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Assessing Emotional and Behavioral Problems in Children with Intellectual Disability: Revisiting the Factor Structure of the Developmental Behavior Checklist

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The objective of the reported study was to reassess the factor structure of the Developmental Behaviour Checklist (DBC) in a large cross-cultural sample representing all levels of intellectual disability. Parent and teacher DBC ratings on a combined sample of 1536 Dutch and Australian children and adolescents (ages 3–22) with mild to profound intellectual disability were used. Principal components analyses produced five subscales: Disruptive/Antisocial, Self-Absorbed, Communication Disturbance, Anxiety, and Social Relating, explaining 43.7% of the total variance. Internal consistencies of these subscales ranged from .66 to .91. The revised factor structure of the DBC appears to be an improved and useful tool for assessing emotional and behavioral problems in children with intellectual disabilities.

KEY WORDS: Developmental Behaviour Checklist; intellectual disability; emotional and behavioral problems.

INTRODUCTION

The assessment of emotional and behavioral problems in children and adolescents with intellectual disability (ID) is a complicated matter, and continuous efforts to develop reliable and valid instruments are urgently needed. In 1991, Aman refrained from recommending any instruments for assessing emotional and behavioral problems for general use in children and adolescents with ID, mainly because of the lack of decent standardization and the inadequate field-testing of the

available instruments. However, he mentioned some promising instruments developed or adjusted for use in children and adolescents with all levels of ID residing in institutions, as well as living in the community, assessing a wide range of emotional and behavioral problems, and using untrained lay informants. The instruments mentioned by Aman (1991) included the Reiss Scales for Children's Dual Diagnosis (Reiss & Valentin-Hein, 1994), the Aberrant Behavior Checklist (ABC; Aman, Singh, Stewart, & Field, 1985; Freund & Reiss, 1991), and the Developmentally Delayed Child Behaviour Checklist (DD-CBC; Einfeld & Tonge, 1992). Following Aman's (1991) review, the development of these instruments progressed. Of these, the DD-CBC, now called the Developmental Behaviour Checklist (DBC), has proved to be a useful questionnaire for the description and measurement of behavioral and emotional disturbance in children and adolescents with ID. Emotions and behaviors represented in the DBC are regarded as problems by virtue of their qualitative or quantitative deviance; that they cannot be explained on the basis of ID

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alone; and that they cause significant distress to the child, the caregivers or the community; as well as the fact that they result in significant added impairment (Einfeld & Tonge, 1992; Rutter, Tizard, & Whitmore, 1970). They do not intend to measure or reflect *a priori* defined (classifications of) diagnostic constructs or categories of aberrant behavior. Both a primary caregiver and a teacher version are available for the DBC. Good reliability has been reported for the original six scales of the DBC, as well as good content, concurrent, and criterion group validity (Einfeld & Tonge, 1992, 1995). Because of these promising properties, the DBC was translated into Dutch to be validated in a large group of children with intellectual disabilities in the Netherlands. The development of a Dutch language version offered the opportunity to re-examine the factor structure of the DBC using a combined Australian-Dutch sample of young people with ID.

Three compelling reasons existed for this re-evaluation. First, the original scales were based on data obtained in Australian samples only. An internal structure based on samples from different countries is more likely to be valid across different cultures. Second, in the sample from which the original DBC scales were derived (Einfeld & Tonge, 1992, 1995), children with mild ID were underrepresented. Therefore, to enhance its generalizability, the internal structure of the DBC was reassessed using a large Australian-Dutch sample, including children with profound, severe, moderate, and mild ID. A final issue concerned the data analytic techniques employed in the original principal components analysis of the DBC (Einfeld & Tonge, 1995; Tonge *et al.*, 1996), involving exploratory principal components analyses with varimax rotation on a matrix of Pearson product-moment correlations. However, because the DBC uses a 3-point (0, 1, 2) or ordinal item rating scale, the calculation of Pearson product-moment correlations, which assume variables measured at interval level, produces an underestimation of the "true" interitem correlations and subsequent factor loadings (Jöreskog & Sörbom, 1996; Rowe & Rowe, 1997). Instead, it is better to use polychoric correlation coefficients, which assume an ordinal level of measurement. Another problem concerns the use of an orthogonal rotation (varimax) in the original DBC principal components analysis. Given that we may expect considerable overlap and comorbidity of dimensions of childhood emotional and behavioral problems (Angold, Costello, & Erkanli, 1999), it may be preferable to employ an oblique rotation that allows the factors to correlate (Floyd & Widaman, 1995; Rowe & Rowe, 1997). In summary, the goal of this study was to employ appropriate analytic techniques to reassess the most appropriate way to summarize the

information contained in the raw DBC data in a cross-cultural sample of children and adolescents representative of the entire range of ID.

