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Measurement and Functional Equivalence of a Reduced Version of the UPPS Impulsivity Scale Among Hispanic, Non-Hispanic Black, and Non-Hispanic White Adolescents

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Abstract

The current study aimed to assess the measurement equivalence and functional equivalence of the UPPS (Urgency, Premeditation, Perseverance, Sensation Seeking) Impulsivity Scale among three ethnoracial adolescent samples in the U.S. seventh-grade students who self-identified as Hispanic ($n = 472$), non-Hispanic Black ($n = 89$), or non-Hispanic White ($n = 90$), and completed an English-language version of the Child version of the UPPS, which was shortened and modified to include positive urgency items. Through a series of confirmatory factor analyses, the UPPS demonstrated configural, metric, and partial threshold invariance. Fisher's r -to- z transformations were used to assess the functional equivalence of the UPPS against well-validated measures of self-regulation and mental health commonly associated with impulsivity. We found some group differences in the magnitude of associations. Yet, overall, this study provides evidence that the UPPS can be used to measure distinct factors of impulsivity among Hispanic, non-Hispanic Black, and non-Hispanic White adolescents.

Keywords

adolescence; impulsivity; measurement invariance; self-regulation; mental health

Impulsivity's impact during adolescent development has been widely studied in psychology resulting in several definitions and various assessment tools. In a major step toward creating a more unified and comprehensive understanding of impulsivity, Whiteside and Lynam (2001) developed the UPPS (Urgency, Premeditation, Perseverance, Sensation Seeking) Impulsive Behavior Scale to identify and assess separable impulsive traits and it has since been adapted for youth (Zapolski et al., 2010). Broadly, impulsivity is the tendency to act on behavioral impulses without planning or regard for potential consequences (Whiteside &

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Declaration of Conflicting Interests

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¹In a single-group five-factor model of the UPPS (Urgency, Premeditation, Perseverance, Sensation Seeking), negative and positive urgency were highly correlated ($r = .86, p < .001$), providing support for combining positive and negative urgency items into a single urgency factor.

Supplemental Material

Supplemental material for this article is available online.

Lynam, 2001). Impulsivity is theorized to play a key role in shaping adolescents' capacities for self-regulation (Eisenberg et al., 2010; Nigg, 2017). Indeed, greater levels of impulsivity have been associated with detrimental outcomes in adolescence such as greater involvement with substances (i.e., cigarettes, alcohol, and marijuana), poorer self-concept, and weaker academic performance (Wulfert et al., 2002). Thus, measurement of impulsivity can have great utility in prospective studies of developmental and health outcomes. However, the UPPS was developed and validated with predominantly Caucasian adult samples (90% Caucasian in Whiteside et al., 2005; 90% Caucasian in Cyders & Smith, 2007; 72% Caucasian in Cyders et al., 2014; and ethnoracial breakdown not reported in Whiteside & Lynam, 2001). Tests of the UPPS for children have also been done with predominantly Caucasian samples. When Zapolski et al. modified the measure for children (called the UPPS-R Child), reliability and validity was tested with a sample of 85% European American children (Zapolski et al., 2010). The current study sought to examine the measurement and functional equivalence of the measure among adolescents from three different ethnoracial groups, a necessary first step before the measure can be used and interpreted with these samples.

The Four-Factor UPPS

The UPPS originally consisted of four factors: *sensation seeking* (i.e., the tendency to seek out novel, thrilling experiences), *lack of perseverance* (i.e., the inability to sustain attention or remain focused on a task), *lack of premeditation* (i.e., the tendency to not plan ahead and act without thinking), and *negative urgency* (i.e., the tendency to act rashly when in an extreme negative mood state) (Whiteside & Lynam, 2001; Zapolski et al., 2010). *Positive urgency* (i.e., the tendency to act rashly when in an extreme positive mood state) was added to the original four-factor structure UPPS scale for adults in 2007, at which point the measure was renamed the UPPS-P and captured five distinct but intercorrelated factors (Cyders & Smith, 2007). Authors of the most recent meta-analysis of the UPPS-P point to the substantial similarities between negative and positive urgency, suggesting that the two may not prove meaningfully distinct from one another for adolescents and young adults (Berg et al., 2015). Similarly, Coskunapinar et al. (2013) found no significant differences between negative urgency and positive urgency's effect sizes on alcohol use and drinking problems among young adults. In fact, positive and negative urgency are very highly correlated among children (Watts et al., 2019) and are routinely combined into a higher-order urgency factor (Billieux et al., 2012; Cyders et al., 2014). Therefore, the current study focuses on the four-factor UPPS measure.

The UPPS and Mental Health

The distinctions between the four facets of impulsivity challenge the common temptation to view impulsivity as a homogeneous construct. The four impulsivity factors demonstrate distinct utility as separable "pathways" that differentially predict behavioral (i.e., alcohol/substance use, suicidality/nonsuicidal self-injury, aggression, and disordered eating), emotional (i.e., anxiety and depression), and trait-like (i.e., borderline personality traits) measures of psychopathology for adolescents and young adults (Berg et al., 2015; Whiteside & Lynam, 2001). Meta-analyses of the UPPS, UPPS-R (reduced scale), and UPPS-P

scales' usage with mostly young adults and some high school students found that each of the impulsivity factors were significantly associated with numerous mental health problems, including alcohol and substance use, depression, anxiety, suicidality, aggression, and disordered eating (Berg et al., 2015; Coskunpinar et al., 2013; Fischer & Smith, 2008). Although the pattern of associations was often similar across the different facets of impulsivity and mental health, there were differences in the strength of associations depending on each impulsivity domain. For example, sensation seeking was most strongly implicated in alcohol/substance use but not related to disordered eating. Similarly, lack of premeditation was strongly associated with alcohol/substance use and weakly correlated with anxiety (Berg et al., 2015). The different patterns of associations highlight the idea that certain facets of impulsivity may be more or less implicated in certain manifestations of psychopathology. In the same meta-analysis, the weighted mean effect sizes between urgency (both negative and positive urgency where available) and mental health were typically in the medium to large range, whereas the effect sizes for lack of premeditation, lack of perseverance, or sensation seeking were generally small to medium in magnitude (Berg et al., 2015).

However, both meta-analyses included studies of predominantly adult, non-Hispanic White (NHW) samples and findings need to be replicated with diverse adolescent samples. For example, over 80% of studies that reported on sample racial/ethnic make-up featured majority non-Hispanic White young adult participants in the meta-analysis by Coskunpinar and colleagues (2013). Although the meta-analysis by Berg et al. (2015) was one exception that included studies with adolescent samples in their meta-analysis (9%, $n = 3,639$), they did not report the race or ethnicity of included samples within their report.

The UPPS and Self-Regulation in Adolescence

Previous researchers have suggested that impulsivity factors, such as sensation seeking, lack of premeditation, and urgency are associated with mental health outcomes, in part, because they are relevant to adolescents' emerging self-regulatory capabilities that are also important predictors of adolescent mental health and substance use problems (Gullo & Dawe, 2008; Tarter, 2002). Therefore, adolescent self-regulation capabilities, such as coping, emotion regulation, and effortful control are also key variables when considering impulsivity and the functional equivalence of the UPPS. For example, certain coping strategies, such as cognitive emotion regulation strategies, have been shown to mediate the relation between lack of perseverance and depressive symptoms among a sample of adolescents in Switzerland who completed the UPPS (d'Acremont & Van der Linden, 2007). Adolescents higher in lack of perseverance were less likely to use appropriate coping strategies (e.g., positive refocusing, refocus on planning, putting into perspective), which in turn was related to higher rates of depressive symptoms. Simultaneously, urgency was inversely related to adaptive coping strategies and positively related to maladaptive coping strategies (e.g., rumination, catastrophizing), which were associated with depressive symptoms. This is consistent with prior studies where the UPPS was administered to adolescents and young adults, which found that negative urgency was associated with greater use of disengagement or reflexive emotion regulation strategies (i.e., denial, avoidance, or suppression) rather than engagement strategies (i.e., problem-solving, reappraisal, or acceptance; King et al.,

2018). Collectively, urgency, lack of perseverance, lack of premeditation, and sensation seeking appear to reflect more than the tendency to act rashly within a plan or giving up on pursuits, but also reflect a reflexive responsivity to emotions that can lead to either rash action or inaction, characteristic of internalizing symptoms in adolescence (Smith et al., 2013). Considering that adaptive emotion regulation strategies may require a combination of engagement with distress-producing stimulus, planning, and/or persistence, these may be particularly difficult for adolescents high in impulsivity. In contrast, coping strategies focused on disengaging from the stressor typically focus on achieving more immediate relief from the negative affective experience.

Effortful control, the ability to shift and focus attention and to actively control emotional and attentional responses, is another key self-regulatory capacity (Capaldi & Rothbart, 1992). Adolescents who are low in effortful control are more prone to becoming easily frustrated and have deficiencies in the ability to inhibit a response and delay gratification, which may lead to higher rates of externalizing behaviors (Fernie et al., 2013; Romer et al., 2010). It is plausible that higher levels of impulsivity may be related to lower levels of effortful control. However, to our knowledge, effortful control's associations with the distinct subfactors of impulsivity in adolescence have not been examined, nor do we know if the associations vary across groups.

