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BRIEF COMMUNICATION

Normative data of the Barratt Impulsiveness Scale 11 (BIS-11) for Brazilian adults

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Objective: The Barratt Impulsiveness Scale (BIS-11) is a valid and reliable instrument, and one of the most often used tools to assess impulsivity. This study assesses the performance of a large sample of adults by using a version of BIS-11 adapted to Brazilian Portuguese.
Methods: We assessed 3,053 adults from eight Brazilian states. Internal consistencies and performance data were presented for two correction criteria of BIS-11: original and the two-factor score.
Results: The associations between age, sex, region, and education and the BIS-11 scores present very small effect sizes. Therefore, we provided a percentile rank parameter for the different BIS-11 subscores considering the whole sample. Given the internal consistency of the two correction systems, we found that only the two-factor system fulfills the psychometric criteria of Cronbach's alpha (cutoff value of at least 0.6).
Conclusion: Our results support the use of the Brazilian adaptation of BIS-11 in different regions of the country as a measure of impulsivity. Since high impulsiveness is a characteristic of several dysfunctional behaviors, the establishment of normative parameters is of utmost relevance and should be extended to other age ranges and populations in future studies.

Keywords: Cognitive neuroscience; diagnosis and classification; impulse control disorders not listed elsewhere; other psychological issues; tests/interviews; psychometric properties

Introduction

Impulsivity is a comprehensive and complex phenotype that encompasses several types of cognitive and behavioral expressions. A broad definition of impulsive behavior includes swift action without planning, acts without previous judgment and forethought, and risk-taking.[1] Of note, impulsivity is not necessarily pathological and may have an adaptive role in several conditions. Dickman[2] proposes the existence of functional impulsivity, which refers to the tendency to act with relatively little forethought when the subject needs to make fast decisions. For example, according to Lage et al.,[3] some types of impulsive behaviors are related to better performance in certain contexts (e.g., sports practice). Even in clinical samples, functional impulsivity seems to be related to better functioning of attention, reaction time, and goal-directed behavior.[4] Nonetheless, even as an aspect of human nature, impulsivity is overexpressed in several psychiatric disorders[5] and is related to several non-adaptive behaviors such as substance abuse,[6] gambling,[7] and suicide.[8] Therefore, the assessment of impulsive behavior is crucial both for clinical practice and for research in neurosciences and related fields.

The Barratt Impulsiveness Scale (BIS) is a self-report questionnaire that measures different dimensions of impulsivity. Since its first presentation in 1959,[9] this scale has undergone several changes. The current version (BIS-11) is one of the most often used tools to assess impulsivity, presenting impressive evidence concerning its validity, reliability, and predictive value.[10]

Briefly, BIS-11 is composed of 30 items scored on a Likert scale (ranging from never = 1 point to very frequently = 4 points). It assesses the three main dimensions of impulsive behavior: attentional (a lack of focus on the ongoing task), motor (acting without thinking), and non-planning impulsivity (orientation to the present rather than to the future). According to Patton et al.,[11] the scale also assesses six first-order factors (attention, cognitive instability, motor, perseverance, self-control, and cognitive complexity); however, most studies reporting BIS-11 scores have focused on the three second-order factors.[10]

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The BIS-11 scale has been adapted to different languages, including Brazilian Portuguese.[12] BIS-11 is reliable (high internal consistency and test/retest stability) and valid, and it has been able to draw associations between inattention and hyperactivity symptoms and smoking habits[12] as well as between psychiatric disorders. In accordance with most studies, the Brazilian version of BIS-11 presents a two-factor structure (inhibition control and non-planning), rather than the original three-factor version.[13]

Although psychometric studies have provided evidence of validity and reliability, normative data for BIS-11 for the Brazilian population are lacking. Since high impulsiveness is a characteristic of various problematic behaviors, the establishment of classification and comparison parameters is thus of utmost relevance. The present study provides data on normative parameters by using BIS-11 in the Brazilian adult population.

