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A cross-cultural comparison between samples of Brazilian and German children with ADHD/HD using the Child Behavior Checklist

■ **Abstract** *Introduction* This study aims to assess cross-cultural similarities and differences in broad-band psychopathology in two naturalistic clinical samples of children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) combined type according to DSM-IV criteria or with Hyperkinetic Disorder (HD) according to ICD-10 criteria. *Methods* We compared two clinical samples of children with ADHD combined type (Brazil, $N = 248$) and HD (Germany; $N = 154$) to controls (Brazil $N = 71$; Germany $N = 135$) using the Child Behavior Checklist (CBCL). ROC-curves (Receiver Operating Characteristic) were determined to evaluate the discriminating validity of the CBCL Attention Problem scale. A two-factorial ANOVA was computed across all 8 scales of the CBCL. *Results* Although Brazilian parents reported significantly higher scores on all CBCL scales than German parents ($P < 0.05$), a similar CBCL profile was detected in both cultures. *Conclusion* Despite the use of different diagnostic systems (DSM-IV vs. ICD-10) and the presence of other clinical differences, the similar broadband psychopathological profile of the CBCL in the two samples provides evidence that dimensional symptoms associated with the categorical diagnosis of ADHD combined type might be comparable in two clinical settings with diverse cultural background.

■ **Key words** attention-deficit/hyperactivity disorder · psychopathology · cross-cultural comparison · children · adolescents

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Introduction

Independently of its classification as Attention-Deficit/Hyperactivity Disorder (ADHD) according to DSM-IV criteria [3] or as Hyperkinetic Disorder (HD) according to ICD-10 criteria [20], this disorder has been recognized in different cultures and countries all over the world [24, 40]. Although there is consensus that ADHD could not be simplified neither as a sociocultural construct nor as an exclusively neurobiological disorder, there is still an ongoing debate about the impact of culture on its diagnosis, prevalence and treatment [4, 21, 55, 64]. While sociocultural factors are not seen as the primary cause of ADHD, they are considered to modulate its phenotype and course in a culture-bound way [53]. Moreover, differences in incidence, prevalence and symptomatology have been found not only across samples from various cultures [64] but also within one country across diverse ethnic groups [38, 51], as well as between native vs. non-native children [6]. Furthermore, culture has an impact on the way the individual, the family and the society experience, interpret and seek for treatment of an abnormal behavior like ADHD [37, 45].

However, the impact of ethnicity and culture on this diagnosis has still to be adequately addressed because of several methodological shortcomings as well as a small base of cross-cultural data despite the

extensive literature on ADHD in general [21, 44–46, 54, 55].

Generally, there are still controversies in research on cross-cultural psychiatry, e.g. concerning the methodology of direct comparison of samples from different cultures [42, 57, 62]. Psychopathological studies in this field often use an empirically-based approach that relies on a quantitative taxonomy in community samples [44]. But, because clinical cut-off scores of rating scales are not necessarily uniform across all cultures [16, 17] and the adaptation of rating-scales in cross-cultural research still awaits an optimal solution [57], both sampling method and psychopathological data under investigation might be confounded by the same problems of cross-cultural validity.

Thus, to minimize these methodological influences on examining the cross-cultural congruency of broadband psychopathology associated with ADHD, it might be of interest to use a two-stage method. At first, a culture-specific full diagnostic assessment similar to that conducted in clinical practice covering key classificatory criteria might be used to identify children with ADHD as usual. Thereafter mean scores of the same cross-culturally valid version of a rating scale like the Child Behavior Checklist (CBCL) may be compared between cultures [10, 17, 29, 65]. The CBCL appears to be one of the most adequate instruments to overcome many of the methodological shortcomings, since its cross-cultural generalizability and validity as a screening instrument of psychopathology has been proved in studies of children and adolescents from all over the world [16, 19, 32]. Its capability is further supported by the cross-cultural consistency of main findings using the CBCL in epidemiological samples despite cultural nuances [16]. Furthermore, the CBCL has shown adequate performance to detect cross-cultural differences in the level of psychopathology, e.g. between Swedish (lowest) and Puerto Rican (highest) children as well as in Asiatic children (higher in Hong Kong than in China) [30]. Not only differences between developed and developing countries have been observed, but also cross-cultural variation in levels of psychopathology has been detected by the CBCL in developed countries (e.g. highest scores were detected in Greek and French and lowest in Iceland and Switzerland) [50].