Measurement and Functional Equivalence

Before the UPPS subfactors' associations with self-regulation and with mental health can be examined, we must first establish the measurement properties of the UPPS. Despite the great utility of a measure of adolescent impulsivity, to our knowledge, measurement and functional equivalence of the scale has not been established across different ethnoracial groups of adolescents. Until measurement invariance is established, we cannot be certain that the same constructs are being accurately measured and unbiasedly compared across different racial and ethnic groups of adolescents. Specifically, configural invariance (i.e., equivalence of model structure), metric invariance (i.e., "weak" invariance; equivalence of factor loadings across groups), and scalar invariance (i.e., "strong" invariance; equivalence of response values across groups) must be established to interpret comparisons of factor means and the relations of factors with other constructs. All are necessary for the UPPS to be meaningfully used and interpreted across diverse populations. Prior validation studies for the UPPS have established invariance across sex (Cyders, 2013), age (Argyriou et al., 2020), and language variations (e.g., Chinese, French, German translations; Keye et al., 2009; Wang et al., 2020) and mostly within adulthood among primarily Caucasian/White samples. Several have examined the psychometric properties of the UPPS, validating it with Hispanic (H)/Latino adult samples (e.g., Stevens et al., 2018). With one exception described below, no prior studies have examined the functional equivalence of the UPPS or whether the relations of the UPPS and outcomes were equivalent across different ethnoracial groups.

Evident when intercorrelations among the UPPS subscales and associations with other constructs are similar across different samples, functional equivalence signals that the construct has the same antecedent and consequences across samples (Hui & Triandis, 1985; Knight et al., 1992). Watts and colleagues (2019) examined the measurement properties

and external validity of an abbreviated version of the UPPS-P, establishing invariance and external validity across child ethnicity (White, Black, Hispanic, and Other Americans), household income (less than US\$50,000, US\$50,000–100,000, and over US\$100,000 annually), and parental education (ranging from less than a high school diploma to postgraduate degree). Their examination was conducted with pre-adolescents aged 9 to 10 years and primarily focused on impulsivity's relation to internalizing psychopathology (e.g., diagnostic measures of mood and anxiety disorders). Given that youths' self-regulatory systems undergo major transformation during the adolescent years, it is necessary to examine the measurement properties of the UPPS among adolescents as well. Furthermore, given the broad impact impulsivity is hypothesized to have on adolescents' emotional and behavioral functioning, evidence of functional equivalence of the UPPS across diverse groups would be further strengthened by examining its relations to both internalizing and externalizing symptomatology and to other aspects of self-regulatory capacity. The current study builds on the work by Watts et al. by examining the measurement properties of the UPPS with an older sample (aged 11–13 vs. 9–10 years in Watts et al., 2019) and focusing on functional equivalence with self-regulation measures.

In summary, among the aforementioned studies connecting impulsivity with self-regulation and mental health, most were conducted with predominantly non-Hispanic White young adult samples (e.g., Coskunapinar et al., 2013) and few examined the relation between impulsivity and self-regulation among ethnically and racially diverse adolescents. In addition, studies with more diverse participants did not test measurement equivalence of these constructs across different ethnoracial groups within their sample (King et al., 2014). Given conceptual links between impulsivity and self-regulation and evidence with predominantly White American samples, researchers often presume that the UPPS/UPPS-P will invariably be associated with self-regulation. However, findings from a Spanish-language translation of the UPPS-P and its correlations with self-regulation among college-aged individuals in Spain challenge this notion. Unlike prior studies conducted in the United States, the authors found few significant associations between the UPPS-P and regulation (Cándido et al., 2012). The different patterns of findings with the Spanish sample suggest that though the UPPS-P may have demonstrated similar measurement properties across different samples, it may not prove to be functionally equivalent across ethnoracial groups. Thus, the current study sought to examine whether and how associations may vary among ethnoracial groups. Our study extends prior work by examining the measurement properties and functional equivalence of the UPPS with well-validated self-regulation measures across diverse adolescents.

The Current Study

In the current study, we tested the measurement invariance and functional equivalence of a four-factor solution to the UPPS-R Child scale (sensation seeking, lack of perseverance, lack of premeditation, and urgency; negative and positive urgency included in a single factor), which was adapted for brevity and administration to adolescents via interview. The study sought to first establish measurement invariance of an English-language, adolescent version of the UPPS Impulsivity Scale among the three largest subgroups currently defined by race and Hispanic origin in the United States (U.S. Census Bureau, 2017): Hispanic,

non-Hispanic Black (NHB), and non-Hispanic White adolescents. These groups currently represent 18.5%, 13.4%, and 60.1% of the U.S. population, respectively (U.S. Census Bureau, 2020). For the present study, we followed the U.S. Census Bureau's guidance for racial and ethnic categories. Hispanic refers to a person of South American, Central American, Cuban, Mexican, Puerto Rican, or other Spanish culture origin. Black includes individuals "having origins in any of the Black [ethnoracial] groups in Africa" and any individuals who self-identify as Black or African American (see the "Method" section for details regarding ethnoracial categorization). We hypothesized that the abbreviated UPPS scale with a four-factor structure would exhibit good model fit to the data for the current study sample given that the UPPS-R Child scale has established reliability and validity of the four factors with a sample of pre-adolescents (Zapolski et al., 2010). We hypothesized that configural invariance would be met. We had no further specific hypotheses regarding metric and threshold invariance.

Second, the study examined the functional equivalence of the UPPS for the three groups in relation to other well-validated measures of self-regulation and mental health commonly associated with impulsivity (i.e., validation by nomological network). Given the distinct nature of the original four UPPS factors, we examined each factor's differential associations with self-regulation and mental health measures (Strickland & Johnson, 2020) across the three ethnoracial groups. We hypothesized that among the four factors, adolescents' self-reported urgency, lack of perseverance, and lack of premeditation would be associated with self-regulation measures and internalizing and externalizing symptoms for the group ethnoracial groups. Given previous studies finding strongest associations between self-regulation and mental health with urgency, we hypothesized that the magnitude of associations would also be greatest with urgency and that this would be true for all three ethnoracial groups. Finally, we expected similar patterns of associations between the four impulsivity factors and measures of self-regulation and mental health symptomatology for all subgroups given the absence of explicit evidence that impulsivity, self-regulation, and mental health symptomatology operate differently across ethnoracial groups of adolescents living in the United States.

Method

Procedure

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. The current study used data from a randomized efficacy trial testing the effects of a family-based prevention intervention program. Families of seventh-grade adolescents and their caregivers were recruited via school events, phone, and/or mails from three Title I middle schools selected from districts with high Hispanic student enrollment. The eligibility criteria for this trial included (a) the adolescent was enrolled in a participating school and in seventh grade; (b) the adolescent was not in a self-contained class for emotional or cognitive impairment; (c) a caregiver was willing to participate and could speak English or Spanish; (d) the participating caregiver needed to have sole or shared custody and live with the adolescent at least 15 days per month; and (e) the family agreed to be randomized to participate in either the prevention intervention trial or a workshop

(control condition). Participants in both the intervention and control arms were included in the present study. Caregivers provided informed consent for their participation and their child's participation. Adolescents provided assent for study participation.

Research staff administered survey measures during inperson interviews conducted in families' homes. Caregivers completed interviews in their preferred language (English or Spanish). Adolescents completed interviews in English. Each participating family member received US\$50 for the pretest interview, which took approximately 1.5 hours. All study procedures were approved by the university's Institutional Review Board.

Participants

From the initial sampling pool of 2,069 families, 763 were eligible and interviewed at pretest which occurred during the fall semester for three annual cohorts. This study used a subsample of individuals that completed the pretest interviews who identified as Hispanic, non-Hispanic Black, or non-Hispanic White. The initial adolescent sample consisted of 473 (72.4%) Hispanic, 89 (13.6%) non-Hispanic Black, and 91 (13.9%) non-Hispanic White seventh-grade students. However, two cases were dropped due to missing data on the UPPS. The final sample consisted of 472 Hispanic, 89 non-Hispanic Black, and 90 non-Hispanic White adolescents. The mean age was 12.02 years ($M_{\text{Hispanic}} = 12.0$, $M_{\text{non-Hispanic Black}} = 12.1$, and $M_{\text{non-Hispanic White}} = 12.1$). Approximately, half of participants identified as female (50.2% overall, 51.7% of Hispanic participants, 47.2% of non-Hispanic Black, and 45.6% of non-Hispanic White). A total of 650 primary caregivers ($n_{\text{Hispanic}} = 471$, $n_{\text{non-Hispanic Black}} = 89$, and $n_{\text{non-Hispanic White}} = 90$) reported on adolescent mental health symptoms. The majority of primary caregivers were female (93.2% of Hispanic caregivers, 85.4% of non-Hispanic Black caregivers, and 94.4% of non-Hispanic White caregivers). Participants' annual household income ranged from less than US\$5,001 to over US\$100,000. The median household income was US\$30,001 to 35,000 for Hispanic and non-Hispanic Black participants and US\$75,001 to 80,000 for non-Hispanic White participants. Table 1 presents the breakdown of demographic information by ethnoracial group and how groups differed on these indices.

