



Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Measurement invariance of the Barratt Impulsiveness Scale across black and white adults with cocaine use disorder

Angela M. Haeny^{*}, Brian D. Kiluk, Charla Nich, Donna M. LaPaglia, Kathleen M. Carroll

Yale School of Medicine, Department of Psychiatry, New Haven, CT 06511, United States

ARTICLE INFO

Keywords:

Race/ethnic group
Impulsivity-related traits
Measurement invariance
Cocaine use disorder
Treatment outcomes

ABSTRACT

This study tests for measurement invariance of impulsivity assessed by the Barratt Impulsiveness Scale (BIS) across Black and White adults with cocaine use disorder and examines the association of BIS impulsivity with treatment retention and outcomes. Data from four clinical trials were combined providing a total sample of 302 participants with cocaine abuse/dependence (42% Black, 58% White, 44% female, $age_{mean} = 40.22$, $SD = 9.26$). We used multi-group confirmatory factor analyses to test for measurement invariance across race and examined bivariate correlations between BIS impulsivity and treatment retention and outcomes by race. Factor analyses indicated a 22-item, two-factor (motor impulsiveness and nonplanning impulsiveness) brief BIS fit the data best ($RMSEA = 0.073$ [90% CI: 0.065–0.080]; $CFI = 0.904$; $TLI = 0.893$; $SRMR = 0.073$) and was configural, metric, and scalar invariant across race. Higher motor impulsiveness was associated with higher percentage cocaine negative urines in the overall sample ($r = -0.15$, $p = .01$), but this association only remained in the Black subsample when examined across race ($r = 0.28$, $p < .001$). Higher motor impulsiveness was also associated with increased days abstinent from cocaine in the Black subsample only ($r = 0.28$, $p < .001$). Nonplanning impulsiveness was associated with lower percentage of treatment days abstinent from cocaine in the White subsample only ($r = -0.16$, $p = .045$). These findings 1) provide evidence for a 21-item, two-factor brief BIS that is invariant across Black and White adults with cocaine use disorder, and 2) suggest that BIS impulsivity may be associated with poorer cocaine treatment outcomes among White but not Black adults.

1. Introduction

Despite wide focus and attention on opioid overdoses, the rate of cocaine overdoses is as high and, in some cases, higher than opioid overdoses among Black people compared to other racial/ethnic groups (Shiels, Freedman, Thomas, & Berrington de Gonzalez, 2018). Further, fentanyl is increasingly mixed with other drugs including cocaine, which coincides with increased overdose deaths among Black people (Spencer et al., 2019). Together, these data indicate a need for research focusing on effective treatments for cocaine misuse across race. Evaluating phenotypic characteristics in treatment seeking samples and the impact on treatment outcomes may facilitate the development of tailored interventions (i.e., precision medicine). Impulsivity is one such phenotype associated with reduced cocaine treatment adherence (Helmus, Downey, Arfken, Henderson, & Schuster, 2001; Moeller et al., 2001; Patkar, Murray, Mannelli, Gottheil, & Weinstein, 2004) and poorer cocaine use outcomes (Carpenter, Schreiber, Church, & McDowell, 2006; Patkar et al., 2004; Washio et al., 2011). However, there is a need

to ensure our impulsivity-related measures assess the same construct across race.

Impulsivity has been broadly defined as a predisposition toward unplanned action with little regard for the negative consequences (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001). Impulsivity is a heterogeneous construct assessed with a range of questionnaires and behavioral tasks (e.g., Dick et al., 2010; Sharma, Markon, & Clark, 2014; Haeny, Bettencourt, & Sher, under review) and hence the term ‘impulsivity’ may be overly broad. One of the most commonly used impulsivity questionnaires is the Barratt Impulsiveness Scale (BIS; Stanford et al., 2009). However, the validity of the BIS has been called into question given that only one study has replicated its original factor structure (Spinella, 2007) and many have not (e.g., Haden & Shiva, 2008; Ireland & Archer, 2008; Li & Chen, 2007; Morean et al., 2014; Patton et al., 1995; Reise, Moore, Sabb, Brown, & London, 2013; Steinberg, Sharp, Stanford, & Tharp, 2013). Given the uneven support for its factor structure, Morean and colleagues (2014) suggested that researchers using the BIS first evaluate its factor structure in their sample. Further, it

^{*} Corresponding author at: Yale School of Medicine, 34 Park Street, SAC-210, New Haven, CT 06519, United States.