Surprisingly, very few data are available on cross-cultural similarities and differences in CBCL scores concerning attention deficits and hyperkinetic behavior. In a Russian sample, an Attention Problems score [13] two-fold higher than the U.S. normative data was detected [1]. The mean score of the Attention Problems scale in a Ukrainian ADHD sample was between both scores [25].

Thus the aim of this study was to add data to this small base of knowledge by directly comparing broadband psychopathology of two samples of children with ADHD from two countries using the CBCL. Using the proposed two-stage method would provide stronger evidence in cross-cultural similarities and differences of broadband psychopathology in ADHD. Naturalistic clinical samples of affected as well as non-ADHD children from Brazil and Germany were compared. Cut-off score independent properties of the CBCL [Receiver Operating Characteristic (ROC) analyses] as well as sensitivity and specificity at identical cut-off scores of the Attention Problems scale were used to show whether the CBCL may provide adequate validity to discriminate ADHD from non-ADHD cases in the samples under investigation. Based on previous findings from the literature, our main hypotheses were: (a) Similar CBCL profiles would be found between the German and the Brazilian sample; (b) Pre-defined cutoff scores in the Attention Problems scale of the CBCL would present a good performance to discriminate ADHD/HD cases from controls in both samples.

Subjects and methods

■ Subjects

The detailed sampling methodology in Brazil was reported elsewhere [45] and it was comparable to that of the German sample. All consecutive patients referred to the clinics during the study period were included. In both samples, families were self-referred, referred by a pediatrician or other specialist, or referred by school personal.

The Brazilian sample consists of 319 children (248 with ADHD and 71 without any psychiatric diagnosis), who were consecutively referred to either the outpatient clinic in the Child and Adolescent Psychiatric Division at one University Hospital in Porto Alegre or to private offices of child psychiatrists from the University.

The German sample includes 154 children with HD and 135 patients without any psychiatric diagnosis which were referred consecutively to the outpatient clinic of the Child and Adolescent Psychiatry Unit of the University of Goettingen. Thus, 402 children aged 8–13 years with ADHD/HD were enrolled in the study.

■ Diagnostic procedures

While ADHD combined type and comorbid conditions were diagnosed using the DSM-IV criteria [3] in Brazil, the ICD-10 criteria for HD and comorbid conditions [20] were used in Germany. In both samples, psychiatric diagnoses were derived by conventional full diagnostic assessment including semi-structured interviews (KSADS-E-Brazil; BADO-Germany) [23, 45]. Additionally, all diagnoses were verified by senior board-certified child psychiatrists in case conferences in Brazil and Germany. Referred children without any psychiatric diagnosis were selected as controls in Brazil (N = 71) and Germany (N = 135).

Although DSM-IV criteria identify a broader group of children than those identified by ICD-10 [35], there is substantial overlap between the groups formed with these different criteria. Since the combined type in the DSM-IV is highly congruent with the diagnosis of HD in the ICD-10 [52, 56], we only included subjects with ADHD combined type from Brazil in order to get highest comparability between samples.