Methods

Participants and procedures

We assessed a convenience sample of 3,053 Brazilian adults aged 18 to 84 years (mean: 31.71±11.85). Participants were residents of eight Brazilian states: Minas Gerais (n=1,107), Rio de Janeiro (n=170), Santa Catarina (n=296), Rio Grande do Norte (n=202), Bahia (n=404), Amazonas (n=618), Rondônia (n=85), and Goiás (n=171). All subjects were recruited from schools, universities, leisure centers, and workplaces. Exclusion criteria were age under 18 years, illiteracy, and self-reported neurological or psychiatric disorders. There were more female (n=1,892) than male participants, and most had a full secondary education or were undergraduates (n=2,159), followed by primary education (n=413) and complete college or graduate degrees (n=481). All participants provided informed consent for participation and answered the BIS-11 questionnaire. The study was approved by the local Ethics Committee and was in accordance with the Declaration of Helsinki.

Statistical analysis

To develop the interpretative parameters, we adopted the four most used criteria for BIS-11 correction: total score (a one-factor solution), the traditional three-factor solution (attentional, motor, and non-planning),[11] the two-factor solution (inhibition control and non-planning) found for the Brazilian population[13] and the six first-order factors reported by Patton et al. (attention, cognitive instability, motor, perseverance, self-control, and cognitive complexity).[11]

Since the BIS-11 data showed a predominant non-parametric distribution (usually leptokurtic curves), normative parameters were presented by using percentile ranks. For the divisions based on sociodemographic measures, we used logarithmic transformations of the BIS-11 scores. These scores were entered into a multivariate general linear model with education (primary, secondary, and higher), sex (male, female) and Brazilian region (southeast, northeast, north, south, and midwest) as fixed factors, and age as a covariate. Effect sizes (estimated by the partial eta-squared statistic) were adopted for potential stratification considering these sociodemographic factors, with moderate effect sizes (0.06 or higher) as cutoff values. We also computed the reliability of each score according to Cronbach's alpha. All procedures were performed by using SPSS version 20.

Results

The BIS-11 data, including internal consistency, are shown in Table 1. The internal consistency of the total score was 0.790, while the values of its subscales ranged from very low (0.147 for the motor subscore from Patton et al.'s first-order factor division) to moderate/high (0.789 for inhibition control from Vasconcelos's two-factor division). The multivariate general linear models containing the BIS-11 measures as dependent variables were all significant (all $p < 0.001$).

Differences in age ($F = 3,530$, $p < 0.001$) and formal education ($\chi^2 = 350.62$, $p < 0.001$) but not sex ($\chi^2 = 2.99$, $p = 0.559$) were found according to the results of the univariate analysis of variance (ANOVA) and chi-square tests. Participants from the south region were older than those from elsewhere and participants from the southeast and north had a lower formal education. Nonetheless, no individual main effect of age, sex, education or region reached the cutoff value of 0.06 for the normative data divisions (effect sizes ranged from 0.00 to 0.04). Therefore, we did not stratify the sample according to sex, region, and education. Table 1 shows the normative data for all BIS-11 scores in the full sample, divided by the total score, the two-factor solution of Vasconcelos et al.,[13] and the three-factor (second-order) and six-factor (first-order) solutions of Patton et al.[11]

Discussion

In this study, we provided percentile ranks for the different components of BIS-11, including the most commonly adopted division[11] and a two-factor division found in the Brazilian population,[13] besides the total score. As pointed by Mitrushina et al.,[14] when considering screening tasks, a Cronbach's alpha value above 0.6 is considered to be acceptable. In our study, only the two-factor version reached these psychometric properties. The internal consistency for the three- and six-factor divisions fell below this threshold, suggesting that their use in research or clinical settings should be done cautiously.