E-mail address: angela.haeny@yale.edu (A.M. Haeny).

<https://doi.org/10.1016/j.addbeh.2020.106721>

Received 29 April 2020; Received in revised form 9 October 2020; Accepted 20 October 2020

Available online 24 October 2020

0306-4603/© 2020 Elsevier Ltd. All rights reserved.

is important to ensure measurement invariance of the BIS, that is, the BIS assesses the same construct regardless of group characteristics (e.g., race) to allow for interpretable comparisons (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). Typically the goal is to achieve configural, metric, and scalar invariance to ensure that observed group differences in test scores reflect true latent differences as opposed to measurement error, differences in interpreting the items across groups, or biased items on the scale (Morean et al., 2014). Measurement invariance of brief versions of the BIS have been found across White and non-White adults who use alcohol or tobacco (Morean et al., 2014) and White and non-White at-risk youth (Charles, Floyd, & Barry, 2019). However, combining people of color into the same group of non-White people ignores important group differences (Burlew, Peteet, McCushtian, & Miller-Roenigk, 2019). Measurement invariance of the BIS across Black and White people with cocaine use disorder remains to be tested. We sought to 1) examine the factor structure of the BIS, 2) assess comparability of the factor structure across race, and 3) evaluate the association of BIS impulsivity to retention and cocaine use outcomes across Black and White adults.

2. Methods

2.1. Participants

Data from four randomized clinical trials of participants with a primary DSM-IV cocaine use disorder were combined for the current study ($N = 302$; 42% Black, 58% White, 44% female, with a mean age of 40.22, $SD = 9.26$; Supplemental Table 1). All participants were recruited from outpatient programs in Connecticut. Inclusion criteria included: ≥ 18 years of age, English-speaking, and met DSM-IV criteria for current (past 28 days) cocaine abuse or dependence. Participants were excluded from the study if they had current psychosis or bipolar disorder, were currently suicidal, or if outpatient treatment was not the appropriate level of care for them. All participants provided written informed consent. A description of each trial included in the combined sample is provided in Supplemental Table 2.

2.2. Measures

Each clinical trial used a similar battery of measures. The Substance Use Calendar, a calendar-based method similar to the Timeline Follow-Back (Sobell & Sobell, 1992), was used to obtain daily self-reports of cocaine use for the period 28 days prior to baseline through the final follow-up. Urine specimens were obtained at each visit including each follow-up. In terms of race, those who endorsed non-Hispanic Black or White were categorized as Black and White, respectively. We originally planned to include Latinx participants in this study; however, the sample of Latinx participants was too small ($n = 53$) to include them in the measurement invariance analyses as a separate subgroup.

Impulsivity was assessed using the Barratt Impulsiveness Scale (BIS; Patton et al., 1995). This measure consists of 30 items assessing a range of impulsiveness using a four-point scale (1 = "rarely/never" to 4 = "almost always/always"). The original BIS-11 consists of three subscales: attentional, motor, and nonplanning impulsiveness. Psychometric support has been found though for various versions of the BIS (Morean et al., 2014).