■ Instruments

The empirically derived Child Behavior Checklist (CBCL) [1] is one of the best-studied instrument for the evaluation of children's and adolescents' psychopathology. It has been translated

Table 1 Clinical and demographic characteristics

Characteristic	Brazil (*n* = 319)		Germany (*n* = 289)	
	ADHD combined type (*n* = 248)	Controls (*n* = 71)	HD (*n* = 154)	Controls (*n* = 135)
Age (year)[a]				
Mean ± SD	10.1 ± 1.7	10.1 ± 1.7	10.1 ± 1.8	9.7 ± 1.5
Range	8–13	8–13	8–13	8–13
Gender, *n* (%)[b]				
Male	212 (85)	38 (54)	135 (88)	87 (65)
Female	36 (15)	33 (46)	19 (12)	48 (35)
Comorbidity *n* (%)[c]				
Oppos. defiant disorder[d]	141 (57)		} 63 (41)	
Conduct disorder[d]	49 (20)			
Anxiety[e]	71 (29)		2 (1)	
Mood disorder[f]	43 (17)		11 (7)	
Others[g]	52 (21)		53 (34)	

Note: ADHD = attention-deficit/hyperactivity disorder; HD = hyperkinetic disorder
[a] total sample: Brazil (*n* =319) vs. Germany (*n* =289) *t* = 1.52, *P* = .129; ADHD: Brazil (*n* = 248) vs. Germany (*n* = 154) *t* = 0.11, *P* = .924; controls: Brazil (*n* = 71) vs. Germany (*n* = 135) *t* = 1.8, *P* = .094, [b] Total sample: Brazil (*n* = 319) vs. Germany (*n* = 289) chi-square = .21; *P* = .646; ADHD: Brazil (*n* = 248) vs. Germany (*n* = 154) chi-square = .38; *P* = .537; controls: Brazil (*n* = 71) vs. Germany (*n* = 135) chi-square = 2.33; *P* = .127, [c] Brazil DSM-IV; Germany ICD-10, [d] For the purpose of this paper, ICD-10 Hyperkinetic Conduct Disorder was considered equivalent to DSM-IV Conduct Disorder and Oppositional Defiant Disorder (61); Chi-square = 20.69; *P* < .01, [e] Chi-square = 47.75; *P* < .001, [f] Chi-square = 8.49; *P* < .01, [g]Chi-square = 5.23; *P* < .05

into more than 60 languages and used in systematic investigations in various settings and different cultures around the world [10]. Cross-cultural comparisons of CBCL total scores, as well as scores in specific scales, revealed remarkable similarities regarding overall psychopathology [16, 31, 32, 59]. The study assessing the CBCL concurrent validity in Brazil found 80.4% sensitivity, 66.7% specificity, and 20.4% total misclassification rate [11]. Results from a German validation study [47] indicated that the discriminant validity of the German version of CBCL is comparable to the original English version. Using the CBCL Total Problem Score as predictor (cut-off T score = 60), 83.8% of children and adolescents could correctly be classified (sensitivity 83.6%, specificity 83.9%).

The 112 behavioral items are scored by a parent. After generating T scores on scales that assess empirically derived dimensions of psychopathology, a profile of childhood psychological problems can be described on eight scales, and three overall dimensions–Internalizing, Externalizing and Total Problem scores. Numerous studies have confirmed the stability of the instrument's psychometric properties, showing good reliability and validity in both clinical and nonclinical populations. The stability of its clinical and competence scales was observed over a 4-year period in a clinical sample of youth with ADHD [9]. Furthermore, it shows good convergence with structured interviews for psychiatric diagnosis in children with ADHD [8] and its Attention Problems scale has a high discriminative power for ADHD [14].

Parents or guardians (usually the mother) were asked to complete the 1991 version of the CBCL as part of the evaluation process. However, the instrument was scored for the purpose of this investigation mostly after the diagnostic process has been completed.

■ **Statistics**

At first, Receiver Operating Characteristic (ROC) analyses were carried out to evaluate the discriminant validity of the Attention Problems scale in each sample. In ROC analyses, sensitivity (percentage of correctly identified 'cases') and specificity (percentage of correctly classified 'non-cases') are calculated for all possible cut-off scores, and then combined in a single value called Area under the Curve (AUC), that reflects the general discriminative validity. An AUC of .5 indicates chance discrimination, whereas an AUC

value of 1.00 would reflect a perfect association between scale scores and clinical diagnosis. An AUC of .8 or higher suggests that an instrument can be considered a useful screening tool [60].