METHOD

Sample and Procedure

The Australian Sample

The Australian sample ($n = 937$) comprised 538 children with ID recruited in 1991 and 1992 from a community epidemiological prevalence study and 399 children included in the original validation studies of the DBC. The sampling procedure for the Australian sample is described in more detail elsewhere (Einfeld & Tonge, 1992; Tonge & Einfeld, 1991). All IQ levels are represented in the Australian sample, although it is acknowledged by the original authors of the DBC that there is an underrepresentation of children in the mild IQ range (Eaton & Menolascino, 1982; Einfeld & Tonge, 1995, 1996).

The Dutch Sample

In 1997, a 20% random sample ($n = 1747$) was selected from all students visiting one of 115 (87.1%) out of all 132 nonresidential school settings for the educable (IQ range about 60–80) and the trainable (IQ range about 30–60), and children from 23 (95.8%) out of 24 daycare centers for children with ID (IQ < 50 and many having additional physical or sensory handicaps) in the province of Zuid-Holland. Children were only included in the sample if (a) they were 6–18 years old, (b) they lived at home for 4 or more days per week, and (c) at least one parent had enough comprehension of the Dutch language to be interviewed. Parents and caregivers of the sampled children were sent a letter through the schools, because the research team could not initiate direct contact with the parent because of privacy regulations. The schools sent a reminder to those parents who did not respond to the initial letter, and, if possible, nonresponding parents were phoned. Of the final number of 1518 eligible students, 188 parents refused to participate; 23 did not fill out the DBC-P, although they consented to participate in the study; and in 250 cases the nonresponding parents could not be contacted by telephone (final response 69.6%; $n = 1057$). After written consent of the parents, 1134 teachers and group workers were sent a DBC-T by mail, of which 930 were returned (82.0%). A differential dropout by educational level and SES was found. A lower response rate was found for parents of children attending schools for the educable and daycare centers ($\chi^2(2) = 30.2, p < .001$), and a larger

($\chi^2(2) = 11.1, p = .004$) proportion of children from low SES families were in the nonparticipating group. No differential dropout by age or sex was found. A more detailed description of the Dutch sampling procedure is given elsewhere (Dekker, Nunn, & Koot, 2002).

The Combined Australian-Dutch Sample

To assess the internal structure of the DBC, data on Australian and Dutch ID subjects were combined ($n = 1536$), representing the whole range of ID (Table I). After excluding borderline-functioning children ($n = 296$) and children attending schools for the educable for whom no reliable information on their intellectual functioning was available ($n = 162$), 599 Dutch subjects remained for this analysis. No significant differences in sex ($\chi^2 = 0.06, df = 1, ns$), or total level of DBC-P emotional and behavioral problems ($t = -0.87, df = 676, ns$) were found between educable children with or without reliable information on their IQ. However, the mean age of the educable children with reliable information was significantly lower (11.4 years) compared to those without reliable information (12.3 years; $t = 3.8, df = 676, p = .000$).

The age and gender distributions of the Dutch and Australian samples were not significantly different from each other ($t = 0.93, df = 1514, ns; \chi^2 = 0.07, df = 1, ns$). However, the Dutch sample contained a higher proportion of children in the mild IQ range compared to the Australian sample (see Table I). A further difference between the samples was that the Australian sample included children living outside the family home in institutional or residential care (approximately

15–20%), whereas all children in the Dutch sample lived predominantly at home.

