



Capturing age-group differences and developmental change with the BASC Parent Rating Scales[☆]



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ABSTRACT

Estimation of age-group differences and intra-individual change across distinct developmental periods is often challenged by the use of age-appropriate (but non-parallel) measures. We present a short version of the Behavior Assessment System (Reynolds & Kamphaus, 1998) Parent Rating Scales for Children (PRS-C) and Adolescents (PRS-A), which uses only their common-items to derive estimates of the initial constructs optimized for developmental studies. Measurement invariance of a three-factor model (Externalizing, Internalizing, Adaptive Skills) was tested across age-groups (161 mothers using PRS-C; 200 mothers using PRS-A) and over time (115 mothers using PRS-C at baseline and PRS-A five years later) with the original versus short PRS. Results indicated that the short PRS holds a sufficient level of invariance for a robust estimation of age-group differences and intra-individual change, as compared to the original PRS, which held only weak invariance leading to flawed developmental inferences. The importance of test–content parallelism for developmental studies is discussed.

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In the context of developmental research, studies are often challenged with the use of developmentally appropriate measures that vary in content according to child age, although tapping presumably into the same underlying psychological construct. Despite an apparent level of conceptual comparability, even slight variations in test content may preclude a rigorous estimation of both age-group differences and intra-individual change across distinct developmental periods. As pointed out by Marsh, Nagengast, and Morin (2013), “unless the underlying factors really do reflect the same construct and the measurements themselves are operating in the same way (across groups, over age and time, or across different levels of continuous variables), mean differences and other comparisons are likely to be invalid” (Marsh et al., 2013, p. 1199). Issues related to the equivalence of assessments and the controversies of “changing persons versus changing tests” have whetted the appetites of methodologists for decades (Nesselrode, 1984). However, despite attempts to outline best practice in the matter (e.g., Marsh et al., 2009; Marsh et al., 2013; Pentz & Chou, 1994; Vandenberg & Lance, 2000; Widaman, Ferrer, & Conger, 2010), such

methodological considerations are still regularly disregarded in contemporary theoretical and applied developmental research.

In this report, we estimate and illustrate the need to maximize test–content parallelism in developmental studies, specifically regarding estimation of age group differences and developmental change, using the Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1998). The BASC is an international reference for the assessment of adaptive and maladaptive behavioral and psychological adjustment of children and adolescents in community and home settings. This multidimensional assessment system includes three forms of Parent Rating Scales (PRS) to represent age-appropriate content: the preschool form (PRS-P) for children under age 6, the child form (PRS-C) for children between 6 and 11 years old, and the adolescent form (PRS-A) for children between 12 and 18 years old. Here we examine specifically the PRS-C and PRS-A forms, which comprise 138 and 126 items, respectively. Items in both are rated on a four-point frequency scale (ranging from 0 = *the behavior never occurs* to 3 = *the behavior almost always occurs*) and compose nine clinical scales (*Aggression, Anxiety, Attention Problems, Atypicality, Conduct Problems, Depression, Hyperactivity, Somatization and Withdrawal*) and three adaptive skills scales (*Leadership, Social Skills and Adaptability*). Because the *Adaptability* scale is not available in the PRS-A form, this scale was discarded in all analyses presented in this report (see *Method and Discussion* sections). By construction, PRS are used to derive three clinical composite indexes: (a) externalizing problems (*Hyperactivity, Aggression, Attention Problems, Conduct Problems*), which are characterized by disruptive or “uncontrolled” behavior,

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(b) internalizing problems (*Anxiety, Depression, Somatization, Withdrawal*), which represent psychological maladjustment not marked by acting-out behavior, and (c) adaptive skills (*Leadership, Social Skills*), mostly summarized by interpersonal or social competency.

Although BASC-PRS subscales and composite index tap conceptually into the same underlying constructs across forms, test scores are obtained using different items depending on the version (i.e., PRS-C or PRS-A) for the particular age cohort studied. Despite these differences, researchers have often considered the PRS-C and PRS-A forms to consist of three “identical” composite scores (e.g., Zeller, Saelens, Roehrig, Kirk, & Daniels, 2004) and they have, therefore, indistinctly or inconsistently merged scores obtained with both forms in the same analyses (e.g., Lopata et al., 2010; Luthar & Sexton, 2007; Seymour et al., 2012; Volker et al., 2010; Zeller et al., 2004). Failing to address this lack of parallelism between forms, normed-referenced scores (T scores) are often used to increase the comparability of scores obtained with the PRS-C and PRS-A forms. However, this strategy interferes even more with the interpretation of results as (a) it does not solve the initial issue of test–content differences (and thus potential differences in substantive meaning of the constructs measured), and (b) it disturbs individual rank-orders by norming them in reference groups that differ according to the child’s age. As a result, some researchers have been more cautious and have separated their analyses depending on the PRS form used (e.g., Merrell, Streeter, Boelter, Caldarella, & Gentry, 2001). At the same time, they have only paid little attention to the impact of the variations in the PRS forms’ content on the substantive meaning of the test scores for younger (PRS-C) versus older individuals (PRS-A), and accordingly, on their possible consequence (e.g., changes in the meaning of the measure over time) for the estimation and interpretation of age-group difference and intra-individual change.