Besides the ROC analyses, sensitivity and specificity for the Attention Problems scale were calculated in the samples of each country based on previously suggested cut-off scores (T-scores 0–59 = normal; 60–63 = borderline; 64–100 = abnormal) [1]. Sensitivity refers to the percentage of people whose Attention Problems scores are in an abnormal range and who have been diagnosed as suffering from ADHD; specificity reflects the number of people who were not diagnosed as ADHD by the categorical diagnostic process and whose Attention Problems scores are in normal range.

Thereafter, an analysis of variance (ANOVA) with two factors ADHD (yes/no) and country (Brazil/Germany) was computed across all eight scales of the CBCL. To get more detailed and clinically useful information, effect sizes (eta squared=η^2; Cohen [15] suggested: <.06 = small; .06–.14 = medium, >.14 = large effect size) were calculated to reveal the contribution of the explained variance for the factors (ADHD and country) on each CBCL scale. For post-hoc pairwise comparisons of the groups (two-tailed), Scheffé-tests were used. The level of significance was set at *P* < .05. For a first analysis, patients with comorbid disorders were not excluded to present data of a naturalistic ADHD sample of outpatient children.

Results

There were no differences in mean age and male-female ratio in the total sample, and in sub-samples of ADHD children and controls between both countries. There were only gender differences between ADHD children and controls within both countries (Brazil: chi-square = 33.26; *P* < .001; Germany: chi-square = 21.78; *P* < .001). A significant difference was also detected in age in the German sample (Brazil: *t* = .28, *P* = .782; Germany: *t* = 2.28, *P* = .024). Baseline demographic and clinical characteristics are listed in Table 1. The pattern of ADHD comorbid disorders differed between Brazil and Germany. In the Brazilian

Fig. 1 Psychopathological profiles (mean T scores of all CBCL scales) of Brazilian and German (a) children with ADHD/HD and (b) controls; (c) Brazilian children with ADHD & controls and (d) German children with HD & controls
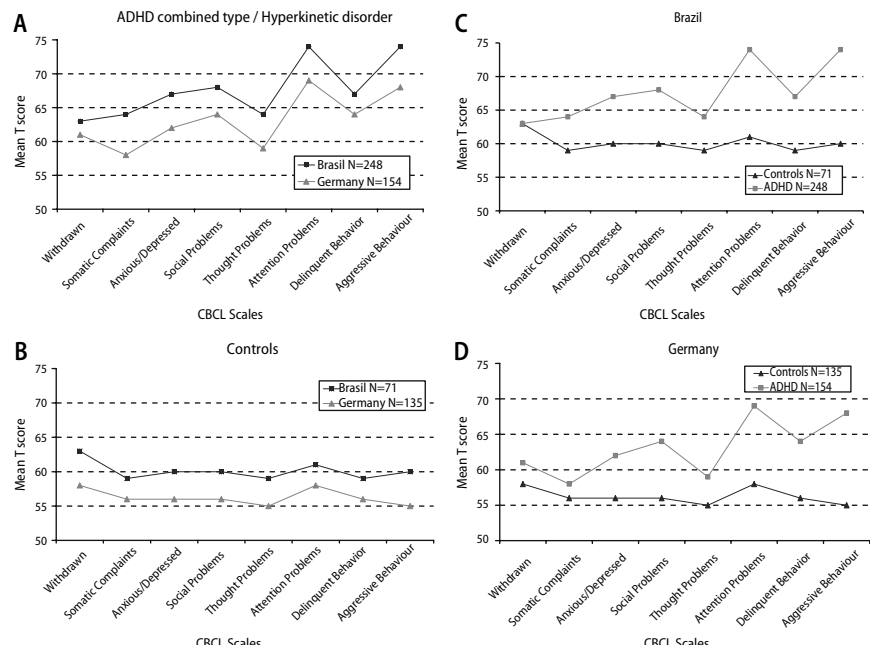
sample, a significantly higher rate of comorbidity with ODD and CD (χ^2 = 20.69; df:1; $P < .001$), anxiety (χ^2 = 47.75; df:1; $P < .001$) and mood disorders (χ^2 = 8.49; df:1; $P < .01$) was found.