2.3. Data analysis

We first conducted a confirmatory factor analysis using MPlus 8.1 (Muthén & Muthén, 2017) to investigate the original three-factor structure of the BIS using the following fit indices: CFI and TLI > 0.90 ; RMSEA < 0.07 ; and SRMR < 0.08 (Bentler, 1990; Hu & Bentler, 1999; Steiger, 2007; Tucker & Lewis, 1973). We tested measurement invariance across race comparing Black and White participants. We used multi-group confirmatory factor analyses with full information

maximum likelihood to investigate measurement invariance in Mplus in three stages. First, we evaluated configural invariance by constraining the factor structure to equality across race. Configural invariance was established if the model fit indices were within range: CFI and TLI > 0.90 ; RMSEA < 0.07 ; and SRMR < 0.08 . Second, we evaluated metric invariance by constraining the factor loadings to equality across race. Metric invariance was established if the changes in model fit compared to the configural model did not exceed the following cutoffs: RMSEA ≥ 0.015 , CFI ≥ -0.01 or SRMR ≥ 0.030 (Chen, 2007). Third, we evaluated scalar invariance by constraining the item intercepts to equality across race. Scalar invariance was established if changes in model fit from the metric model did not exceed the following cutoffs: CFI ≥ -0.010 in addition to change in SRMR ≥ 0.010 or RMSEA ≥ 0.015 (Chen, 2007). Finally, we examined bivariate correlations of the BIS impulsivity and treatment outcome variables by race.

3. Results

3.1. BIS factor analysis

Initial attempts to fit the original 3-factor BIS model were not successful as the fit indices were not in range (RMSEA = 0.113 [90% CI: 0.108-0.118]; CFI = 0.605; TLI = 0.572; SRMR = 0.134). We conducted an exploratory factor analysis utilizing the scree plot, items per factor (i.e., at least three items with factor loadings > 0.40 and cross loadings < 0.32 ; Ferguson & Cox, 1993), and fit indices to determine the best model fit for the data. A two-factor (22-item) solution fit the data best (RMSEA = 0.073 [90% CI: 0.065-0.080]; CFI = 0.904; TLI = 0.893; SRMR = 0.073). The items for the motor impulsiveness (e.g., "I act on impulse") and nonplanning impulsiveness (e.g., "I save regularly" – reverse scored) factors are reported in Table 1. These findings most closely replicate the 24-item, two-factor structure found by Haden and Shiva (2008). Internal consistency for each factor was high as indicated by Cronbach's coefficient alpha: motor impulsiveness $\alpha = 0.84$ and nonplanning impulsiveness $\alpha = 0.85$. Notably, models based on the original 3-factor BIS and a unidimensional model were tested

Table 1

Latent factor structure and standardized factor loadings for the 22-item, 2-factor Barratt Impulsiveness Scale.

	Motor impulsiveness	Nonplanning impulsiveness
I don't "pay attention" (5)	0.60	
I have "racing" thoughts (6)	0.64	
I "squirm" at plays or lectures (11)	0.65	
I say things without thinking (14)	0.61	
I act "on impulse" (17)	0.78	
I get easily bored when solving thought problems (18)	0.63	
I act on the spur of the moment (19)	0.84	
I change residences (21)	0.38	
I buy things on impulse (22)	0.59	
I change hobbies (24)	0.40	
I spend or charge more than I can earn (25)	0.46	
I often have extraneous thoughts when thinking (26)	0.64	
I am restless at the theater or lectures (28)	0.71	
I plan tasks carefully (1*)		0.78
I plan trips well ahead of time (7*)		0.55
I am self controlled (8*)		0.68
I concentrate easily (9*)		0.75
I save regularly (10*)		0.56
I am a careful thinker (12*)		0.81
I plan for job security (13*)		0.67
I am a steady thinker (20*)		0.68
I am future oriented (30*)		0.58

Note. *Items reversed scored.

investigating the possibility of a method effect due to the reverse-scored items (Eid, 2000; Gu, 2017; Paiva-Salisbury, Gill, & Stickle, 2017); however, none of the models provided a good fit for the data.