Measures

Youth Ethnoracial Identity.—Adolescents who self-identified as Hispanic, Latino, or Spanish origin were categorized as “Hispanic” ($n = 472$). Adolescents who self-identified as of Black or African American (but not Hispanic) were categorized as non-Hispanic Black ($n = 89$). Adolescents who self-identified as White or Anglo (but not Hispanic) were categorized as non-Hispanic White ($n = 90$). This designation was used for the multiple-group comparisons.

UPPS-R Child Version.—The UPPS-R Child Version (Zapolski et al., 2010) was modified for brevity, inclusion of items tapping into positive urgency, and administration via interview within an adolescent substance use and mental health preventive intervention. Zapolski and colleagues (2010) first adapted Whiteside and Lynam's (2001) UPPS questionnaire for children by reducing the scale from 45 to 32 items and by simplifying the sentence structure and vocabulary to require no more than a fourth-grade reading level.

For the present study, the study team removed items that were similar to reduce participant survey burden. For example, we removed the item “I often make matters worse because I act without thinking when I am upset” and retained the item “When you are upset you often act without thinking.” As the UPPS-R Child version from 2010 measured only negative urgency, we supplemented the scale with items tapping into positive urgency (e.g., “I tend to lose control when I am in a great mood”). Finally, all items were adapted to be read aloud to the participant via interview (e.g., “I am very careful” was modified to “You are very careful”). All eight items tapping into sensation seeking were retained as the parent grant aims examined adolescent temperament correlates of substance use/prevention. Thus, the study team administered a total of 27 items from the UPPS-R Child Version tapping into the constructs of sensation seeking (eight items), lack of perseverance (five items), lack of premeditation (six items), and urgency (positive and negative urgency; four items each). Adolescents self-reported on how much each item described them on a 4-point ordinal categorical scale (1 = *Not at all like me* to 4 = *Very much like me*). All items in the lack of perseverance scale and lack of premeditation scale were reverse scored. Internal consistency and detailed psychometric properties are reported in the results.

The Early Adolescent Temperament Questionnaire—Revised.—We used the 16-item effortful control subscale of the Early Adolescent Temperament Questionnaire—Revised (EATQ-R) to assess dimensions of temperament related to self-regulation: activation control (i.e., capacity to perform actions when there exists a strong tendency to avoid actions; “If you have a hard assignment to do, you get started right away”), inhibitory control (i.e., capacity to suppress inappropriate responses; “When someone tells you to stop doing something, it is easy for you to stop”), and attention control (i.e., capacity to focus and shift attention; “You are good at keeping track of several different things that are happening around you”) (Ellis & Rothbart, 2001). Adolescents rated the frequency with which each item applied to them on a 5-point Likert-type scale (1 = *Almost never or never* to 5 = *Almost always or always*). Items were averaged to create one index of effortful control. The effortful control subscale previously showed acceptable internal consistency with Hispanic (Clark et al., 2015; Evich et al., 2019) and Black (Véronneau et al., 2014) adolescents. Internal consistency was good in the current sample ($\alpha_H = .76$; $\alpha_{NHB} = .79$; and $\alpha_{NHW} = .84$).

Difficulties in Emotion Regulation Scale.—The Difficulties in Emotion Regulation Scale (DERS) is a self-report measure that assesses adolescents’ difficulties in regulating emotions (Gratz & Roemer, 2004). The current study included two subscales of the DERS: *nonacceptance of emotional responses* (six items, e.g., “When you were upset, you became embarrassed for feeling that way”) and *limited access to emotion regulation strategies* (eight items originally; e.g., “When you were upset, you started to feel very bad about yourself”). Adolescents rated the frequency with which each statement described them in the past month on a 5-point Likert-type scale (1 = *Almost never or never* to 5 = *Almost always or always*). Background psychometric analyses revealed that one item in the limited access to emotion regulation strategies subscale had a low factor loading producing poor model fit. We dropped the poorly fitting item, leaving a total of seven items in the limited access to emotion regulation strategies subscale. Items were averaged to create subscale scores, with higher scores indicating greater difficulties with regulating negative emotions. Both

subscales demonstrated strong reliability (nonacceptance: $\alpha_H = .84$, $\alpha_{NHB} = .81$, $\alpha_{NHW} = .87$ and limited access: $\alpha_H = .88$, $\alpha_{NHB} = .88$, $\alpha_{NHW} = .93$). The DERS has previously been used successfully with racially diverse adolescents (Charak et al., 2019; Pisani et al., 2013).

Cognitive Emotion Regulation Questionnaire.—The Cognitive Emotion Regulation Questionnaire (CERQ) is an adolescent self-report measure of nine cognitive components of emotion regulation (Garnefski et al., 2001). We used four subscales: *positive refocusing* (four items; e.g., “You think of nicer things than what you have experienced”), the *refocus on planning* (four items; e.g., “You think about how to change the situation”), *putting into perspective* (four items; e.g., “You think that it all could have been much worse”), and *catastrophizing* (four items; “You often think that what you have experienced is the worst that can happen to a person”). Adolescents reported how often they used cognitive emotion regulation strategies or engaged in catastrophizing in the past month on a 5-point Likert-type scale (1 = *Almost never or never* to 5 = *Almost always or always*). Subscale items were averaged to create subscale scores, with higher scores indicating greater utilization of cognitive strategies or greater catastrophizing, respectively. Each of the subscales demonstrated good reliability in the current sample (positive refocusing: $\alpha_H = .77$, $\alpha_{NHB} = .79$, $\alpha_{NHW} = .82$; refocus on planning: $\alpha_H = .82$, $\alpha_{NHB} = .78$, $\alpha_{NHW} = .86$; putting into perspective: $\alpha_H = .67$, $\alpha_{NHB} = .67$, $\alpha_{NHW} = .70$; catastrophizing: $\alpha_H = .76$, $\alpha_{NHB} = .71$, $\alpha_{NHW} = .64$).

Internalizing and Externalizing Symptoms.—Adolescents and primary caregivers reported on the adolescent’s socioemotional and behavioral symptoms in the past month through the 112-item adolescent report Youth Self Report (YSR) and the caregiver report Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2019). In this study, the internalizing and externalizing symptoms’ subscales were used. Reporters rated items on a 3-point Likert-type scale (0 = *Not true* to 2 = *Very true or often true*). This measure has been widely used and validated across diverse adolescents, including Hispanic and Black adolescents (Gonzales et al., 2012; Loyd et al., 2019). *T* scores for the subscales were calculated, which reflected the degree to which scores deviate from a normative sample matched on sex and age. Subscales demonstrated strong reliability (YSR internalizing: $\alpha_H = .87$, $\alpha_{NHB} = .87$, $\alpha_{NHW} = .90$; YSR externalizing: $\alpha_H = .84$, $\alpha_{NHB} = .90$, $\alpha_{NHW} = .84$; CBCL internalizing: $\alpha_H = .85$, $\alpha_{NHB} = .82$, $\alpha_{NHW} = .89$; and CBCL externalizing: $\alpha_H = .88$, $\alpha_{NHB} = .88$, $\alpha_{NHW} = .94$).

Data Analysis Plan

The current study first aimed to establish factorial invariance of the factor structure of the UPPS. Though the UPPS was originally conceptualized as a four-factor model (Whiteside & Lynam, 2001), positive urgency was added to create two valenced urgency factors (i.e., positive and negative urgency), resulting in five impulsivity factors in total (Lynam et al., 2007). However, in this five-factor solution, a higher-order “Urgency” factor is created that includes both positive and negative urgency. Previous studies have shown high correlations between the positive and negative urgency factors (e.g., $r = .71$ in Watts et al., 2019), questioning the utility of separate factors. Thus, we elected to use the four-factor structure of the UPPS with positive and negative urgency items subsumed within one urgency factor.

We conducted systematic invariance analyses (i.e., configural, metric, threshold, strict) using multi-group confirmatory factor analysis (CFA) in Mplus 8.4 (Muthén & Muthén, 1998–2019). As UPPS items were rated on a 4-point ordered scale, we followed recommendations by Liu et al. (2017) and Millsap & Tein (2004), and used weighted least square mean and variance adjusted estimators for establishing measurement invariance among ordered-categorical measures. First, we established *configural invariance*, or invariance of the factor structure across groups, using a four-factor CFA framework based on a priori UPPS structure separately for each group and then together in a single multiple-group CFA. After running the single-group CFA with each of the ethnicity samples, we deleted items that had response categories without full representation from all groups and items with nonsignificant factor loadings in at least one group. We then conducted a multiple-group model of the items that remained. Latent factors were allowed to intercorrelate with one another. We used the marker variable approach to identify the variance and mean structures of the latent common factors. The loading for the first indicator items of each of the four factors was set to 1 and all other loadings were freely estimated between groups. Common factor means were set to 0 in the Hispanic group and freely estimated in the non-Hispanic Black and non-Hispanic White groups. Similarly, item variances were set to 1 in the Hispanic group and freely estimated in the other two groups. One threshold for each indicator and a second threshold for each marker variable were constrained to be equal across groups. *Metric invariance*, often called “weak” factorial invariance, was examined next by constraining the factor loadings across all groups. The chi-square difference test (i.e., DIFFTEST within Mplus) was used to make all nested model comparisons (i.e., configural vs. metric invariance models), which is recommended for comparing models with categorical outcomes (Liu et al., 2017). *Threshold invariance*, or “strong” invariance, was determined by comparing the metric invariance model to one in which thresholds for all items were constrained across groups. We intended to compare with the threshold invariance model with a strict factor invariance model in which all parameters to be equivalent across the three groups, including the unique factor variances. A *strict invariance* model is generally not expected (Meredith & Teresi, 2006; Van De Schoot et al., 2015) and is not necessary for examining functional invariance.