The ROC analyses determining the cut-off score independent value of the Attention Problems scale revealed a high validity to discriminate between children with and without ADHD for both the Brazilian (AUC-value = .89) and the German sample (AUC-value = .80). Although the specificity of previously suggested cut-off scores (T-scores 0–59 = normal; 60–63 = borderline; 64–100 = abnormal) [1] was similarly low in Brazil (49.3%) and in Germany (53.3%), the sensitivity was high in both countries (96.8% for Brazilian children and 85.1% for German children).

A two-factor analysis of variance with the factors 'ADHD' (yes/no) and 'country' (Brazil/Germany) revealed main effects for the factor 'ADHD' on all 8 CBCL scales (Withdrawn [F (1, 604) = 5.74, $P < .05$, $\eta^2 = .01$], Somatic Complaints [F (1, 604) = 21.33, $P < .001$, $\eta^2 = .03$], Anxious/Depressed [F (1, 604) = 57.39, $P < .001$, $\eta^2 = .09$], Social Problems [F (1, 604) = 92.19, $P < .001$, $\eta^2 = .13$], Thought Problems [F (1, 604) = 38.99, $P < .001$, $\eta^2 = .06$], Attention Problems [F (1, 604) = 263.57, $P < .001$, $\eta^2 = .30$], Delinquent Behavior [F (1, 604) = 118.67, $P < .001$, $\eta^2 = .16$] and Aggressive Behavior [F (1, 604) = 208.99, $P < .001$, $\eta^2 = .26$]), i.e. children with ADHD revealed higher scores on all CBCL scales (see Fig. 1).

For the factor 'country' there were also significant main effects on all 8 CBCL scales (Withdrawn [F (1, 604) = 24.94, $P < .05$, $\eta^2 = .04$], Somatic Complaints [F (1, 604) = 34.22, $P < .001$, $\eta^2 = .05$], Anxious/Depressed [F (1, 604) = 32.59, $P < .001$, $\eta^2 = .05$], Social Problems [F (1, 604) = 18.15, $P < .001$, $\eta^2 = .03$], Thought Problems [F (1, 604) = 28.64, $P < .001$, $\eta^2 = .05$], Attention Problems [F (1, 604) = 30.62,

$P < .001$, $\eta^2 = .05$], Delinquent Behavior [F (1, 604) = 9.56, $P < .01$, $\eta^2 = .02$] and Aggressive Behavior [F (1, 604) = 37.98, $P < .001$, $\eta^2 = .06$]) indicating higher scores on all scales for Brazil children (see Fig. 1).

Except on the Somatic Complaints scale [F (1, 604) = 4.68, $P < .05$, $\eta^2 = .01$], no interaction between country and ADHD status has been observed. Post-hoc Scheffé test revealed no difference on the Somatic Complaints scale between both countries in controls ($P = .169$), whereas Brazilian parents rated their children with ADHD higher than the German parents ($P < .001$).

Nevertheless, the 8 CBCL scales of both groups with ADHD and without ADHD showed a similar profile in both countries (see Fig. 1).