3.2. Measurement invariance

Results of the multi-group confirmatory factor analyses provided evidence of configural invariance indicating the factor structure of the 22-item brief BIS was the same across race (RMSEA = 0.056 [90% CI: 0.046–0.066]; CFI = 0.952; TLI = 0.945; SRMR = 0.075). The model fit indices for the metric invariance model (RMSEA = 0.057 [90% CI: 0.047–0.066]; CFI = 0.949; TLI = 0.944; SRMR = 0.081) did not substantially differ from the configural model (Δ RMSEA = -0.001 ; Δ CFI = 0.003; Δ SRMR = -0.006) indicating the magnitude of the factor loadings were the same across Black and White individuals. The scalar invariance model (RMSEA = 0.057 [90% CI: 0.048–0.066]; CFI = 0.940; TLI = 0.943; SRMR = 0.083) did not change substantially from the metric model (Δ CFI = 0.009; Δ SRMR = -0.002 ; Δ RMSEA < 0.001) indicating the mean responses across items on each factor did not vary by race.

3.3. Bivariate correlations in the overall sample and by Racial/Ethnic group

In the overall sample, the two impulsivity factors were correlated ($r = 0.25, p < .0001$). However, only motor impulsiveness was positively correlated with percentage of cocaine negative urine screens during treatment ($r = 0.12, p = .04$), and nonplanning impulsiveness was negatively associated with percentage of treatment days abstinent from cocaine ($r = -0.15, p = .01$). In the Black subsample, the two impulsivity factors were not correlated, motor impulsiveness was associated with percentage of treatment days abstinent from cocaine ($r = 0.28, p < .001$) and percentage of cocaine negative urine screens during treatment ($r = 0.31, p < .001$), and nonplanning impulsiveness was associated with abstinence in the last two weeks of treatment ($r = 0.19, p = .03$). In the White subsample, the two impulsivity variables were correlated ($r = 0.40, p < .0001$), and nonplanning impulsiveness was negatively associated with percentage of treatment days abstinent from cocaine ($r = -0.16, p = .045$) (Table 2). Descriptive statistics by race for the impulsivity factors and treatment outcomes are in Supplemental Table 3.

4. Discussion

Overall, our findings suggest the 22-item, two-factor brief BIS assesses the same impulsivity-related construct across Black and White adults with a primary cocaine use disorder. Bivariate correlations

suggested some differences in the relation between BIS impulsiveness and outcomes across race. This study replicates and extends prior research by evaluating the factor structure of the BIS and associations with outcomes across samples of Black and White adults with cocaine use disorder.

This study found support for a 22-item brief BIS consisting of two factors: motor impulsiveness and nonplanning impulsiveness. Notably, consistent with prior BIS factor analyses (Haden & Shiva, 2008; Spinella, 2007), all negatively worded items loaded onto the nonplanning impulsiveness factor and all positively worded items loaded onto the motor impulsiveness factor suggesting the possibility of a methodological artifact. However, negatively worded items significantly loaded on the motor impulsiveness and positively worded items significantly loaded on nonplanning impulsiveness, but they did not meet the 0.40 threshold. Further, the two new BIS subfactors were significantly positively correlated indicating the subscales function similarly. As noted by Haden and Shiva (2008), we do not believe the wording of the items led to the division of reverse and non-reverse-scored items. The current study also provided evidence that this version of the BIS is invariant across Black and White adults, making it well-suited for between group comparisons. Given the mixed support for the original factor structure of the BIS in prior work (e.g., Haden & Shiva, 2008; Patton et al., 1995; Reise et al., 2013) and findings in the current study, we endorse Morean and colleagues (2014) suggestion that future researchers using the BIS should first conduct a factor analysis to determine the best factor structure for their data.