In the event that threshold invariance was not supported, we aimed to establish partial threshold invariance (Byrne et al., 1989; van de Schoot et al., 2012). To establish partial invariance, we examined freely estimated thresholds to identify the item thresholds with the largest differences between groups. We re-ran the multi-group model with all thresholds constrained except for one item’s thresholds (with a large threshold difference between groups), which was freely estimated between groups (van de Schoot et al., 2012). When releasing thresholds for free estimation across groups, the first of the three total thresholds per item remained constrained for model estimation purposes (Liu et al., 2017). We then compared this model with selective thresholds freely estimated to the metric invariance model. The process was repeated, releasing one threshold at a time, until the chi-square difference test revealed no significant difference between the metric invariance model and the partial threshold invariance model at a $p = .10$ level (Vandenberg & Lance, 2000). Guidelines for establishing partial invariance are nonspecific and a source of continued debate, but methodologists often agree that the majority of loadings, intercepts, or thresholds

need to be invariant for partial invariance (Putnick & Bornstein, 2016; Vandenberg & Lance, 2000). In the current study, we determined that 80% of thresholds must be invariant across groups to establish partial threshold invariance.

Finally, if measurement invariance (i.e., metric and threshold invariance or partial invariance at minimum) was achieved, we sought to examine functional equivalence of the UPPS to well-established measures of self-regulation and mental health across groups. Items within the UPPS subscales were averaged to create an index of each construct, with higher scores indicating adolescents' greater agreement with each description of sensation seeking, lack of perseverance, lack of premeditation, or urgency. Then, index scores from each of the UPPS subscales were correlated with each other and other measures of interest (e.g., effortful control, difficulties with emotion regulation, cognitive emotion regulation strategies) separately for each sample. For example, sensation seeking was correlated with effortful control within the ethnoracial samples. Correlations of .10 were judged to be small, .30 medium, and .50 large (Cohen, 1992). We then examined all pairwise differences in the correlations among the Hispanic, non-Hispanic White, and non-Hispanic Black samples using a Fisher's *r*-to-*z* transformation (Cohen & Cohen, 1983). To balance Type I and Type II errors, we focused on correlations that were significantly different between groups at the $p < .01$ level. However, all correlations significantly different at the $p < .05$ level are reported in their respective tables.

We had complete missing data on the UPPS from two participants, who were removed from the analytic sample. Given the very small number of participants with missing data and complete missingness, we elected to remove these participants in lieu of multiple imputation.

Results

Measurement Equivalence

Configural Invariance.—To establish the baseline model, we ran a CFA with four a priori latent factors (sensation seeking, lack of perseverance, lack of premeditation, and urgency¹) with each of the ethnicity samples. Item 22 did not have full representation in each response category in the non-Hispanic White sample (i.e., to the question “You almost always finish projects that you start,” no participants selected the response “1 = Not at all like me”). As a CFA with categorical ordinal variables requires full representation of each item response category in each group, Item 22 was therefore dropped from further analyses. One item from the sensation seeking factor (Item 1: “You like new, thrilling things to happen”) and one item from the lack of perseverance factor (Item 2: “You like to see things through to the end”) had nonsignificant factor loadings in the non-Hispanic Black sample (Item 1: $B = .08$, $p = .44$; Item 2: $B = -.03$, $p = .80$) and had relatively low factor loadings in the Hispanic (Item 1: $B = .39$, $p < .001$; Item 2: $B = .37$, $p < .001$) and/or non-Hispanic White samples (Item 2: $B = .32$, $p < .01$). Therefore, Items 1 and 2 were removed from subsequent models, leaving a total of 24 items to be included in the subsequent invariance analyses. In addition, modification indices suggested that one item originally conceptualized to be on the lack of premeditation model, be loaded on to the urgency factor instead for each of the three groups (Hispanic: $MI = 92.31$; non-Hispanic Black: $MI = 28.52$; and non-Hispanic White: $MI =$

24.74). Review of the item content (Item 4: “You tend to blurt out things without thinking”) confirmed that the item content was similar to the urgency construct. Thus, we set this item to load onto the urgency factor instead of the lack of premeditation factor in subsequent analyses. Figure 1 presents all of the final UPPS items within the four-factor model.

The fits of the four-factor CFAs with the modified items for each ethnoracial group sample are Hispanic participant model: $\chi^2 = 801.14$, $df = 246$, $p < .001$, root mean square error of approximation (RMSEA) = .07, comparative fit index (CFI) = .91, standardized root mean square residual (SRMR) = .07; non-Hispanic Black participant model: $\chi^2 = 421.409$, $df = 246$, $p < .001$, RMSEA = .09, CFI = .89, SRMR = .12; non-Hispanic White participant model: $\chi^2 = 282.27$, $df = 246$, $p = .06$, RMSEA = .04, CFI = .98, SRMR = .08. Model fit was not ideal for the three groups. However, given the complexity of the four-factor CFA using ordinal categorical variables, the fit was deemed sufficient for proceeding with a multiple-group baseline model and measurement equivalence analyses (Cheung & Rensvold, 2001; Hu & Bentler, 1999; Kline, 2015). Although model fit may have improved with correlated residual terms, we elected to keep all item residuals uncorrelated for model simplicity. A multiple-group CFA revealed adequate model fit ($\chi^2 = 1,390.14$, $df = 738$, $\chi^2/df < 2$, RMSEA = .06, CFI = .92, SRMR = .08), establishing configural invariance for the UPPS across the three groups. A summary of model fit statistics for the configural, metric, and threshold invariance models is presented in Table 1. Standardized factor loadings from the three-group configural model are presented alongside factor loadings for a single-group CFA in Table 2.

Metric Invariance.—The metric invariant model (i.e., factors loadings set to equal across all three groups) displayed adequate model fit ($\chi^2 = 1,423.80$, $df = 778$, $\chi^2/df < 2$, RMSEA = .06, CFI = .92, SRMR = .08). The difference test comparing the metric invariant model with the baseline model was not significant ($\chi^2 = 42.05$, $df = 40$, $p = .38$), establishing metric invariance across the three groups.

Threshold Invariance.—The threshold invariant model (i.e., thresholds for items set to equal across all three groups) displayed adequate model fit ($\chi^2 = 1,506.25$, $df = 866$, $\chi^2/df < 2$, RMSEA = .06, CFI = .92, SRMR = .08). Although the CFI was identical between the threshold invariant model and the metric invariant model (CFI = .92), the difference test comparing the two models was significant ($\chi^2 = 139.65$, $df = 88$, $p > .001$), and thus, threshold invariance was not established at this step. By releasing four items’ thresholds across groups (i.e., 24 thresholds unconstrained across groups), the revised model was no longer significantly different from the metric invariance model at the .05 significance level ($\chi^2 = 90.41$, $df = 72$, $p = .07$). By releasing five items’ thresholds across groups (i.e., 30 thresholds unconstrained across groups), the revised model was no longer significantly different from the metric invariance model at the .10 significance level ($\chi^2 = 81.26$, $df = 68$, $p = .13$). We examined response patterns for the five items with unconstrained thresholds and did not find a consistent response pattern for any of the groups (i.e., one group did not appear to consistently report higher/lower scores for items than other groups). Unconstrained thresholds made up 14% of the total number of thresholds in the four-factor model. Thus, partial threshold invariance was achieved (Vandenberg & Lance, 2000).

Internal Consistencies.—Tests of internal consistency indicated that the final scales demonstrated strong reliability overall. Internal consistencies were lowest for the lack of perseverance subscale, which featured only three items (lack of perseverance: $\alpha_{\text{Full}} = .68$, $\alpha_{\text{H}} = .76$, $\alpha_{\text{NHB}} = .64$, and $\alpha_{\text{NHW}} = .70$). Alphas were .75 and above for most other subscales (sensation seeking: $\alpha_{\text{Full}} = .77$, $\alpha_{\text{H}} = .76$, $\alpha_{\text{NHB}} = .75$, $\alpha_{\text{NHW}} = .81$; lack of premeditation: $\alpha_{\text{Full}} = .76$, $\alpha_{\text{H}} = .69$, $\alpha_{\text{NHB}} = .87$, $\alpha_{\text{NHW}} = .85$; and urgency: $\alpha_{\text{Full}} = .86$, $\alpha_{\text{H}} = .85$, $\alpha_{\text{NHB}} = .88$, $\alpha_{\text{NHW}} = .89$).