Since the significant differences between countries might be due to the higher rate of comorbidity in Brazil, we performed further analyses excluding any other comorbid condition (Brazil: ADHD $N = 60$, controls $N = 71$; Germany: ADHD $N = 55$, controls $N = 135$). There were again no differences in age and sex between the Brazilian and the German sample. Similar results concerning the CBCL profiles were found. A two-factor analysis of variance with the factors 'ADHD' (yes/no) and 'country' (Brazil/Germany) revealed main effects for the factor 'country' on all 8 CBCL scales. For the factor 'ADHD' there were also significant main effects on 5 CBCL scales. Only on the scales Withdrawn, Anxious/Depressed and Thought Problems, no main effect could be observed for the factor 'ADHD'. Furthermore, no interaction effects between the factors were found on any scale. In sum, there was also a cross-culturally stable profile specific for pure ADHD cases with constantly higher levels in Brazil (data available upon request).

Discussion

This is the first study examining cross-cultural similarities and differences of psychopathology derived by comparing directly two samples of children from Brazil and Germany with a clinical diagnosis of ADHD combined type or HD using the CBCL. The study was performed enrolling a large naturalistic ADHD referral sample in both countries with typical comorbidities. Cut-off independent ROC analyses as well as sensitivity and specificity based on pre-defined cut-off scores [1] of the Attention Problems scale revealed that this CBCL scale might be a useful screening tool to discriminate ADHD/HD cases from non-cases.

Despite differences in diagnostic systems (DSM-IV: ADHD combined type vs. ICD-10: HD) and several further uncontrolled possible confounders (e.g. help seeking process, diagnostic procedure, socioeconomic status), we detected qualitatively similar profiles of parental ratings of behavioral and emotional problems in both children with ADHD and non-ADHD controls in the two countries. This strengthen previous evidence of similar CBCL profiles in children with ADHD with highest scores on Attention Problems and Aggressive Behavior scales and lowest scores on Somatic Complaints, Withdrawn and Thought Problems scales reported in many clinical [7–9, 22, 26, 48, 58] and epidemiological [39] samples of children with ADHD combined type. In accordance to our results based on a two-stage method with the direct cross-cultural comparison, data from different studies indicates that ADHD in children is consistently associated with a specific pattern of psychopathology independent of culture, and diagnostic system. Moreover, several findings from other investigations documented the long-term stability of this profile [9, 49].

Despite the similarities in profile, scores on all CBCL scales were higher in the Brazilian sample independently of ADHD status except for the Somatic Complaints scale in controls. Firstly, cultural differences in the parents' perception concerning the 3-point response scale (i.e., 0 for "not true", 1 for "somewhat or sometimes" and 2 for "very true or often true") as well as the possible tendency of Brazilian parents to over-report behavior problems in their children [2, 18, 28] might have contributed to the higher scores on all CBCL scales in Brazil. Secondly, the higher CBCL ratings in both groups of the Brazilian sample may reflect sample differences in socioeconomic status. This suggestion is in line with findings from another cross-cultural study that did not focus on psychiatric disorders [16, 17]. Comparing epidemiological samples from 12 different countries, these authors observed in Puerto Rico consistently higher Total, Externalizing and Internalizing Problems scores [16] as well higher scores on the eight empirically derived scales compared to all other countries under investigation [17]. The authors attributed this finding to a lower average socioeconomic status of the Puerto Rican families due to an inverse association between SES and CBCL ratings shown in various cultures [59]. Thirdly, cultural differences on steps of the help-seeking process such as recognizing a child's problem [41], seeking an evaluation, and obtaining a professional diagnosis [12] might have contributed to the higher CBCL scores in our Brazilian clinical sample. Elevated Brazilian thresholds for the utilization of mental health services might contribute to the cross-cultural CBCL difference by referring only the most severely disordered children or by the tendency of parents to use extreme item scores to get entrance to mental health services [16]. Whether or not parents consider a trait of child's behavior as problematic and worthy of professional help is likely a function of parental thresholds which have been shown to vary in cross-cultural studies. To minimize such influences a 'referability index' has been developed that measures the culture-bound likelihood that a child's behavioral problem will result in a medical referral [61]. But despite much progress in this field, there are still unresolved problems of cross-cultural equivalence of sampling methods and measures of psychopathology [42, 57].