The bivariate correlations suggested differences in the associations of BIS impulsivity with treatment outcomes across race. Specifically, the association between motor and nonplanning impulsiveness was substantially attenuated when examined in the overall sample versus the White subsample, and no association was found in the Black subsample. In addition, higher motor impulsiveness was associated with higher percentage cocaine negative urines in the overall sample, but this association only remained in the Black subsample when examined across race. Counter to prior research, higher motor impulsiveness was associated with increased days abstinent from cocaine and cocaine negative urines while in treatment, but this was only evident in the Black subsample. Consistent with prior research, nonplanning impulsiveness was associated with lower percentage of treatment days abstinent from cocaine, but only in the White subsample. This highlights how findings may differ when race is not accounted for and suggests that higher scores on BIS impulsivity-related traits may be associated with poorer cocaine treatment outcomes among White but not Black adults. If these findings are replicated in future studies, this would suggest that clinicians and researchers should consider alternative phenotypic characteristics that should be targeted in cocaine treatment for Black adults other than BIS impulsivity-related traits. However, given the rather modest

Table 2

Bivariate Pearson correlations between the impulsiveness factors and treatment outcomes for the overall sample and by racial/ethnic group.

		Motor Impulsiveness	% of Treatment Days Completed	Treatment Completer	% of Treatment Days Abstinent from cocaine	% of cocaine negative urines while in treatment	Abstinent in last 2 weeks of treatment
Overall Sample (N = 302)	Motor Impulsiveness		-0.06	0.03	0.11	0.12*	-0.03
	NonPlanning Impulsiveness	0.25***	0.00	0.05	-0.15*	-0.09	0.05
Black Participants (n = 128)	Motor Impulsiveness		-0.05	0.01	0.28***	0.31***	-0.13
	NonPlanning Impulsiveness	-0.01	-0.01	0.04	-0.12	-0.07	0.19*
White Participants (n = 174)	Motor Impulsiveness		-0.13	-0.10	0.04	0.06	0.02
	NonPlanning Impulsiveness	0.40***	-0.02	-0.04	-0.16*	-0.08	-0.08

Note. * $p < .05$. ** $p < .01$. *** $p < .0001$. The range of degrees of freedom for the overall sample = 264–300, Black participants = 106–126 and White participants = 156–172.

associations found, it is possible the BIS may not be the most useful impulsivity measure to assess the association between impulsivity-related traits and cocaine treatment outcomes regardless of race.

Limitations of the current study include, first, important contextual factors (e.g., childhood neighborhood, trauma history) that could account for racial differences were not assessed and could not be adjusted for in this study. It is also important that future studies adjust for age, sex, and socioeconomic status when examining the association between impulsivity-related traits and substance use treatment outcomes across racial/ethnic groups. Second, this study did not include other potentially relevant within group variables (e.g., sex differences, level of acculturation, ethnic identity) associated with substance use outcomes. Third, these findings may not generalize to other measures of impulsivity. Fourth, the heterogeneity of the combined sample (e.g., different co-occurring disorders in participants, different treatments investigated) may have affected the association between impulsivity-related traits and outcomes. Fifth, although we investigated the possibility of a method effect due to reverse-scored items, these models were based on the original 3-factor BIS and a unidimensional BIS factor structure. The overlap between the method factor and the nonplanning impulsiveness factor precluded our ability to test for a method effect in the 2-factor model. Lastly, the trials that contributed data to these analyses were all conducted within outpatient treatment settings, which may have limited variability in cocaine use severity and impulsivity. Subsequent studies could investigate severity of cocaine use disorder as a potential moderator of the association between impulsivity-related traits and cocaine treatment outcomes in a racially/ethnically diverse sample.

In summary, this study provides evidence of measurement invariance of a 22-item, 2 factor brief BIS across Black and White adults with cocaine use disorder. It is essential to examine whether there are racial/ethnic differences in the association between impulsivity-related traits and treatment outcomes because people with diverse racial/ethnic backgrounds are more likely to experience psychosocial stressors like racial discrimination that increase their risk for substance misuse (e.g., Desalu, Goodhines, & Park, 2019; Gibbons et al., 2010; Schmitt, Branscombe, & Postmes, 2014). Prior research has found racial discrimination moderated the association between impulsivity-related traits and alcohol use outcomes among Black and Asian people (Latzman, Chan, & Shishido, 2013). Future research could elucidate how the combination of racial discrimination and impulsivity-related traits impact cocaine treatment outcomes among people with diverse racial/ethnic backgrounds.