Instruments

DBC-P

The DBC-P (Einfeld & Tonge, 1992, 1995, 2002) is a 96-item checklist completed by parents or caregivers to assess a broad range of behavioral and emotional problems in children with ID ages 4–18 years (Dutch manual: Koot & Dekker, 2001). Most respondents can complete the DBC in 15–20 min. The items were derived from 664 clinical records with detailed descriptions of behavioral concerns. The six original empirically derived subscales, Disruptive, Self-Absorbed, Communication Disturbance, Anxiety, Social Relating, and Antisocial, showed good internal consistency, and interrater and test-retest reliability. Furthermore, the DBC's criterion and concurrent validity are satisfactory and the instrument is specific and sensitive in distinguishing psychiatric disorder cases from noncases (Einfeld & Tonge, 1992). About 40% of the Australian sample was distinguished as a clinical case, which is within the 30%–60% range of prevalence estimates of emotional and behavioral problems found in representative population-based studies of school-age children and adolescents with ID (Chess, 1977; Chess & Hassibi, 1970; Cormack, Brown, & Hastings, 2000; Gillberg, Persson, Grufman, & Themner, 1986; Jacobson, 1982; Koller, Richardson, Katz, & McLaren, 1982; Linna *et al.*, 1999; McQueen, Spence, Garner, Pereira, & Winsor, 1987; Rojahn, Borthwick-Duffy, & Jacobson, 1993; Rutter *et al.*, 1970).

Table I. Combined Australian-Dutch Sample Characteristics

	Sample		
	Australian ($n = 937$)	Dutch ($n = 599$)	Total ($n = 1536$)
Age	Mean = 12.0 years SD = 4.4 Range = 3–22	Mean = 12.2 years SD = 3.3 Range = 6–18	Mean = 12.1 years SD = 4.0 Range = 3–22
Sex (% male)	58.3%	58.9%	58.5%
Level if ID:			
Mild	31.7%	62.1%	43.6%
Moderate	40.8%	14.7%	30.6%
Severe	23.6%	4.2%	16.0%
Profound	3.9%	1.8%	3.1%
Mild to moderate ^a	—	10.2%	4.0%
Moderate to profound ^b	—	7.0%	2.7%

^a Level of ID estimated from placement in school for the trainable.

^b Level of ID estimated from daycare center placement.

DBC-T

The DBC-T (Einfeld, Tonge, & Parmenter, 1998; Parmenter, Einfeld, Tonge, & Dempster, 1998; Einfeld & Tonge, 2002) is a 93-item checklist completed by teachers or teacher's aids designed to assess a broad range of behavioral and emotional problems in children with ID (Dutch manual: Koot & Dekker, 2001). All items have a counterpart on the DBC-P, except for three items related to sleep disturbance that have been deleted and one item that has been added, "Unpopular with other children." The DBC-T has good test-retest and interrater reliability (Einfeld *et al.*, 1998). The correlation between parent and teacher ratings on a small subsample ($n = 51$) of the Australian sample was nonsignificant ($ICC = .05$; Einfeld *et al.*, 1998). Other studies also find relatively low agreement between parent's and teacher's ratings of emotional and behavioral problems, even though similar internal factor structures are found for both informants (e.g., Achenbach, McConaughy, & Howell, 1987).

Data Analysis

The internal structure of the DBC was ascertained by principal components analysis on a matrix of polychoric correlations. An oblique rotation (promax) was performed on four-, five-, and six-factor solutions. In total, 90 of 96 items from the parent/primary caregiver version of the DBC were included in the analysis. Item 36 (inappropriate sexual activity) and item 80 (talks about suicide) were removed because of low observed frequencies (4.5% and 4.4%). Also deleted were three items symptomatic of psychotic illness: item 15 (delusions), item 79 (hallucinations), and item 84 (unconnected thoughts), which are acknowledged by the authors of the DBC to be rated unreliably by parents/primary caregivers (Einfeld & Tonge, 1992). The analysis was performed using NOVAX (Waller, 1994), a stand-alone factor analysis program for ordinal polytomous data. In accordance with guidelines proposed by Achenbach (1991), it was decided that factors must contain at least six items with a loading of .30 or greater. To reduce the number of cross-loadings, only items loading .40 or greater on a secondary factor were retained.

