0.60*** (0.31)
Moderations by PU × LP and PU × LPV				
Positive urgency (PU)	−0.75(−0.29)	−0.64(−0.32)	−0.65* (−0.32)	−0.48(−0.25)
Lack of premeditation (LP)	−1.68* (−0.65)	−0.62(0.30)	−0.51(−0.22)	−0.67(−0.31)
PU × LP	0.19** (1.13)	0.089(0.55)	0.08* (0.55)	0.10* (0.72)
Lack of perseverance (LPV)	1.50* (0.63)	−0.03(−0.02)	−0.01(−0.01)	−0.32(−0.18)
PU × LPV	−0.04(−0.23)	0.04(0.26)	0.07(0.49)	0.05(0.39)
Age	−0.05(−0.10)	−0.02(−0.05)	−0.02(−0.06)	−0.02(−0.05)
Sensation seeking	0.25(0.11)	0.41** (0.22)	0.06(0.03)	0.11(0.07)
Negative urgency	0.13(0.05)	0.46* (0.24)	0.22* (0.12)	0.06(0.04)

Note. IA = inattention; HY/IM = hyperactivity/impulsivity. Values not in parenthesis and in parenthesis are the unstandardized and standardized beta coefficients, respectively).

*** $p < .001$.

** $p < .001$.

* $p < .05$.

hyperactivity/impulsivity in women. Thus, moderation varied by gender and the ADHD domain in question. Notwithstanding this, for all significant moderations, higher levels of lack of premeditation increased the relations of the predictors with the ADHD domains.

4.1. Measurement, theoretical, and treatment implications

Our findings for the factor structure of the S-UPPS-P have theoretical and measurement implications for the UPPS-P model. Although not the primary focus of the study, our findings, based on equivalence testing with adjusted fit indexes, indicated, at best, marginal fit for the 5-factor UPPS-P model. This differs from existing findings that have generally found at least adequate support for this model (Billieux et al., 2012; Cyders et al., 2014; D'Orta et al., 2015; Dugré et al., 2019). Thus there are grounds to question the validity of the proposed UPPS model.

The additive and moderation findings also have theoretical and treatment implications. Considering that, conceptually, the UPPS-P dimensions of lack of premeditation and lack of perseverance (i.e., cognitive impulsivity) can be linked to top-down processing, and negative urgency and positive agency (emotional impulsivity) dimensions can be linked to bottom-up processing, and that top-down processing and bottom-up processing are linked to inattention and HY/IM, respectively, our findings have relevance for the dual impulsivity pathway model of ADHD (Sonuga-Barke, 2003). Given our significant moderation findings, our findings indicate that inattention in men and women and hyperactivity/impulsivity in women also arise through the interaction of bottom-up and top-down processes. Based on our findings, we believe that the dual pathway model of ADHD is different in men and women. In men, it applies to inattention and not hyperactivity/impulsivity. In women, it applies to both inattention and hyperactivity/impulsivity.

Our findings suggest that the reduction of trait impulsivity can be effective for the treatment of ADHD. In this respect, our findings raise the possibility that directly focusing on emotionally- and cognitively-driven impulsivity and sensation seeking can be an effective treatment for ADHD. To date, there has been no proven treatment for impulsivity. Major non-pharmaceutical treatments have included cognitive-behavioral therapy and dialectic behavior therapy (Neto & True, 2011). Siegel (2010) has also proposed a mediation-based intervention strategy that focuses on the regulation of emotion, with the goal to move from "being the emotion" to becoming a more distant observer of the emotion. It is assumed that with repeated practice of the strategies in this approach, the cortical connections necessary to regulate intense emotions will be built. As will be evident, Siegel's intervention can be seen as especially useful for treating emotional impulsivity.

4.2. Limitations and further research

Several limitations in this study need to be considered when interpreting the findings and the conclusions made. First, as all data were collected using self-rating scales, the findings may have been influenced by common method variance. Second, as we examined community samples of men and women, the findings may not be relevant to those with clinical diagnoses of ADHD. Third, as we used cross-sectional data, our findings cannot be interpreted in causal terms. Fourth, as we examine a single sample, replication of our findings is needed before they can be generalized. Fifth, based on equivalence testing with adjusted fit indexes, we found only marginal fit for the 5-factor UPPS-P model that framed our study. Despite these limitations, this study has provided new and novel findings and strong support for more studies in this area, controlling for the limitations raised here.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Credit authorship contribution statement

Rapson Gomez: Conceptualization, Methodology, Data collection, Formal analysis, Writing - original draft, Supervision.

Shaun Watson: Conceptualization, Ethics Application, Data collection, Writing, Review & Editing, Supervision.

Data availability

Data will be made available on request.

Acknowledgements

All participants involved in the study.

Appendix A. Supplementary material

Supplementary material to this article can be found online at <https://doi.org/10.1016/j.paid.2023.112125>.

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