

Diagnostic Inventory for Screening Children (DISC): Evidence of Concurrent Validity in a Preschool Rehabilitation Setting

Abstract

The concurrent validity of the Diagnostic Inventory for Screening Children (DISC) and the Vineland Adaptive Behavior Scales Survey Form was investigated in a sample of 26 preschoolers (mean age = 56.96 months, SD=5.61; 15 male, 11 female) in a rehabilitation day treatment setting. Parent and teacher report on the Vineland was comparable. Pearson correlations between the DISC and Vineland yielded an expected pattern with significant correlation between parallel scales ($p < .01$). Repeated measures ANOVAs comparing age equivalents for five similar DISC and Vineland scales indicated no significant differences ($p > .01$). The results support the concurrent validity of the DISC.

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The Diagnostic Inventory for Screening Children (DISC; Amdur, Mainland, & Parker, 1999) is an individually-administered test for referred preschool children from birth to five years old who are suspected to have a developmental disability. The DISC was developed in Ontario to fill a clinical need for a measure more sensitive than screening instruments used in mass testing of non-referred children and less expensive and comprehensive than a full diagnostic assessment (Parker, Mainland, & Amdur, 1990). The DISC has good reliability (Darrah, Hodge, Magill-Evans, & Kembhavi, 2003; Drummond, Fleming, McDonald, & Kysela, 2005; Parker et al., 1990), but validity data are limited (Parker et al., 1990; Watson & Henington, 1998). Despite this relatively weak psychometric foundation of the DISC (e.g., Watson & Henington, 1998), it is used in various programs across Canada (Darrah et al., 2003; Drummond et al., 2005; Heidebrecht, 2006; Horner & Heidebrecht, 2004), and is potentially useful as an upward extension of the Bayley Scales of Infant and Toddler Development (Bayley, 2005) for assessing low functioning children who are too old

for the Bayley. The aim of the present study was to investigate concurrent validity of the DISC with the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, & Cicchetti, 1984), a psychometrically robust measure of adaptive skills for children with developmental disabilities (e.g., de Bildt, Kraijer, Sytema, & Minderaa, 2005).

Preschool-age children with developmental disabilities require assessment at regular intervals in order to be considered qualified for many intervention programs, to facilitate program planning, and to assess developmental progress (American Association on Mental Retardation, 2002; Sattler, 2006). Ideally, assessment should provide a clear link to intervention (Gilliam & Mayes, 2000), but standard measures, such as intelligence tests, often have too high a "floor" for this population and provide little information useful to intervention planning (Siegel-Causey & Allinder, 1998).

The DISC was developed with facilitation of treatment planning as an important goal (Amdur et al., 1999). The DISC provides a profile of scores in eight skill areas, each of which contains 27 items arranged by difficulty and distributed fairly evenly across the age range: Fine Motor, Gross Motor, Receptive Language, Expressive Language, Auditory Attention and Memory, Visual Attention and Memory, Self Help, and Social Skills. The items are scored by prompting the child and observing the child's response, although caretaker report may be accepted for Self Help, Social Skills, and for Expressive Language items below age two.

DISC items were derived from a review of the developmental literature and from existing intelligence and developmental tests, standardized on 500 participants, and normed on an additional sample of 571, with about 50 children at each of 11 age ranges (Parker et al., 1990). The test

authors reported good reliability (split-half .98 - .99, test-retest .94 - .98 over a one week interval). Small sample validity studies suggested adequate concurrent validity with the Stanford-Binet (Terman & Merrill, 1972) and Denver Screening Test (Frankenburg & Dodds, 1969), although the DISC identified more children as delayed than either the Denver or Binet (Parker et al., 1990). Concurrent validity with the Minnesota Child Developmental Inventory (Iretin & Thwing, 1974) has also been demonstrated with Pearson correlations of .76 - .88 on scales measuring similar skills (Hopchin & Erickson, 1997). The DISC is currently used to identify young children for early intervention programs and to monitor their progress in program (Darrah et al., 2003; Drummond et al., 2005; Horner & Heidebrecht, 2004).

The DISC may be particularly useful for evaluating older preschool-age children who are low functioning and able to respond to very few items on age-appropriate intelligence tests. The DISC scales begin with items below the one year level for typically-developing children, providing opportunities to observe the child's skills within a range appropriate to the child's cognitive level. Direct observation of the child is a potential advantage of the DISC over parent-reported measures often used for this population, but the child may not exhibit the same knowledge and behaviours during formal testing as in the more familiar home environment, and important low base-rate behaviour may not occur during the observation period. Consequently, using a multi-method, multi-informant approach that takes advantage of both direct observation and report by informants who know the child well is recommended (e.g., Carter, Briggs-Gowan, & Davis, 2004). The present study compared direct observation of the child (DISC) with both parent and teacher rating of child skills (VABS). Because parent report is potentially involved on

several DISC scales, rater bias is a possible contaminant of DISC and parent-reported VABS comparisons. Teacher-reported VABS provide an additional set of ratings uncontaminated by parent bias.