RESULTS

The analysis produced 21 factors with an Eigenvalue greater than 1. However, examination of the scree plot suggested that a four-, five-, or six-factor solution was most appropriate. The four-factor solution ac-

counted for 40.8% of the total variance. Examination of the unrotated variance components indicated that the Self-Absorbed factor accounted for most of the variance (24.1%), followed by the Disruptive/Antisocial factor (8.6%), Social Relating factor (4.5%), and Communication Disturbance factor (3.6%). The five-factor solution accounted for 43.7% of the total variance and included the four previous factors plus an additional factor pertaining to anxiety problems (accounting for 2.9% of the variance) (Table II). After promax rotation, four items from the original 90 failed to load significantly on any of the factors: item 12 (distressed when hearing particular sounds), item 19 (easily distracted), item 65 (scratches or picks skin), and item 67 (sleeps too little). Four items loaded significantly on more than one factor: item 14 (deliberately runs away), item 50 (overactive) and item 86 (throws or breaks objects) cross-loaded on the Disruptive/Antisocial and Self-Absorbed factors, and item 3 (aloof) loaded on both the Self-Absorbed and Social Relating factors. Interfactor correlations after promax rotation ranged from -0.12 (Communication Disturbance with Social Relating) to -0.34 (Disruptive/Antisocial with Anxiety). The internal consistency of the Disruptive/Antisocial and Self-Absorbed factors was high ($\alpha = .91$ $\alpha = .89$) and satisfactory for the Communication Disturbance and Social Relating factors ($\alpha = .73$ and $\alpha = .71$). The internal consistency of the Anxiety factor was marginally less than satisfactory ($\alpha = .66$). Of the 96 items of the DBC-P, 86 are represented in this five-factor solution. The six-factor solution (accounting for 46.2% of the total variance) included the previous five factors plus a sixth factor containing six items mostly relating to overactivity and distractibility that had been included in the Disruptive/Antisocial factor from the five-factor solution. However, it also included the item "stands too close to others," which did not appear to fit very well with the rest of the items. Furthermore, the forced six-factor solution had a negative impact on the item compositions of some of the other subscales. It was therefore decided that the five-factor solution provided the best overall summary of the dimensionality of the DBC.

A principal components analysis of items in the teacher version of the DBC ($n = 1155$) produced a solution that was similar but not identical to that found for the parent checklist. Similar to the procedure with the DBC-P, three items that were symptomatic of psychotic illness were removed (15, delusions; 79, hallucinations; and 84 unconnected thoughts), and item 21 (eats non-food), item 42 (lights fires), and item 77 (talks about suicide) were removed because of low observed frequencies. The four-factor solution included Disruptive/Antisocial,

Table II. Item Loadings of the Revised Subscales of the Developmental Behaviour Checklist