Functional Equivalence

UPPS Subscale Intercorrelations.—Correlations among the UPPS subscales for each of the three groups are presented in Table 3. Sensation seeking was significantly negatively associated with lack of perseverance among Hispanic and non-Hispanic White adolescents, but not for non-Hispanic Black adolescents. Sensation seeking was not significantly correlated with lack of premeditation among either of the three groups. Sensation seeking was significantly positively correlated with urgency among the Hispanic and non-Hispanic Black adolescents, but not the non-Hispanic White adolescents. The magnitude of sensation seeking's association with urgency was greater among Hispanic and non-Hispanic Black adolescents than non-Hispanic White adolescents.

Lack of perseverance, lack of premeditation, and urgency were all significantly correlated with one another for each of the three groups; however, the magnitudes of the correlations differed across groups. Urgency's correlations with lack of perseverance and with lack of premeditation were significantly greater among the non-Hispanic White adolescents than among the Hispanic adolescents. The remaining comparisons of correlations between groups were not significant at the $p < .01$ level.

UPPS Subscales' Associations With Self-Regulation Measures.—Correlations between the UPPS subscales and self-regulation measures for each of the three groups are presented in Table 4. Sensation seeking was significantly correlated with effortful control, refocus on planning, and catastrophizing within the Hispanic adolescent sample and with limited access to emotion regulation strategies and refocus on planning within the non-Hispanic White sample. Significant associations were small to medium in magnitude. Sensation seeking was not significantly correlated with any of the self-regulation measures within the non-Hispanic Black sample. Across 21 pairwise comparison examining sensation seeking associations with measures of self-regulation, only one correlation showed a difference in magnitude at the $p < .01$ level. The correlation between sensation seeking and limited access to emotion regulation strategies was significantly greater among non-Hispanic White adolescents than Hispanic adolescents.

Lack of perseverance was significantly or marginally significantly correlated with all of the self-regulation measures for non-Hispanic White and non-Hispanic Black samples and the magnitude of the correlations were comparable between the two groups. Across 21 pairwise comparisons involving lack of perseverance, four correlations showed a difference in magnitude at the $p < .01$ level and all four involved comparisons with the Hispanic group. Lack of perseverance was significantly negatively correlated with effortful control, positive

refocusing, refocus on planning, and putting into perspective for the Hispanic sample. The magnitude of the correlations between lack of perseverance with effortful control, nonacceptance of emotional responses, limited access to emotion regulation strategies were all significantly smaller among Hispanic adolescents than one or both of their non-Hispanic counterparts.

Lack of premeditation was significantly correlated with all the self-regulation measures among the Hispanic, non-Hispanic Black, and non-Hispanic White adolescents, with the exception of the catastrophizing measure. The magnitude of significant associations ranged from small ($r = .11$) to large ($r = -.68$). Across 21 pairwise comparisons with lack of premeditation, the magnitude of correlations did not significantly vary between groups at the $p < .01$ level.

Urgency was significantly correlated with effortful control, nonacceptance of emotional responses, limited access to emotion regulation strategies, refocus on planning, and catastrophizing among the three groups. Magnitude of significant associations were primarily in the medium to large range (r range = $-.19$ to $-.78$). Across 21 pairwise comparisons involving urgency, five correlations showed a difference in magnitude at the $p < .01$ level and all five involved comparisons of the non-Hispanic White sample with one or both of the other groups. Urgency's associations with effortful control, nonacceptance of emotional responses, limited access to emotion regulation strategies were significantly greater in magnitude among non-Hispanic White adolescents than Hispanic adolescents. Urgency's correlations with effortful control and catastrophizing were significantly stronger among non-Hispanic White adolescents than non-Hispanic Black adolescents.

UPPS Subscales' Associations With Mental Health Symptoms.—Correlations between the UPPS subscales and mental health symptomology for each of the three groups are presented in Table 5. Sensation seeking was significantly positively correlated with adolescent report of internalizing symptoms and both adolescent and caregiver reports of externalizing symptoms among Hispanic adolescents. However, sensation seeking was significantly negatively associated with adolescent report of internalizing symptoms among non-Hispanic White adolescents. Sensation seeking was significantly positively associated with caregiver report of externalizing symptoms among non-Hispanic Black adolescents. No other significant correlations with sensation seeking emerged. The magnitudes of significant associations were primarily in the small range (r range = $.10$ – $.24$). Two of the 12 pairwise comparisons involving sensation seeking correlations with mental health showed a difference in magnitude at the $p < .01$ level. The correlations between sensation seeking and adolescent report of internalizing and externalizing symptoms significantly differed between Hispanic adolescents and non-Hispanic White adolescents. The magnitude of remaining correlations did not significantly differ between groups at the $p < .01$ level (Table 6).

Lack of perseverance was significantly positively correlated with adolescent report of internalizing and externalizing symptoms among all three samples. Among non-Hispanic Black adolescents, lack of perseverance was also significantly positively correlated with caregiver report of externalizing symptoms. Among non-Hispanic White adolescents, lack of perseverance was also significantly correlated with caregiver report of both internalizing

and externalizing symptoms. The magnitudes of significant associations were in the small to medium range for Hispanic adolescents (r range = .15–.28), medium range for non-Hispanic Black adolescents (r range = .35–.44), and medium to large range for non-Hispanic White adolescents (r range = .37–.57). Four of the 12 pairwise comparisons involving lack of perseverance showed a difference in magnitude at the $p < .01$ level. Correlations between lack of perseverance and adolescent- and caregiver-reported symptoms were significantly greater among non-Hispanic White adolescents than Hispanic adolescents. Correlations did not differ between the non-Hispanic Black and non-Hispanic White samples at the $p < .01$ level.

Lack of premeditation was significantly correlated with adolescent-reported symptoms among all three groups. Lack of premeditation was significantly correlated with caregiver-reported symptoms among the non-Hispanic Black and White groups only. The magnitudes of significant associations were in the small to medium range for Hispanic adolescents (r range = .19–.36), small to medium range for non-Hispanic Black adolescents (r range = .21–.47), and small to large range for non-Hispanic White adolescents (r range = .26–.56). Two of the 12 pairwise comparisons involving lack of perseverance showed a difference in magnitude at the $p < .01$ level. The magnitude of lack of premeditation's association with caregiver report of symptoms was significantly greater among non-Hispanic White adolescents than Hispanic adolescents but not non-Hispanic Black adolescents at the $p < .01$ level.

Urgency was significantly positively correlated with adolescent report of internalizing and externalizing symptoms among all three groups. The magnitudes of associations were in the large range (r range = .47–.68) and did not significantly vary between groups. Three of the 12 pairwise comparisons involving urgency showed a difference in magnitude at the $p < .01$ level. Urgency was significantly positively associated with caregiver report of symptoms among non-Hispanic Black adolescents in the medium range (r range = .28–.47) and non-Hispanic White adolescents in the medium to large range (r range = .45–.51). The magnitude of urgency's association with caregiver report of internalizing symptoms was significantly greater among non-Hispanic White than Hispanic adolescents. The magnitude of urgency's association with caregiver report of externalizing symptoms was significantly lower among Hispanic adolescents than their non-Hispanic counterparts.

Discussion

The current study had two aims: (a) to evaluate the measurement properties of an adaptation of the Child version of the UPPS Impulsivity Scale among three ethnorracial samples of adolescents and (b) to examine the functional equivalence of this measure in relation to other self-regulation and mental health symptomology measures across ethnorracial groups. To our knowledge, this is the first study to examine how facets of impulsivity may be differentially associated with adolescent self-regulation and mental health, both of which are theorized to be concurrently and prospectively related to impulsivity.

Findings indicate that the current four-factor solution of the UPPS is a valid and reliable measure of impulsivity among Hispanic, non-Hispanic Black, and non-Hispanic White

adolescents. We must first acknowledge that the majority of the study participants were from relatively low socioeconomic status households (i.e., median annual household income in the US\$30,001 to 35,000 range; enrollment in Title I schools), measurement properties were not examined across diverse socioeconomic samples in the current study, and uneven sample sizes between the ethnoracial groups may have weakened study power somewhat. Nonetheless, we were able to establish configural, metric, and partial threshold invariance, suggesting that the UPPS reliably measures adolescents' sensation seeking, lack of perseverance, lack of premeditation, and urgency (composed of both negative and positive urgency) across the three ethnoracial groups. Adding to our confidence, Watts et al. (2019) similarly found evidence of measurement invariance for the UPPS-P among diverse ethnoracial and socioeconomic samples of 9- to 10-year-old children. Although their abbreviated version of the UPPS-P for children had some key differences from the UPPS administered and examined in the current study (e.g., five-factor structure, four items per factor), collectively our findings suggest that the variations of the UPPS and UPPS-P can be reliably used to measure key facets of impulsivity. Study findings should be replicated with additional samples to ensure measurement reliability among more diverse youth including clinical samples, diverse socioeconomic groups, distinct Latinx subgroups within the broader Hispanic category (e.g., Mexican, Puerto Rican), and other ethnoracial minority youth.