An adaptive behaviour measure was selected as an appropriate comparison measure for the DISC rather than an intelligence test for several reasons. As mentioned above, intelligence tests often have too few low level items to provide a useful sample of the skills of a child who is low functioning. Further, definitions of the term 'mental retardation' in the United States emphasize measurement of adaptive behaviour over intelligence (Kraijer, 2000; Schalock, 1999). In addition, IQ and adaptive behaviour measures tend to be highly correlated in low functioning populations (Bloom & Zelko, 1994; de Bildt, Serra, Luteijn, Sytema, & Minderaa, 2005; Liss et al., 2001). Adaptive behaviour measures provide a richer sample of the child's skills and translate more directly into intervention goals than do standard IQ tests (Siegel-Causey & Allinder, 1998).

The VABS provide psychometrically sound estimates of a range of adaptive skills (communication, daily living skills, socialization, and motor skills), with alternate forms standardized specifically for obtaining information from the child's teacher in a rating scale format (Classroom Edition; Sparrow, Balla, & Cicchetti, 1985) or from the parent through a semi-structured interview (Survey Form; Sparrow et al., 1984). Research examining interrater reliability of the VABS Classroom and Survey for children with developmental disabilities has shown that the Survey Form correlates significantly with the Classroom Edition, but yields systematically lower skill estimates than does the Classroom Edition for children with developmental disabilities (Hundert, Morrison, Mahoney, Mundy, & Vernon, 1997; Szatmari, Archer, Fisman, & Streiner, 1994; Voelker, Shore,

Hakim-Larson, & Bruner, 1997). Most of the Survey and Classroom items overlap, but the Survey has a greater density of items at the lowest levels. When teacher and parent responses on identical items are compared, there is close agreement (Voelker, Shore, Lee, & Szuszkiewicz, 2000). Given this Classroom Edition floor effect, the Survey is more appropriate for evaluating low functioning children. The Survey Form has excellent reliability and construct validity in this context (de Bildt, Kraijer, et al., 2005), and it provides results comparable to the standard parent interview when administered to teachers in checklist format (Voelker, Johnston, Agar, Gragg, & Menna, 2007). The present study investigated concurrent validity of the individually-administered DISC with the VABS Survey Edition administered as a checklist to teachers and semi-structured interview to parents.

Method

Participants

The sample included 26 children in a self-contained rehabilitation day treatment program in southern Ontario. The 15 male (58%) and 11 female (42%) participants ranged in age from 49 to 71 months ($M=56.96$; $SD=5.61$). All children evidenced severely compromised functioning in multiple areas, including cognitive, sensory, and motor skills, all secondary to congenital central nervous system damage.

Measures

The Diagnostic Inventory for Screening Children (DISC) was completed for each of the study participants. Each of the DISC's eight scales is comprised of 27 items scored yes, no, or refusal/no opportunity. Each scale yields a percentile or age equivalent score. The test authors recommend using the percentile scores: "A" for average/

above average performance (%ile >24), "P" for possible delay (%ile 10-24), or "D" for delay (%ile <10). There is no composite score for the DISC to avoid obscuring significant variation in skills across scales (Amdur et al., 1999).

The VABS Survey Form contains 297 items and is administered to the child's caretaker through a semi-structured interview. For the present study, the maladaptive behaviour section was excluded, reducing the number of items to 261. The Survey summary score, the Adaptive Behavior Composite, is derived from four domains, each of which is divided into subdomains: Communication - Receptive, Expressive, and Written; Daily Living Skills - Personal, Domestic, and Community; Socialization - Interpersonal Relationships, Play and Leisure Time; and Motor Skills - Fine and Gross. Each item is scored as never, sometimes, or usually performed, don't know, or no opportunity. Standard scores are available for the domains and composite, but not for the subdomains. Subdomains are scored using age equivalents or adaptive levels (i.e., Adequate, Moderately Low, Low). Due to differences in range across domains and subdomains, raw scores are recommended for statistical analysis (Carter et al., 1998).

Procedure

The DISC was individually administered according to standard procedures (Amdur et al., 1996) in the context of regular clinical assessment of developmental progress of children enrolled in preschool day treatment. The VABS Survey was administered to each child's mother ($n=22$; 85%), father ($n=2$; 7%), mother and father together ($n=1$; 4%), or grandmother ($n=1$; 4%) following the standard semi-structured interview format. Advanced doctoral students in child clinical psychology administered the above measures.

The checklist version of the VABS Survey developed in Voelker et al. (2007) was completed by each child's teacher. The teachers had graduate degrees in special education and taught the participating children in small classes of about five students for a minimum of four hours a day. Teachers completed the VABS in the second semester, so each teacher had a minimum of four months of extensive contact with each child before completing the ratings, well beyond the one to two months suggested by Cicchetti and Sparrow (1989) as sufficient to ensure reliable ratings. All measures were administered within approximately one week for each child.