Scale	Loading	Scale	Loading
<i>Number of items; $\alpha_{DBC-P}/\alpha_{DBC-T}$</i>		<i>Number of items; $\alpha_{DBC-P}/\alpha_{DBC-T}$</i>	
Item ^a (original DBC scale ^b)		Item ^a (original DBC scale ^b)	
I. DISRUPTIVE/ANTISOCIAL			
<i>27 items; .91/.90</i>			
Abusive, swears (D)	.86	Overactive ^{cross-I} (S-A)	.46
Lies (D/AS)	.81	Overexited (D)	.46
Stubborn, disobedient (D)	.78	Deliberately runs away ^{cross-I} (S-A)	.46
Manipulates others (D)	.73	Strips off clothes (S-A)	.44
Steals (AS)	.73	Aloof, in own world ^{cross-V} (SR)	.43
Very bossy (D)	.71	Grinds teeth (—)	.43
Impulsive (D)	.68	Under-reacts to pain (CD)	.42
Kicks, hits others (D)	.67	Screams a lot (S-A)	.41
Impatient (D)	.64	Poor attention span (—)	.39
Temper tantrums (D)	.64	Unusual body movements (—)	.36
Irritable (D)	.62	Facial twitches (SR)	.33
Jealous (D)	.61	III. COMMUNICATION DISTURBANCE	
Whines a lot (D)	.59	<i>13 items; .73/.73</i>	
Hides things (AS)	.57	Arranges objects (—)	.61
Overly attention seeking (D)	.56	Echolalia (CD)	.51
Lights fires (AS)	.56	Talks to self or imaginary others (CD)	.49
Says things not capable of (D)	.54	Confuses pronouns (CD)	.49
Easily led by others (—)	.53	Repeats words or phrases (CD)	.46
Talks too much (CD)	.53	Unusual tone or rhythm (CD)	.44
Rapid mood changes (D)	.51	Unrealistically elated (CD)	.42
Throws or breaks objects ^{cross-II} (D/S-A)	.50	Obsessed idea or activity (—)	.41
Refuses to go to school (AS)	.45	Interested in mechanical things (—)	.41
Noisy or boisterous (D)	.45	Doesn't mix with own age-group (—)	.38
Deliberately runs away ^{cross-II} (S-A)	.42	Preoccupied with one or two interests (—)	.35
Over-active ^{cross-II} (S-A)	.41	Over-affectionate (—)	.33
Tense (D)	.39	Stands too close to others (—)	.31
Lacks self-confidence (—)	.37	IV. ANXIETY	
II. SELF-ABSORBED			
<i>31 items; .89/.91</i>			
Eats nonfood (S-A)	.85	Distressed when separated (A)	.60
Hums, grunts (S-A)	.78	Distressed being alone (A)	.60
Mouths objects (S-A)	.75	Nightmares, sleep walks ^{dbc-p} (A)	.52
Bites others (—)	.67	Fears things, situations (A)	.49
Soils though trained (S-A)	.66	Cries for no reason (A)	.42
Poor sense of danger (S-A)	.65	Shy (A)	.37
Hits or bites self (S-A)	.65	Loss of appetite (—)	.35
Plays with unusual objects (S-A)	.63	Upset over small changes (A)	.32
Smells, tastes, licks objects (S-A)	.62	Fussy eater, food fads (A)	.30
Repetitive activity (S-A)	.60	V. SOCIAL RELATING	
Stares at lights (S-A)	.59	<i>10 items; .71/.76</i>	
Repeated movements (SR)	.59	Under-active (SR)	.59
Wanders aimlessly (S-A)	.56	Doesn't show affection (SR)	.55
Flicks objects (S-A)	.55	Depressed, unhappy (SR)	.55
Throws or breaks objects ^{cross-I} (S-A)	.54	Sleeps too much ^{dbc-p} (SR)	.50
Bangs head (S-A)	.54	Resists being cuddled (SR)	.49
Gorges food (—)	.52	Aloof, in own world ^{cross-II} (SR)	.45
Urinates outside toilet (S-A)	.52	Avoids eye contact (SR)	.41
Masturbates in public (S-A)	.46	Overbreathes, other complaints (—)	.38
Laughs for no reason (SR)	.46	No response to others (SR)	.38
		Prefers to be on his/her own (S-A)	.36

^a The terms used are summary terms, not the actual wording of the items in the checklist; ^{cross-I} = cross-loading of scale I; ^{cross-II} = cross-loading of scale II; ^{cross-V} = cross-loading of scale V; ^{dbc-p} = item only listed in DBC-P.

^b Original DBC scales: D = Disruptive; S-A = Self-Absorbed; CD = Communication Disturbance; A = Anxiety; SR = Social Relating; AS = Antisocial; — = not on an original DBC scale.

Self-Absorbed, Communication Disturbance, and Social Relating subscales that were similar in item composition to that found in the DBC-P five-factor solution. It was found that 81.5% of the DBC-T items on the Disruptive/Antisocial subscale corresponded with the Disruptive/Antisocial subscale of the DBC-P. The same was true for 77.4% of the items of the Self-Absorbed subscale, 70% of the items of the Social Relating subscale, and 53.8% of the items of the Communication Disturbance subscale. The DBC-T Communication Disturbance subscale did not incorporate the stereotypic behaviors represented in the corresponding DBC-P subscale. Three items of the Social Relating subscale and two items of the Communication Disturbance subscale of the DBC-T corresponded to the items of the Anxiety subscale of the DBC-P. Unlike the DBC-P five-factor solution, the DBC-T five-factor solution was unable to clearly separate anxiety symptoms into a distinct and meaningful subscale.