Confirmatory factor analyses and structural equation modeling of latent variables (LVs) are robust approaches to address such developmental effects, for example, by modeling inter-individual change over time with latent difference models (Steyer, Eid, & Schwenkmezger, 1997) or examining age-group differences in latent means. These approaches explicitly take into account measurement error that may bias estimates of the relations among the underlying constructs (e.g., Kline, 2010). Importantly, these approaches allow for the test of measurement invariance (i.e., whether latent constructs have the same substantive meaning, and thus, are comparable), an essential prerequisite that has to be established in order to infer valid comparisons of latent variable means across groups or over time (e.g., De Beuckelaer & Swinnen, 2010; Meredith & Horn, 2001).

In a cross-sectional context, measurement invariance establishes whether a given measure taps a particular latent construct (e.g., externalizing behavior) similarly across various groups (e.g., different age groups) so that meaningful inferences can be made across the groups. For the BASC PRS, this means that the latent structure of both PRS-C and PRS-A forms should be identical in order to represent the same underlying constructs and, thus, allow for meaningful comparisons between children and adolescents. In a longitudinal context, the assumption of measurement invariance over time (i.e., the relations between the observed scores and their underlying latent variables do not change over time) has to be empirically tested before drawing conclusions about intra-individual change in latent means. Besides simulation studies that have addressed the consequences of failure to measurement invariance in developmental research (e.g., De Beuckelaer & Swinnen, 2010), there are only few practical examples available to applied developmental researchers concerned with using age-appropriate measures in their studies.

The BASC PRS is especially informative and illustrative in this regard as it allows for the estimation of possible bias in developmental analyses resulting from the use of non-parallel scale content for targeted age groups (such as the PRS-C and PRS-A). In order to illustrate this bias, here we examine the level of cross-sectional (age-group) and

longitudinal invariance reached with non-parallel scale forms (i.e., the original PRS-C and PRS-A scores) as compared to a version of these scales that are maximized for content parallelism.

Present study

Although the number of items varies across the BASC PRS-C and PRS-A forms, there is an overlap of 85 identical items (representing 61.5% and 67.5% of the items in the PRS-C and PRS-A, respectively). The purpose of this study was to develop a content invariant short version of the PRS scales that purposefully capitalizes on these overlapping items to derive estimates of the initial constructs that are comparable in content across age groups and over time. Supporting this purpose, Reynolds and Kamphaus’ (1998) structural analysis of the BASC PRS across child and adolescent forms suggests that these identical items function in the same way regardless of the PRS form. Building on this result, the main goal of this study was to evaluate the extent to which the resulting “comparable scale scores” (CSS) properly address the issues of (a) age-group differences and (b) intra-individual change across distinct developmental periods, as the CSS should presumably achieve an adequate level of measurement invariance. To do so, we conducted a series of structural comparisons between the original PRS scores and the new CSS set. For this purpose, we used data gathered from a two-wave longitudinal research study, comprised of a sample of at-risk mothers and their school-age children and adolescents. These subjects were tested at baseline and re-assessed after a period of five years (see Barbot, Hunter, Grigorenko, & Luthar, 2013; Luthar & Sexton, 2007; Yoo, Brown, & Luthar, 2009).

Specifically, to address measurement invariance and mean level differences of the original PRS versus the CSS between children and adolescents, we compared cross-sectionally a sample of children rated by their mothers with the PRS-C form and a sample of adolescents rated with the PRS-A form. To address intra-individual change across distinct developmental periods (childhood through adolescence), we examined a subsample of participants followed up after five years, using the PRS-C form at baseline and the PRS-A form at follow-up, to investigate longitudinal measurement invariance and latent change estimates yielded by the original scores versus the CSS. Together, this study was intended to substantiate the robustness of the BASC PRS short-form scores (CSS) for developmental investigation while estimating the potential adverse impact of relying on unparallel test–content in such investigations.

Method

Participants

At the time of recruitment (Time 1, T1), the sample consisted of 361 mother–child and mother–adolescent dyads living in an urban area in Connecticut recruited from community settings and from outpatient treatment facilities for drug abuse and other mental health problems. Mothers’ age ranged from 23.5 to 55.8 years ($M = 38.2$ years, $SD = 6.2$ years). Per study inclusion criteria, each participant was the biological mother of a child between 8 and 17 years old (54% girls, 46% boys, $M_{ageGirls} = 12.7$, $SD = 2.9$, $M_{ageBoys} = 12.3$, $SD = 2.7$), was the child’s legal guardian, and lived with the child. This sample was divided into two distinct age groups according to the BASC-PRS form that was used by the mothers to rate their child’s behavioral and psychological adjustment. Accordingly, the mother–child group included 161 mothers of children between the age 8 and 11 (51% girls, 49% boys, $M_{ageGirls} = 9.5$, $SD = 1.2$, $M_{ageBoys} = 9.4$, $SD = 1.2$) and the mother–adolescent group comprised 200 mothers of adolescents between the age 12 and 17 (56% girls, 44% boys; $M_{ageGirls} = 14.3$, $SD = 1.8$; $M_{ageBoys} = 14.1$, $SD = 1.8$). Among the participants followed-up longitudinally, we examined a cohort of 115 mothers who rated their child using the PRS-C at baseline (50.5% girls, 49.5% boys, $M_{ageGirls} = 9.4$, $SD = 1.6$,

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