Having established measurement equivalence across groups, the current study provides preliminary support for the administration and application of the present version of the UPPS-R Child to examine potential group differences in impulsivity. Much of the utility of the UPPS lies in being able to interpret group mean differences when groups include heterogeneous ethnoracial groups (i.e., both Hispanic and non-Hispanic White adolescents within the same group). For one, researchers can conclude that significant differences of pre- and post-intervention measures of adolescents' lack of perseverance or lack of premeditation (done in relatively short time intervals) are in fact meaningful with the understanding that the measure behaves similarly for their Hispanic, non-Hispanic Black, and non-Hispanic White participants. Certainly, some caution is needed to interpret findings as we were unable to establish full threshold invariance. Guidance around what is needed to establish partial invariance remains murky in the field, and indeed, some argue that partial invariance is insufficient to use composite scores over factor scores (e.g., Steinmetz, 2013). However, 86% of item thresholds in the threshold invariance model were invariant across the groups and a minimum of 66% of item thresholds per factor were invariant across groups, both exceeding the commonly used cutoff of a single majority to establish partial invariance (Putnick & Bornstein, 2016). Thus, we believe ethnoracial group comparisons of the factor means and estimates in relation to other study variables can be meaningfully interpreted.

Notably, the majority of the UPPS factors' intercorrelations and correlations with self-regulation and mental health measures were in expected directions (e.g., urgency and emotion regulation difficulties were positively correlated, lack of premeditation and effortful control were negatively correlated). In addition, most intercorrelations and correlations did not vary significantly between groups. Across 150 pairwise comparisons, 125 comparisons (83.3%) of the UPPS factors' correlations for the three ethnoracial groups were not significantly different at the $p < .01$ level. This consistency in patterns supports common

assumptions about the role of impulsivity as an important factor in self-regulation and mental health broadly (Berg et al., 2015; Eisenberg et al., 2010). However, there were some differences in the relative contributions of impulsivity depend on the specific dimensions assessed. For example, sensation seeking showed far fewer associations with self-regulation compared with the other impulsivity dimensions, suggesting that the other factors are better indicators of self-regulation than sensation seeking. Additional studies with larger samples are needed to establish if sensation seeking is a weaker indicator of self-regulation for adolescents, or if this is specific to the current study sample.

We found some significant differences in the magnitude of intercorrelations between the four factors across the three adolescent ethnoracial groups. With the exception of the intercorrelation of sensation seeking and urgency, the magnitude of intercorrelations generally were greater among the non-Hispanic White adolescents than their counterparts. The relatively larger magnitude of intercorrelations for the non-Hispanic White sample may reflect the scale development. As discussed earlier, following conceptualization of the interrelated impulsivity factors, the UPPS was initially tested and validated with samples that consisted of 72% to 90% White/Caucasian individuals. It stands to reason that hypothesized intercorrelations would be most apparent among the sample the scale was first validated with and that other items might serve as more salient indicators of impulsivity in culturally diverse samples. Also noteworthy, the non-Hispanic White adolescents in our sample came from families with higher household incomes than the Hispanic and non-Hispanic Black adolescents (US\$45,000 difference in median household income). Differences may reflect socioeconomic differences in the sample in addition or instead of ethnoracial ones.

Regarding functional equivalence to self-regulation measures, two of the four UPPS factors were similarly related to adolescent report of self-regulation. Broadly speaking, sensation seeking and lack of premeditation's relation to effortful control and adolescents' report of emotional regulation and dysregulation were similar across groups, suggesting the two factors have similar predictive validity when it comes to self-regulation. However, lack of perseverance and urgency's correlations with the self-regulation measures displayed more variation. Lack of perseverance was significantly associated with difficulties in emotion regulation (i.e., nonacceptance of emotional responses, limited access to emotion regulation strategies) among the non-Hispanic groups, but was not significantly associated for Hispanic adolescents. In addition, the magnitude of urgency's associations was significantly stronger among non-Hispanic White adolescents than Hispanic adolescents for effortful control and difficulties in emotion regulation. These associations were generally stronger for non-Hispanic White adolescents than non-Hispanic Black adolescents as well ($p < .05$), however, only the association with effortful control remained significantly stronger at the more conservative $p < .01$ level of significance. It is possible that there are other cultural factors that support control and coping in diverse cultural groups, such as Hispanics, who may rely on their obligation and loyalty to family (i.e., familism values) to motivate greater behavioral regulation and self-control (Davis et al., 2018; Germán et al., 2009; Hernández & Bámaca-Colbert, 2016; Umaña-Taylor et al., 2011). It was noteworthy that the magnitude of associations between urgency and several aspects of self-regulation were especially robust for the non-Hispanic White sample (e.g., $r = .78$ for effortful control, $r =$

.65 for nonacceptance of emotional responses) and consistently higher than for the other samples; this was supported by significant comparisons at the $p < .01$ level and with less conservative differences shown at $p < .05$. However, until these patterns are replicated, it is unclear whether these findings are artifacts of measurement (e.g., measurement properties of the UPPS or other measures in the study, between group differences in variance on measures that affect power for detecting differences) or whether they may reflect culturally linked differences in the development of self-regulation among minoritized youth. For example, it is theoretically plausible that urgency is more closely associated with reduced self-regulatory capacities among the non-Hispanic White youth because these youth face less severe consequences if they act rashly when faced with strong emotions or threatening experiences. Minoritized youth, in contrast, may experience more intense pressure as well as racial socialization (Garcia Coll et al., 1996; Wang et al., 2020) to manage or regulate their reactions when emotionally excited or threatened to avoid racially linked reactions (i.e., from teachers, police, community members) and more severe consequences that can result if they fail to act without thinking. In addition, minoritized youth in our sample also come from families with fewer financial resources and rash actions may have more extensive and long-lasting consequences for poorer youth than those from affluent families. Thus, minoritized youth are further encouraged to regulate their reactions and behaviors.

We also found a similar pattern of variation in correlations between the impulsivity factors and multi-informant report of mental health symptoms. Overall, the magnitudes of correlations were significantly greater among non-Hispanic White adolescents than their Hispanic counterparts, suggesting that the UPPS factors do not have as strong predictive validity of mental health symptoms for Hispanic adolescents. Although the relatively smaller relation between impulsivity and mental health may be a result of additional differences in measurement, the YSR and CBCL have been used extensively with Hispanic youth. Thus, these patterns may speak to more meaningful between group differences in the role or salience of impulsivity in Hispanic youth psychopathology. For example, lack of premeditation and lack of perseverance are indicative of deficits in conscientiousness that contribute to internalizing and externalizing symptoms among non-Hispanic White adolescents, but for Hispanic adolescents, these relations may be moderated or mediated by other intervening factors (i.e., family socialization or values, contextual opportunities, and challenges) for Hispanic youth. Given that measurement invariance was established in the current study for Hispanics, along with some evidence of functional equivalence, future research to replicate and account for these differential patterns may lead to important advances in culturally informed theory and interventions for this population.

In contrast, we did not find consistent differences in correlations between the non-Hispanic Black adolescent sample and other samples. The UPPS's four factors confirmed herein exhibited functional equivalence for the non-Hispanic Black adolescents compared with both alternate groups in our sample, we can reasonably expect the two samples' measurement of sensation seeking, lack of perseverance, lack of premeditation, and urgency to signify the same construct and function similarly in relation to antecedents and consequents of impulsivity factors. Certainly, it is possible that we were underpowered to detect significant differences between non-Hispanic Black and non-Hispanic White, and replication with larger sample sizes is needed.

Our findings suggest that the UPPS Child Version can be reasonably used with diverse adolescent samples and findings can be situated with prior work. However, it is important to note that several modifications were made to the UPPS measure administered in the present study that caution direct comparisons of the current measurement work with prior studies. Specifically, two items (sensation seeking item: “You like new, thrilling things to happen”; lack of perseverance item: “You like to see things through to the end”) were dropped from the measure as they were not significant indicators for the non-Hispanic Black group. One item from the lack of perseverance factor (“You almost always finish project that you start”) was removed as it did not have full representation in each response category and the item “You tend to blurt things out without thinking” was moved from the lack of premeditation factor to the urgency factor. Although these modifications were justified by data and theory, additional psychometric work with larger, balanced samples is needed to replicate findings and determine whether the modifications are reflective of group differences in responses or item attributions that need to be addressed in all future administrations of the UPPS (Jones, 2019). Ongoing transparent discussion and documentation of measurement work, adaptations to measures, and cross-cultural administration of the UPPS versions is needed (Stark et al., 2006).

Also noteworthy, our examination of the functional equivalence of the UPPS is predicated on the measurement equivalence of the other measures included in the study. Aside from examining Cronbach’s alphas as a measure of reliability within the current sample, we did not conduct measurement equivalence analyses for the measures of adolescent effortful control, cognitive emotion regulation strategies, and difficulties in emotion regulation. Alphas for each of these measures were acceptable; however, it is plausible that measurement invariance would not hold. Indeed, the level of reliability and validation for the included measures varies drastically measure to measure. For example, validation of the CERQ has primarily been done with European samples and not in North America where the current study took place (Garnefski & Kraaij, 2007; Jermann et al., 2006). At the time of writing, we did not find studies establishing measurement invariance of the CERQ among different ethnoracial samples. It is plausible that variability in the correlations between the CERQ and the UPPS factors is not due to true variation in the relationship, but rather an artifact of CERQ measurement non-invariance. Thus, our findings on differences in functional equivalence of the UPPS factors by ethnoracial groups must be interpreted with caution. Finally, the current study findings were limited by the uneven sample distributions across the three groups, which may have restricted our power to detect meaningful differences in the functional equivalence analyses. In addition, it is possible that the unbalanced sample sizes may have masked non-invariance. Yoon and Lai (2018) found that when two groups were severely unbalanced, fit indices may inaccurately suggest invariance as estimates of fit in multiple-group analyses are often weighted by group sample size. As suggested by Yoon and Lai, we ran subsample analyses using random subsamples from the Hispanic group to produce three balanced samples. Subsample analyses demonstrated invariance, boosting confidence in our current study findings of invariance (see Supplemental Material). Relatedly, it is likely that the relatively small sample size for our non-Hispanic samples results in us being underpowered to detect significant

correlations between the impulsivity subscales and self-regulation measures. Future studies would benefit from larger, even sample distributions within groups.