The results indicate that the item composition of the Disruptive/Antisocial, Self-Absorbed, and Social Relating subscales are similar across the parent and teacher versions of the DBC. The composition of the Communication Disturbance subscale is less similar, and, as indicated earlier, the principal components analysis of the DBC-T failed to identify a separate Anxiety factor. Application of the DBC-P five-factor solution to the teacher sample data produces subscales with good internal consistency for the Disruptive/Antisocial and Self-Absorbed subscales and satisfactory consistency for the Communication and Social Relating subscales. The Anxiety factor in the teacher sample is marginally less than satisfactory (see Table II). Given the broad similarities between the factor structures of the parent and teacher versions of the DBC and to facilitate comparison of parent and teacher ratings, it was decided to apply the parent five-factor solution to both the parent and teacher checklists.

Finally, we examined the correlations between the original and the revised DBC subscales (based on unit-weighted summation of the items within each scale) (Table III). Correlation coefficients exceeding .90 were found between the corresponding subscales, except for the Communication Disturbance subscales, which correlated .81. The revised Communication Disturbance scale included additional items related to stereotypical behaviors, for example, "arranges objects in strict order," "gets obsessed with idea or activity," "overly interested in mechanical things," "preoccupied with one or two interests." The original sixth subscale "Antisocial" correlated .66 with the revised Disruptive/Antisocial subscale, which incorporated all the five items of the original An-

Table III. Pearson Product-Moment Correlation Coefficients
^a-Between Corresponding Revised and Original DBC-P
 and DBC-T subscales

Revised DBC subscales	Original DBC subscales	DBC-P (n = 1536)	DBC-T (n = 1155)
Disruptive/Antisocial	Disruptive	.97	.97
	Antisocial	.66	.53
Self-Absorbed	Self-absorbed	.96	.96
Communication Disturbance	Communication Disturbance	.81	.82
Anxiety	Anxiety	.91	.89
Social Relating	Social Relating	.92	.92

^a All $p < .05$.

tisocial scale. Similar results were obtained for the original and revised subscales of the DBC-T.

CONCLUSION

This study aimed to establish a good summarization of the patterns of correlation coefficients among the observed variables of the DBC. Five interpretable and clinically relevant subscales for the DBC-P were derived, explaining 44% of the variance in a combined Australian/Dutch sample. This revised scale structure constitutes an improvement over the original structure given that it is based on a larger sample and one that better represents all levels of ID. Furthermore, the revised component structure explains a larger proportion of the item variance compared to the proportion accounted for by the original principal component analysis of the DBC (44% versus 33%) (Einfeld & Tonge, 1995). Overall, the percentage of variance explained in this study is similar to that found for other instruments assessing emotional and behavioral problems in children with intellectually disability. For example, a percentage of explained variance of 51% was found for both the English and the French version of the Nisonger Child Behavior Rating Form (Aman, Tassé, Rojahn, & Hammer, 1996; Girouard, Morin, & Tassé, 1998; Tassé, Aman, Hammer, & Rojahn, 1996; Tassé, Morin, & Girouard, 2000), and for the Aberrant Behavior Checklist, a percentage of explained variance of 52% was found in a sample of children attending special classes (Marshburn & Aman, 1992).

Furthermore, the revised scale structure incorporates 86 of the 96 items of the DBC and has four cross-

loadings, compared to 81 items and five cross-loadings in the original DBC structure. The 10 items that do not have component loadings above .30 on any of the subscales (four items) or that were excluded in the analyses because of low frequency (three items) or because the symptoms were psychotic in nature (three items) were retained in the DBC, because of their clinical relevance in relation to the inventorial purpose of the DBC, and are used in the calculation of the Total Behaviour Problem Score, but are not included in the calculation of the subscales.

The reliability of the scales was satisfactory as shown by the good to high internal consistency of the subscales Self-Absorbed, Disruptive/Antisocial, Communication Disturbance, and Social Relating. A moderate internal consistency was found for the Anxiety subscale. However, we decided to incorporate this scale in the final solution because anxiety problems are seen as clinically relevant indicators of internalizing problems. Furthermore, anxious, tense, fearful behavior is one of the factors that tend to reoccur in empirically derived instruments for children with ID (Aman, 1991). Future revisions of the DBC should consider adding or revising the items in the Anxiety scale to improve its psychometric properties.