The two-factor structure showed better reliability and seemed to be more robust for clinical and research purposes. As discussed by Vasconcelos et al.,[13] the factor structure of the Brazilian BIS-11 seems to be corroborated by evidence that supports the independence of the inhibition and non-planning (decision-making) components of impulsivity. The neurofunctional correlates of these two aspects are dissociated in the prefrontal cortex, involving the dorsolateral and orbitofrontal cortices, respectively.[15] While the dorsolateral prefrontal circuit has been associated with the organization of information, including the inhibition of motor responses

Table 1 Performance of Brazilian adults on the BIS-11 scale: interpretative parameters

		Vasconcelos et al.[13]		Patton et al. (2nd order)[10]			Patton et al. (1st order)[10]					
	Total	Inhibition control	Non-Planning	Attentional	Motor	Non-planning	Attention	Cognitive instability	Motor	Perseverance	Self-control	Cognitive complexity
Items	30	20	8	8	11	11	5	3	7	4	6	5
Min-max	30-120	20-80	8-32	8-32	11-44	11-44	5-20	3-12	7-28	4-16	6-24	5-20
Alpha	0.790	0.789	0.618	0.658	0.594	0.593	0.565	0.514	0.655	0.147	0.627	0.286
Mean	61.92	38.63	17.95	16.81	36.36	25.57	10.42	6.40	12.75	6.79	13.43	12.14
SD	10.29	7.79	4.10	3.95	7.03	4.78	2.76	1.92	3.48	1.75	3.41	2.53
Percentile 1	**40**	**24**	**9**	**5**	**3**	**7**	**4**	**6**	**6**	**9**	**23**	**15**
Percentile 5	**46**	**27**	**11**	**6**	**4**	**8**	**4**	**8**	**8**	**11**	**26**	**18**
Percentile 10	49	30	13	7	4	9	5	9	9	12	28	19
Percentile 15	52	31	14	8	4	9	5	10	9	13	29	20.8
Percentile 20	53	32	14	8	5	10	5	10	10	14	31	22
Percentile 25	**55**	**33**	**15**	**8**	**5**	**10**	**6**	**11**	**10**	**14**	**32**	**22**
Percentile 30	56	34	16	9	5	11	6	12	11	15	32	23
Percentile 35	58	35	16	9	6	11	6	12	11	15	33	24
Percentile 40	59	36	17	10	6	12	6	12	11	15	34	24
Percentile 45	60	37	17	10	6	12	6	13	12	16	35	25
Percentile 50	**61**	**38**	**18**	**10**	**6**	**12**	**7**	**13**	**12**	**16**	**35**	**25**
Percentile 55	62	39	18	11	6	13	7	14	12	17	36	26
Percentile 60	64	40	19	11	7	13	7	14	13	17	37	27
Percentile 65	65	41	20	11	7	14	7	15	13	18	38	27
Percentile 70	66	42	20	12	7	14	7	15	13	18	39	28
Percentile 75	**68**	**43**	**21**	**12**	**8**	**15**	**8**	**16**	**14**	**19**	**40**	**29**
Percentile 80	70	44	21	13	8	15	8	16	14	20	42	30
Percentile 85	72	47	22	13	8	16	9	17	15	21	43	31
Percentile 90	75	50	23	14	9	18	9	18	15	22	46	32
Percentile 95	**80**	**53**	**25**	**16**	**10**	**19**	**10**	**19**	**16**	**24**	**50**	**34**
Percentile 99	**90**	**60**	**28**	**18**	**12**	**23**	**12**	**21**	**18**	**28**	**56**	**37**

Higher BIS-11 scores are indicative of higher impulsivity.
Alpha = Cronbach's alpha; Min-max = minimum-maximum; SD = standard deviation.

and attentional control, the ventromedial prefrontal circuit is related to the emotional aspects of decision-making.[15]

As mentioned in the Results section, since the differences between the sociodemographic variables did not reach a high effect size, we did not stratify our sample. However, our sample also did not follow the distribution of the Brazilian population, showing an imbalance with reference to sex and formal education. Although our regression analysis did not show the significant influence of these aspects on the BIS-11 scores, sample selection might have biased our analysis. We also relied on patients' self-reported data rather than on a structured interview to assess psychiatric symptoms.

Despite the above-mentioned limitations, the present study presented preliminary normative parameters for BIS-11 for Brazilian adults. Future studies could address the applicability of BIS-11 for assessing the clinical population by considering diagnostic purposes and obtaining the normative parameters in a nationally representative sample.

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Disclosure

The authors report no conflicts of interest.

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