5. Contributors

All authors contributed to the conceptualization of the project, and all authors contributed to writing, reviewing, editing, and approving the final version of the manuscript.

Role of Funding Sources

Funding for this study was provided by NIH Grants. NIH did not participate in the study design or data collection, analysis, or interpretation, or manuscript development, or the submission of the manuscript for publication.

CRediT authorship contribution statement

Angela M. Haeny: Conceptualization, Formal analysis, Writing - original draft. **Brian D. Kiluk:** Conceptualization, Investigation, Supervision, Writing - review & editing. **Charla Nich:** Conceptualization, Validation, Formal analysis, Data curation, Writing - review & editing. **Donna M. LaPaglia:** Writing - review & editing. **Kathleen M. Carroll:** Conceptualization, Investigation, Resources, Supervision, Project administration, Funding acquisition, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Supported by NIDA grants P50 DA009241 and UG1 DA015831 to Kathleen Carroll, R33 DA041661 to Brian Kiluk, T32 DA019426 to Jacob Tebes, and R25 DA035163 to Carmen Masson and James Sorenson.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2020.106721>.

References

- Bentler, P. M. (1990). Comparative fit indexes in structural models. Retrieved from *Psychological Bulletin*, 107(2), 238–246 <https://escholarship.org/content/qt6cn677bx/qt6cn677bx.pdf>.
- Burlew, A. K., Peteet, B. J., McCuistian, C., & Miller-Roenigk, B. D. (2019). Best practices for researching diverse groups. *American Journal of Orthopsychiatry*. American Psychological Association Inc. <https://doi.org/10.1037/ort0000350>.
- Carpenter, K. M., Schreiber, E., Church, S., & McDowell, D. (2006). Drug Stroop performance: Relationships with primary substance of use and treatment outcome in a drug-dependent outpatient sample. *Addictive Behaviors*, 31(1), 174–181. <https://doi.org/10.1016/J.ADDBEH.2005.04.012>.
- Charles, N. E., Floyd, P. N., & Barry, C. T. (2019). The structure, measurement invariance, and external validity of the Barratt impulsiveness scale-brief in a sample of at-risk adolescents. *Assessment*, 107319111987225. <https://doi.org/10.1177/1073191119872259>.
- Chen, F. F. (2007). Sensitivity of GOODNESS OF FIT INDEXES TO LACK OF MEASUREMENT INVARIANCE. Retrieved from *Structural Equation Modeling*, 14(3), 464–504 <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.459.8501&rep=rep1&type=pdf>.
- Desalu, J. M., Goodhines, P. A., & Park, A. (2019). *Racial discrimination and alcohol use and negative drinking consequences among Black Americans: a meta-analytical review.* <https://doi.org/10.1111/add.14578>.
- Dick, D. M., Smith, G., Olausson, P., Mitchell, S. H., Leeman, R. F., O'Malley, S. S., & Sher, K. (2010). Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*, 15(2), 217–226. <https://doi.org/10.1111/J.1369-1600.2009.00190.X>.
- Eid, M. (2000). A multitrait-multimethod model with minimal assumptions. Retrieved from *Psychometrika*, 65, 241–261 <https://link.springer.com/content/pdf/10.1007/BF02294377.pdf>.
- Ferguson, E., & Cox, T. (1993). Exploratory factor analysis: A users' guide. *International Journal of Selection and Assessment*, 1(2), 84–94. <https://doi.org/10.1111/j.1468-2389.1993.tb00092.x>.
- Gibbons, F. X., Etcheverry, P. E., Stock, M. L., Gerrard, M., Weng, C.-Y., Kiviniemi, M., & O'Hara, R. E. (2010). Exploring the link between racial discrimination and substance use: What mediates? What buffers? *Journal of Personality and Social Psychology*, 99(5), 785–801. <https://doi.org/10.1037/a0019880>.
- Gu, H. (2017). Examining and controlling for wording effect in a self-report measure: A Monte Carlo simulation study nonsuicidal self-injury (NSSI) view project. *Structural Equation Modeling: A Multidisciplinary Journal*, 1–11. <https://doi.org/10.1080/10705511.2017.1286228>.
- Haden, S. C., & Shiva, A. (2008). Trait Impulsivity in a Forensic Inpatient Sample: An Evaluation of the Barratt Impulsiveness Scale. *Behavioral Sciences and the Law*, 26, 675–690. <https://doi.org/10.1002/bsl.820>.
- Haeny, A. M., Bettencourt, B. A., & Sher, K. J. (under review). A Meta-analytical review of the relation between impulsivity-related traits and family history of alcohol use disorder.
- Helmus, T. C., Downey, K. K., Arfken, C. L., Henderson, M. J., & Schuster, C. R. (2001). Novelty seeking as a predictor of treatment retention for heroin dependent cocaine users. *Drug and Alcohol Dependence*, 61(3), 287–295. [https://doi.org/10.1016/S0376-8716\(00\)00153-8](https://doi.org/10.1016/S0376-8716(00)00153-8).
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>.
- Ireland, J. L., & Archer, J. (2008). Impulsivity among adult prisoners: A confirmatory factor analysis study of the Barratt Impulsivity Scale. *Personality and Individual Differences*, 45(4), 286–292. <https://doi.org/10.1016/J.PAID.2008.04.012>.
- Latzman, R. D., Chan, W. Y., & Shishido, Y. (2013). Impulsivity moderates the association between racial discrimination and alcohol problems. *Addictive Behaviors*, 38(12), 2898–2904. <https://doi.org/10.1016/J.ADDBEH.2013.08.020>.