The internal structure of the DBC-T was similar to the Disruptive/Antisocial, Self-Absorbed, and Social Relating scales found for the DBC-P. A four-factor structure without a separate Anxiety scale fit the DBC-T data best. This structure may suggest that teachers generally provide less differentiated ratings of internalizing problems than do parents. Although, the DBC-P and DBC-T internal structure did not fit perfectly, it was decided to use the same items and scales for both the DBC-P and DBC-T to enhance cross-informant comparisons. The internal structure of the DBC-P was chosen because it differentiated best between internalizing behaviors and because the internal consistency measures of the DBC-T, using the DBC-P five-factor solution, were very similar to those found for the DBC-P. A similar level of consistency in factor structure across rater types has been found for the Nisonger Child Behavior Rating Form (Aman *et al.*, 1996; Tassé *et al.*, 2000) and the Aberrant Behavior Checklist in a community sample of children attending special classes (Marshburn & Aman, 1992).

The correlation between parent and teacher revised DBC subscale scores varied from .27 for the Anxiety scale to .57 for the Self-Absorbed scale in a large ($n = 851$) representative Dutch sample (Dekker, Nunn, & Koot, 2002). This moderate cross-informant agreement between parent and teachers is similar or even somewhat

higher to those reported in many other studies assessing emotional and behavioral problems in both children with and without intellectual disability (Achenbach *et al.*, 1987; Aman *et al.*, 1996; Freund & Reiss, 1991). Situation specificity of problem behaviors, together with observer specificity may account for the modest agreement between parents and teachers (van der Ende, 1999).

The correlations between similar original and revised subscales of the DBC-P and the DBC-T showed that the basic structure of the DBC is stable. However, we did not find any reason for including a separate scale incorporating only antisocial behavior, as was found in the original 1995 analyses. Furthermore, the revised Communication Disturbance scale incorporated four items reflecting stereotypical behaviors. None of these clinically significant behaviors were represented in the original scale structure of the DBC. Adding stereotypical behaviors to the communication disturbance items might suggest the use of another name for this factor, for example, "Communication disturbances and stereotypical behaviors." However, because changing the name does not mean that the factor is any better understood, we preferred to keep the original DBC factor name. The observation that both communication disturbances and stereotypical behavior tend to co-occur is in correspondence with the behavioral pattern seen in children with pervasive developmental disorders (American Psychiatric Association, 1994).

Aman (1991) concluded that the following factors tend to recur with considerable consistency across five empirically derived instruments assessing emotional and behavioral problems in children and adults with ID: (a) Aggressive, Antisocial, Self-Injurious behavior, (b) Withdrawn behavior, (c) Stereotypic behavior, and (d) Hyperactivity. In addition, (e) Repetitive verbalizations, (f) Anxious, Tense, Fearful behavior, and (g) Self-Injurious behavior tended to emerge also, but with less consistency. The DBC scale structure shows similarities with these reoccurring structures. The DBC Disruptive/Antisocial scale corresponds to (a), Self-Absorbed to (c) and (g), Social Relating to (b), Communication Disturbance to both (c) and (e), and Anxiety to (f).

It could be argued that Confirmatory Factor Analysis (CFA) would be a better way to evaluate the internal structure of the DBC. However, at this point, and even more when the DBC items were selected, there is not sufficient theory regarding the dimensionality of emotional and behavioral problems in children and adolescents with ID. The DBC items were not selected based on a theory that related them to some underlying construct, but purely by the fact that those behaviors and emotions were seen in this particular population and

considered to reflect more than just ID. The CFA approach to construct validation is too restrictive, given the fact that no sufficient theory on dimensionality of emotional and behavioral problems is available, that the principal component solution found in this and other studies explains only about 50% of all the variance, and the large amount of variables involved. Finally, regardless of these objections, we have tried to fit the original six-factor DBC solution on the Dutch sample, and both the original six-factor and the revised five-factor DBC solution on an independent large Dutch-Friesian sample ($n = 838$) representative of all levels of ID, using both polychoric and Pearson correlations as an input matrix. Unfortunately, all correlation matrices were not positive definite, and the output could not be trusted.