Historically, our field of work has often been tardy in validating measures with ethnoracially and socioeconomically diverse populations prior to administering them to these same groups (Corral & Landrine, 2010; Nielsen et al., 2017). Through the present study, the adolescent version of the UPPS administered and evaluated herein demonstrated measurement invariance across three different ethnoracial groups and can reasonably be administered and interpreted among other samples of similar age and ethnoracial characteristics. Differences in average levels of sensation seeking, lack of premeditation, lack of perseverance, and urgency between Hispanic, non-Hispanic Black, and non-Hispanic White adolescents in future studies can be interpreted as representing true group mean differences. However, there were some notable differences in the functional equivalence of the UPPS between the three groups. The current study also adds to pre-existing arguments for each of the four factors in the UPPS is interpreted as distinct constructs explaining different and complementary facets of impulsivity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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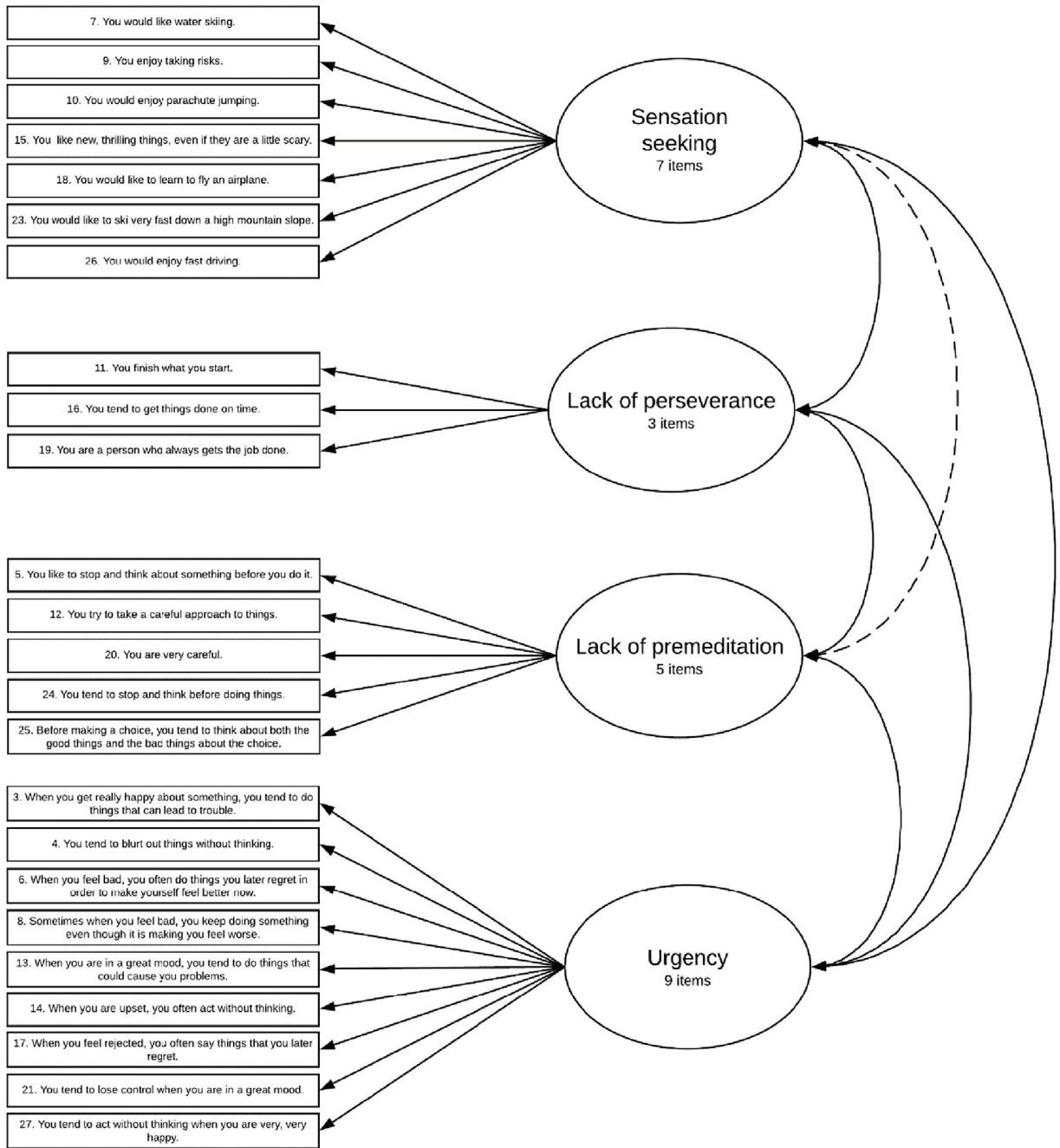


Figure 1.

Four-Factor Model of the UPPS for Adolescents

Note. All items loading on to the lack of perseverance factor and the lack of premeditation factor were reverse scored. Solid lines represent factor loadings and intercorrelations significant (i.e., $p < .05$) for at least one of the three ethnorracial groups. Dashed line presents an intercorrelation that is not significant (i.e., $p > .05$) for all three ethnorracial groups. UPPS = Urgency, Premeditation, Perseverance, Sensation Seeking.

Participant Demographic Background by Ethnoracial Group—Hispanic (n = 472), Non-Hispanic Black (n = 89), Non-Hispanic White (n = 90).

Table 1.

Participant Characteristics	Hispanic	Non-Hispanic Black	Non-Hispanic White	χ^2	<i>p</i> *
Age, <i>M</i> (<i>SD</i>)	11.99 (.47)	12.11 (.53)	12.12 (.47)	4.92 ^a	.01
Sex, % female	51.69	47.19	45.56	1.52	.47
Primary caregiver, % female	93.22	85.39	94.44	7.13	.04
Median annual household income	US\$30,001 to 35,000	US\$30,001 to 35,000	US\$75,001 to 80,000		
Annual household income, %				153.53	< .001
US\$25,000	40.26	29.55	13.48		
US\$25,001 to 50,000	36.36	48.86	22.47		
US\$50,001 to 75,000	16.45	13.64	10.11		
US\$75,001 to 100,000	4.76	5.68	30.34		
> US\$100,000	2.16	2.27	23.60		

^a *F*-statistic from ANOVA.

* *p* value for chi-square test using Fisher's exact test.

Summary of Three-Group Factorial Invariance Tests—Hispanic (n = 472), Non-Hispanic Black (n = 89), Non-Hispanic White (n = 90).

Table 2.

Model	Model estimates					Difference testing			
	χ^2	df	χ^2/df	RMSEA	CFI	SRMR	χ^2	df	p
Configural invariance model	1,390.14	738	1.88	.06	.92	.08	—	—	—
Metric invariance model	1,423.80	778	1.83	.06	.92	.08	42.05	40	.38
Threshold invariance model ^a	1,506.25	866	1.74	.06	.92	.08	139.65	88	>.001
Partial threshold invariance									
Four items' thresholds free to vary ^b	1,473.05	850	1.73	.06	.93	.08	90.41	72	.07
Five items' thresholds free to vary ^c	1,467.12	846	1.73	.06	.93	.08	81.26	68	.13

^aThe threshold invariant model holds all 216 thresholds equal across groups (24 items × 3 thresholds × 3 groups).

^bThe first threshold of each item is a marker threshold and therefore remains fixed between groups in the partial threshold invariance models. A total of 24 thresholds (11%) were freely estimated between groups for Items 4, 18, 19, and 27.

^cA total of 30 thresholds (14%) were freely estimated between groups for Items 4, 14, 18, 19, and 27.

Table 3. Standardized Factor Loadings for Hispanic (n = 472), Non-Hispanic Black (n = 89), Non-Hispanic White (n = 90) Samples, and Overall Sample for Configurational Model.