- Li, C. R., & Chen, S.-H. (2007). Obsessive-compulsiveness and impulsivity in a non-clinical population of adolescent males and females. *Psychiatry Research*, *149*(1–3), 129–138. <https://doi.org/10.1016/J.PSYCHRES.2006.05.001>.
- Moeller, F., Barratt, E. S., Dougherty, D. M., Schmitz, J. M., & Swann, A. C. (2001). Psychiatric aspects of impulsivity. Retrieved from *American Journal of Psychiatry*, *158*, 11 <https://ajp.psychiatryonline.org/doi/pdfplus/10.1176/appi.ajp.158.11.1783>.
- Moeller, F. G., Dougherty, D. M., Barratt, E. S., Schmitz, J. M., Swann, A. C., & Grabowski, J. (2001). The impact of impulsivity on cocaine use and retention in treatment. Retrieved from *Journal of Substance Abuse Treatment*, *21*, 193–198 <http://pdfs.semanticscholar.org/d829/c7da5aa6590d1929d9eeb3d7d30cac6422e0.pdf>.
- Morean, M. E., DeMartini, K. S., Leeman, R. F., Pearson, G. D., Anticevic, A., Krishnan-Sarin, S., ... O'Malley, S. S. (2014). Psychometrically improved, abbreviated versions of three classic measures of impulsivity and self-control. *Psychological Assessment*, *26*(3), 1003–1020. <https://doi.org/10.1037/pas0000003>.
- Muthén, L. K., & Muthén, B. O. (2017). *Mplus: Statistical Analysis with Latent Variables: User's Guide (Version 8)*. Los Angeles, CA: Authors.
- Paiva-Salisbury, M. L., Gill, A. D., & Stickle, T. R. (2017). Isolating trait and method variance in the measurement of callous and unemotional traits. *Assessment*, *24*(6), 763–771. <https://doi.org/10.1177/1073191115624546>.
- Patkar, A. A., Murray, H. W., Mannelli, P., Gotthel, E., & Weinstein, S. P. (2004). Pre-treatment measures of impulsivity, aggression and sensation seeking are associated with treatment outcome for African-American cocaine-dependent patients. *Journal of Addictive Diseases*, *23*(2), 109–122. https://doi.org/10.1300/J069v23n02_08.
- Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. Retrieved from *Journal of Clinical Psychology*, *51*(6), 768–774 <https://onlinelibrary.wiley.com/doi/pdf/10.1002/1097-4679%28199511%2951%3A6%3C768%3A%3AAID-JCLP2270510607%3E3.0.CO%3B2-1>.
- Reise, S. P., Moore, T. M., Sabb, F. W., Brown, A. K., & London, E. D. (2013). The Barratt impulsiveness scale-11: Reassessment of its structure in a community sample. *Psychological Assessment*, *25*(2), 631–642. <https://doi.org/10.1037/a0032161>.
- Schmitt, M. T., Branscombe, N. R., & Postmes, T. (2014). *The Consequences of Perceived Discrimination for Psychological Well-Being: A Meta-Analytic Review The glass cliff View project Parents Perceptions of the Aboriginal Focus School in Vancouver View project*. <https://doi.org/10.1037/a0035754>.