Study Strengths and Limitations

The combined Australian-Dutch sample was large, with many more than five subjects per observed variable, as suggested by Tabachnick and Fidell (1989). Furthermore, the sample was representative of the full range of ID. The empirically derived DBC scales in this study are based on the most comprehensive sample of intellectually disabled children and adolescents currently available. Because principal component and internal consistency analyses are descriptions of relationships between items, and not descriptions of populations, we expect differential nonresponse of subjects within the samples, for example, children from families with low SES being underrepresented, not to be problematic.

The scale structure of the DBC may need further refinement when future samples of clinically referred children with ID become available, although one can wonder whether the expected high co-occurrence of problem behaviors in referred samples will actually enhance the internal structure of the DBC and its discriminative validity. On the other hand, combinations of rare problem behaviors, which are more common in referred populations of children with ID, might be important indicators of emotional and behavioral problems. In addition to our preliminary psychometric studies (Dekker *et al.*, 2002), the validity of the DBC subscales may be further tested using consensus-based clinical syndromes (e.g., DSM-IV), as well as biological and observation-based behavioral data as a criterion.

Because the DBC was designed to assess emotional and behavioral problems in the intellectually disabled, children in the borderline IQ range were excluded from the Principal Component Analysis. However, a post-hoc analysis showed that the structure of the DBC based on the Australian-Dutch sample with these children in-

cluded in the analysis was similar to the structure presented in this paper. The question remains whether emotional and behavioral problems of children with borderline intellectual functioning are most similar to problems of children from the general population or to those of children with ID. In other words, are these children best served by using instruments designed for the general population, such as the Child Behavior Checklist (Achenbach, 1991), or by instruments such as the DBC, especially developed for children with ID.

Although the revised factor structure reported here is a significant improvement on the original factor analysis of the DBC, only a modest amount of the total item variance has been accounted for (44%). Although this is not surprising given the length and complexity of the DBC, and comparable with the amount of variance explained in similar instruments, it suggests that a significant amount of item redundancy remains in the checklist. Floyd and Widaman (1995) suggest that a good factor solution should explain approximately 80% of the estimated common variance. Although there is little doubt that the 96-item DBC-P provides a comprehensive listing of relevant individual symptoms in young people with ID, and therefore has many benefits in terms of its ability to provide a detailed assessment of an individual's mental health status, this investigation suggests that it may be possible to capture the main dimensions of emotional and behavioral problems with a smaller number of key items loading on each factor. The development of a shortened version of the DBC, including a revision of some of the content of the factors Communication Disturbance, Anxiety, and Social Relating for research purposes to enhance the psychometric properties of the DBC, is a task that should be pursued in the future.

Clinical and Research Implications

As the prevalence of emotional and behavioral problems in children with ID is estimated to be much larger than in the general population (Koller *et al.*, 1982; Linna *et al.*, 1999; Rutter *et al.*, 1970), and given the problems in defining emotional and behavioral problems in children with ID, the use of standardized, reliable, and valid instruments to assess and record emotional and behavioral problems and evaluate interventions is recommended in this underdiagnosed and undertreated group.

In clinical applications, the improved factor structure will allow for meaningful comparisons of an individual's percentile score against norms. Standardized norms for the DBC for both the Australian and the Dutch population of the intellectually disabled will en-

able clinicians to relate subscale scores obtained for individual clients with those of a representative group of children with a similar level of ID. The revised subscales also promise to provide enhanced screening properties for clinical syndromes such as anxiety and autistic spectrum disorders (Brereton, 2000; Gray & Tonge, 2000).

Good test-retest reliability and a moderate interparent and parent-teacher agreement was found in a large representative sample of Dutch children with ID and borderline intellectual functioning. In addition, good criterion-related validity was shown by significant mean DBC scale differences between referred and nonreferred children and between children with or without a corresponding DSM-IV diagnosis (Dekker *et al.*, 2002). Further research is needed to assess the reliability and validity of the revised DBC-P and DBC-T subscales in both clinical and community samples. In the Australian sample a clinical cut-off score of 46 or larger for the Total Behaviour Problem Score was found to discriminate best between psychiatric cases and noncases (Einfeld & Tonge, 1992, 1995). However, more research is needed to try to replicate these findings in other samples and to establish valid scale cut-off scores that discriminate best between children and adolescents in need of professional mental health care versus those who are not. Finally, research is needed to test whether the present internal structure will replicate across different samples.

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