Items	Standardized factor loading			
	H	NHB	NHW	Overall
Sensation seeking				
7. You would enjoy water skiing	.56***	.40***	.73***	.57***
9. You enjoy taking risks	.51***	.64***	.43***	.51***
10. You would enjoy parachute jumping	.73***	.64***	.84***	.74***
15. You like new, thrilling things, even if they are a little scary	.55***	.47***	.70***	.54***
18. You would like to learn to fly an airplane	.68***	.64***	.71***	.68***
23. You would like to ski very fast down a high mountain slope	.77***	.81***	.78***	.78***
26. You would enjoy fast driving	.57***	.75***	.47***	.57***
Lack of perseverance				
11. You finish what you start	.58***	.80***	.71***	.64***
16. You tend to get things done on time	.62***	.67***	.74***	.64***
19. You are a person who always gets the job done	.76***	.59***	.81***	.73***
Lack of premeditation				
5. You like to stop and think about something before you do it	.60***	.90***	.78***	.68***
12. you try to take a careful approach to things	.61***	.43***	.64***	.58***
20. You are very careful	.61***	.76***	.73***	.65***
24. You tend to stop and think before doing things	.72***	.91***	.93***	.80***
25. Before making a choice, you tend to think about both the good things and the bad things about the choice	.66***	.77***	.78***	.71***
Urgency				
3. When you get really happy about something, you tend to do things that can lead to trouble	.80***	.74***	.84***	.79***
4. You tend to blurt out things without thinking	.65***	.78***	.71***	.68***
6. When you feel bad, you often do things you later regret to make yourself feel better now	.53***	.61***	.74***	.56***
8. Sometimes when you feel bad, you keep doing something even though it is making you feel worse	.68***	.69***	.73***	.69***

Items	Standardized factor loading			
	H	NHB	NHW	Overall
13. When you are in a great mood, you tend to do things that could cause your problems	.85***	.84***	.84***	.83***
14. When you are upset, you often act without thinking	.70***	.78***	.81***	.72***
17. When you feel rejected, you often say things that you later regret	.59***	.74***	.79***	.63***
21. You tend to lose control when you are in a great mood	.74***	.76***	.69***	.73***
27. You tend to act without thinking when you are very, very happy	.72***	.68***	.71***	.71***

Note. H = Hispanic; NHB = non-Hispanic Black; NHW = non-Hispanic White; overall = full sample.

p < .001.

Table 4.

Comparison of UPPS Subscales Correlations With Other UPPS Subscales.

	<i>r</i> _H	<i>r</i> _{NHB}	<i>r</i> _{NHW}	<i>Z</i> _{H-NHB}	<i>Z</i> _{H-NHW}	<i>Z</i> _{H-NB-NHW}
Sensation seeking with						
Lack of perseverance	-.13 ^{***}	-.17	-.30 ^{**}	0.35	1.53 [†]	0.91
Lack of premeditation	.03	-.02	-.13	0.43	1.38 [†]	0.73
Urgency	.28 ^{***}	.37 ^{***}	.01	-0.86	2.38^{**}	2.59^{**}
Lack of perseverance with						
Lack of premeditation	.58 ^{***}	.70 ^{***}	.72 ^{***}	-1.75 [*]	-2.10 [*]	-0.27
Urgency	.19 ^{***}	.36 ^{***}	.55 ^{***}	-1.57 [†]	-3.65^{***}	-1.59 [†]
Lack of premeditation with						
Urgency	.30 ^{***}	.40 ^{***}	.59 ^{***}	-0.97	-3.15^{**}	-1.67 [*]

Note. H = Hispanic; NHB = non-Hispanic Black; NHW = non-Hispanic White; UPPS: Urgency, Premeditation, Perseverance, Sensation Seeking.

[†] *p* < .10.

* *p* < .05.

** *p* < .01.

*** *p* < .001

Z scores significant at the *p* < .01 level are in bold.

Table 5. Comparison of UPPS Subscales Correlations With Adolescent-Reported Self-Regulation Measures.

	<i>r</i> _H	<i>r</i> _{NHB}	<i>r</i> _{NHW}	<i>Z</i> _{H-NHB}	<i>Z</i> _{H-NHW}	<i>Z</i> _{NHB-NHW}
Sensation seeking with						
Effortful control	-.10*	-.12	.08	.17	-1.55 [†]	-1.32 [†]
DERS nonacceptance of emotional responses	.06	-.06	-.14	1.02	1.72*	0.53
DERS limited access to emotion regulation strategies	.05	-.07	-.23*	1.02	2.44**	1.08
CERQ positive refocusing	.09 [†]	.03	.17	.51	-.70	-.093
CERQ refocus on planning	.10*	.06	.28**	.34	-1.61 [†]	-1.50 [†]
CERQ putting into perspective	.08 [†]	.15	.15	-.61	-.61	0.00
CERQ catastrophizing	.10*	-.17	-.16	2.32*	2.24*	-.007
Lack of perseverance with						
EAT-Q effortful control	-.53***	-.66***	-.70***	1.73*	2.37**	0.49
DERS nonacceptance of emotional responses	.05	.41***	.29**	-3.29**	-2.13*	0.90
DERS limited access to emotion regulation strategies	.08 [†]	.46***	.35***	-3.56***	-2.44**	0.87
CERQ positive refocusing	-.27***	-.21 [†]	-.29**	-.54	0.19	0.56
CERQ refocus on planning	-.38***	-.36***	-.45***	-.20	0.73	0.71
CERQ putting into perspective	-.11*	-.23*	-.21*	1.06	0.88	-.014
CERQ catastrophizing	.03	.28**	.25*	-2.20*	-1.93*	0.21
Lack of premeditation with						
EAT-Q effortful control	-.52***	-.62***	-.68***	1.27	2.17*	0.69
DERS nonacceptance of emotional responses	.11*	.25*	.21*	-1.24	-.88	0.28
DERS limited access to emotion regulation strategies	.11*	.27*	.27**	-1.42 [†]	-1.43 [†]	0.00
CERQ positive refocusing	-.31***	-.39***	-.29**	.78	-.019	-.075
CERQ refocus on planning	-.45***	-.58***	-.52***	1.52 [†]	0.79	-.057
CERQ putting into perspective	-.11*	-.29**	-.29**	1.60 [†]	1.61 [†]	0.00
CERQ catastrophizing	.05	.02	.14	.26	-.078	-.080

	<i>r</i> _H	<i>r</i> _{NHB}	<i>r</i> _{NHW}	<i>Z</i> _{H-NHB}	<i>Z</i> _{H-NHW}	<i>Z</i> _{NHB-NHW}
Urgency with						
EAT-Q effortful control	-.56***	-.54***	-.78***	-.24	3.53***	2.90**
DERS nonacceptance of emotional responses	.37***	.42***	.65***	-.51	-3.31***	-2.15*
DERS limited access to emotion regulation strategies	.41***	.44***	.66***	-.31	-3.06**	-2.11*
CERQ positive refocusing	-.12**	-.18 [†]	-.15	.52	0.26	-0.20
CERQ refocus on planning	-.19***	-.28**	-.32**	.81	1.19	0.29
CERQ putting into perspective	.07	.10	.04	-.26	0.26	0.40
CERQ catastrophizing	.35***	.24*	.54***	1.03	-2.05*	-2.36**

Note. H = Hispanic; NHB = non-Hispanic Black; NHW = non-Hispanic White; EAT-Q = Early Adolescent Temperament Questionnaire; DERS = Difficulties in Emotion Regulation Scale; CERQ = Cognitive Emotion Regulation Questionnaire.

[†] *p* < .10.

* *p* < .05.

** *p* < .01.

*** *p* < .001

z scores with *p* < .01 are in bold.

Table 6. Correlations Between UPPS Subscales and Multi-Informant Report of Adolescent Mental Health Symptoms.

	<i>r</i> _H	<i>r</i> _{NHB}	<i>r</i> _{NHW}	<i>Z</i> _{H-NHB}	<i>Z</i> _{H-NHW}	<i>Z</i> _{NHB-NHW}
Sensation seeking with						
YSR internalizing	.12**	.02	-.23*	0.96	3.04**	1.67 [†]
YSR externalizing	.20***	.19 [†]	-.13	0.09	2.86**	2.13*
CBCL internalizing	-.04	.06	-.18 [†]	-0.89	1.20	1.60 [†]
CBCL externalizing	.10*	.24*	-.05	-1.21	1.31 [†]	1.94*
Lack of perseverance with						
YSR internalizing	.15**	.35***	.41***	-1.83*	-2.44**	-0.46
YSR externalizing	.28***	.44***	.57***	-1.57 [†]	-3.08**	-1.15
CBCL internalizing	.02	.20 [†]	.39***	-1.54 [†]	-3.35***	-1.38 [†]
CBCL externalizing	.02	.25*	.37***	-1.97*	-3.16**	-0.89
Lack of premeditation with						
YSR internalizing	.19***	.21*	.26*	-0.18	-0.63	-0.35
YSR externalizing	.36***	.47***	.56***	-1.14	-2.19*	-0.81
CBCL internalizing	.04	.25*	.36***	-1.79*	-2.84**	-0.80
CBCL externalizing	.06	.32**	.45***	-2.30*	-3.58***	-0.98 [†]
Urgency with						
YSR internalizing	.55***	.47***	.55***	0.92	0.00	-0.71
YSR externalizing	.59***	.62***	.68***	-0.40	-1.30 [†]	-0.69
CBCL internalizing	.03	.28**	.45***	-1.80*	-3.90***	-1.26 [†]
CBCL externalizing	.08 [†]	.47***	.51***	-3.64***	-4.12***	-0.35

Note. H = Hispanic; NHB = non-Hispanic Black; NHW = non-Hispanic White; YSR = Youth Self Report; CBCL = Child Behavior Checklist.

[†] *p* < .10.
 * *p* < .05.
 *** *p* < .01.

Z scores significant at the $p < .01$ level are in bold.

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