- Sharma, L., Markon, K. E., & Clark, L. A. (2014). Toward a theory of distinct types of “impulsive” behaviors: A meta-analysis of self-report and behavioral measures. *Psychological Bulletin*, *140*(2), 374–408. <https://doi.org/10.1037/a0034418>.
- Shiels, M. S., Freedman, N. D., Thomas, D., & Berrington de Gonzalez, A. (2018). Trends in U.S. Drug Overdose Deaths in Non-Hispanic Black, Hispanic, and Non-Hispanic White Persons, 2000–2015. *Annals of Internal Medicine*, *168*(6), 453. <https://doi.org/10.7326/M17-1812>.
- Sobell, L. C., & Sobell, M. B. (1992). Timeline Follow-Back. In measuring alcohol consumption (pp. 41–72). Totowa, NJ: Humana Press. https://doi.org/10.1007/978-1-4612-0357-5_3.
- Spencer, M. R., Warner, M., Bastian, B. A., Trinidad, J. P., Food, U. S., Administration, D., & Hedegaard, H. (2019). Drug overdose deaths involving fentanyl, 2011–2016. National Vital Statistics Reports (Vol. 68). Retrieved from <https://www.cdc.gov/nchs/products/index.htm>.
- Spinella, M. (2007). Normative data and a short form of the Barratt Impulsiveness Scale. *International Journal of Neuroscience*, *117*(3), 359–368. <https://doi.org/10.1080/00207450600588881>.
- Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences*, *47*(5), 385–395. <https://doi.org/10.1016/J.PAID.2009.04.008>.
- Steenkamp, J.-B. E. M., & Baumgartner, H. (1998). Assessing Measurement Invariance in Cross-National Consumer Research. Retrieved from <https://academic.oup.com/jcr/article-abstract/25/1/78/1807396>.
- Steiger, J. H. (2007). Understanding the limitations of global fit assessment in structural equation modeling. *Personality and Individual Differences*, *42*(5), 893–898. <https://doi.org/10.1016/J.PAID.2006.09.017>.
- Steinberg, L., Sharp, C., Stanford, M. S., & Tharp, A. T. (2013). New tricks for an old measure: The development of the barratt impulsiveness scale-brief (BIS-Brief). *Psychological Assessment*, *25*(1), 216–226. <https://doi.org/10.1037/a0030550>.
- Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika*, *38*(1), 1–10. <https://doi.org/10.1007/BF02291170>.
- Vandenberg, R. J., & Lance, C. E. (2000). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research.
- Washio, Y., Higgins, S. T., Heil, S. H., Mc Kerchar, T. L., Badger, G. J., Skelly, J. M., & Dantona, R. L. (2011). Delay discounting is associated with treatment response among cocaine-dependent outpatients. *Experimental and Clinical Psychopharmacology*, *19*(3), 243–248. <https://doi.org/10.1037/a0023617>.