In general, there is an impact of comorbid conditions like mood disorders and anxiety on the CBCL profile [7, 8, 48]. For instance, Biederman et al. [8] reported several group differences in mean T-scores of CBCL scales between controls and probands with ADHD. However, they found no between-group differences on Withdrawn, Somatic Complaints and Thought Problems scales of the CBCL. In our study, the impact of the factor 'ADHD' on these three CBCL scales only disappeared when excluding comorbid conditions from analyses. The higher rate of comorbid mood and anxiety disorders in Brazil in our investigation has to be seen with caution, because ICD-10 criteria do not recommend a diagnosis of HD in the presence of internalizing disorders such as anxiety and depression in contrast to ADHD combined type in the DSM-IV. However 13 German children with HD received the diagnosis of an internalizing disorder due to severity. Nevertheless, analyses performed after excluding children with any condition comorbid to ADHD also revealed a similar CBCL profile in both ADHD groups and a constant elevation of scores in both Brazilian groups remained. Thus, it seems that broadband symptomatological profile is comparable in naturalistic clinical samples from both cultures. These findings reinforce the comparability of ADHD combined type diagnosed by DSM-IV and HD diagnosed according to ICD-10 criteria.

This suggestion is also supported by the ROC analyses as well as sensitivity and specificity based on pre-defined cut-off scores of the Attention Problems

scale [1], which indicated adequate diagnostic efficiency of the Attention Problems scale in both cultures for the diagnosis of ADHD combined type/HD. The AUC of the Attention Problems scale found in this study for both cultures are similar to those reported by others—AUC = .84 [33], AUC = .84 [43], AUC .79 [36]. Accordingly, Chen et al. [14] found that the Attention Problems scale significantly predicted ADHD with an AUC of .96. However, it is important to bear in mind that its predictive value depends substantially on the base rate prevalence of ADHD in the population being evaluated [27]. All together, these findings suggest that the Attention Problems scale could serve as a rapid and useful screening instrument to identify cases of ADHD in clinical samples [8, 34].

◼ Limitations

There are some limitations of this study. First, we found group differences in gender distribution within each country and in age within the German sample. However, these findings are of minor importance because we used identical pre-defined age and gender standardized T-scores of the CBCL in both samples for our analyses [1]. Additionally, the main focus of our analyses was cross-cultural differences and similarities and there were no differences in gender and age distribution between both countries. Second, our referral samples are not representative of the entire culture in both Brazil and Germany. Thus, our findings must be generalized cautiously to other clinical samples even in the countries assessed. Further, our data are limited to ADHD combined type/HD. Recently the well known subtype specificity of the profiles of inattention and externalizing symptoms has been confirmed in a Hispanic sample and it has been concluded that these groups appear to represent distinct disorders [5]. Hence, our findings may not be generalizable to ADHD per se. Nevertheless, many of the documented differences between children of distinct ADHD subtypes can be found across several cultures [25]. For example, higher ratings for aggressive behavior in the CBCL in children with the hyperactive-impulsive type and combined type compared to children with the inattentive type in a Ukrainian sample are consistent with the findings of many other studies (reviewed by [63]). Finally, the inclusion of more measures of impairment (e.g., social skills, academic achievement, parent-child relationships) would have strengthened the design of the present results.

In conclusion, we were able to detect an ADHD-specific CBCL profile in both countries despite various cross-cultural differences including the use of different diagnostic systems. Thus, our results provide strong support for the suggestion of Beiser et al. [6] that there is little culture-bound about the symptoms of ADHD and its correlates. Additionally, the

capability of the CBCL Attention Problem scale to classify true positives ADHD cases correctly in different cultures could be ascertained (good sensitivity), even when different classificatory systems were used. Further cross-cultural investigation including genetic and environmental aspects of shared risk will provide valuable insight into the cultural boundaries of ADHD.

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