Results

Mean age equivalents in months and standard deviations for the scales of the DISC and the subdomains of the VABS Parent and Teacher Surveys are presented in Table 1 [page 72]. These scores reflect delayed skill development in all areas, with the weakest performance across measures in gross motor skills and, specific to the VABS Teacher Survey, Community Daily Living Skills. On average, the present study sample performed at about the 2 ½ year level, indicating overall skills more than two years below chronological age.

The DISC and the VABS Surveys feature a subset of five scales with similar content: Fine Motor, Gross Motor, Receptive Language, Expressive Language, and Self-Help (DISC)/Personal (VABS). Mean age equivalent scores for these scales are graphically depicted in Figure 1 [page 73]. Five one-way univariate repeated-measures ANOVAs comparing age equivalent scores for the five scales across the DISC and both administrations of the VABS were conducted. For these analyses, a Bonferroni correction was implemented to reduce the probability of Type 1 error (Howell, 1992). The ANOVAs revealed

Table 1. DISC Scale and VABS Parent and Teacher Survey Subdomain Age Equivalent Scores in Months

DISC Scale/ VABS Subdomain	DISC		Parent Survey ^a		Teacher Survey ^b	
	M	SD	M	SD	M	SD
DISC/VABS Fine Motor	29.56c	13.58	27.12	15.11	24.21	15.96
DISC/VABS Gross Motor	19.28c	11.16	20.40	14.08	19.17	14.69
DISC/VABS Receptive Language	36.36d	11.98	33.40	12.56	34.38	16.77
DISC/VABS Expressive Language	30.54d	13.27	30.60	14.89	25.96	12.54
DISC Self-Help/ VABS Personal	27.41e	12.13	25.52	11.58	23.67	12.61
DISC Social	35.02e	10.64	-	-	-	-
DISC Auditory Attention and Memory	28.30a	09.63	-	-	-	-
DISC Visual Attention and Memory	29.90b	10.69	-	-	-	-
VABS Written	-	-	31.84	17.85	35.79	16.34
VABS Domestic	-	-	26.08	10.39	25.96	08.63
VABS Community	-	-	30.52	14.15	19.58	11.10
VABS Interpersonal	-	-	30.96	13.58	24.25	14.71
VABS Play	-	-	24.04	09.80	24.13	12.47
VABS Coping	-	-	40.84	14.92	36.75	17.16

a n=25, b n=24, c n=9, d n=26, e n=23.

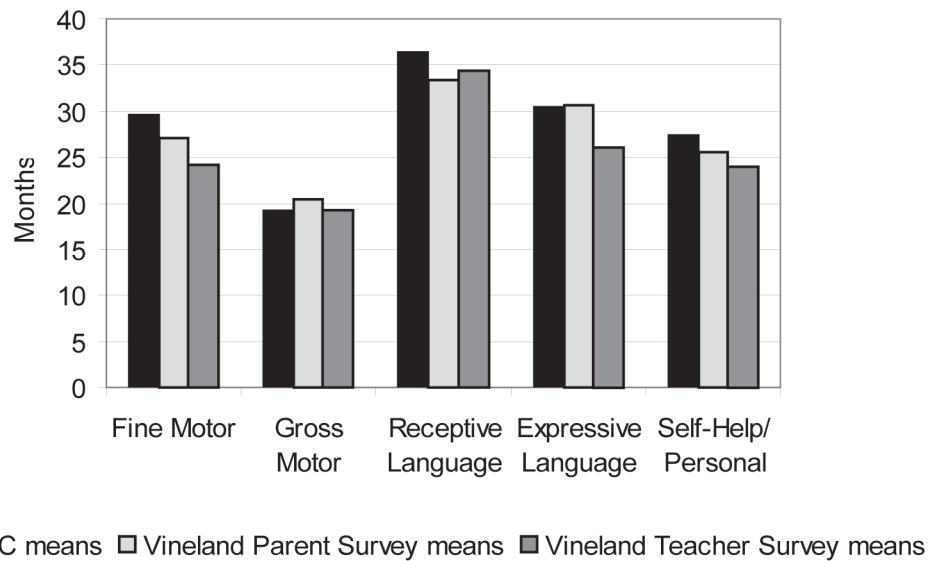


Figure 1. Comparison of mean age equivalent scores for VABS Parent and Teacher Survey and DISC scales with similar content.

that the age equivalent scores for each of the five scales did not differ significantly across measures ($p > .01$).

The mean raw scores by parents and teachers appeared to be relatively close for most sub-domains (Table 1), but to test for statistically significant difference, raw scores for the 11 VABS subdomains were compared for teacher and parent report using t-tests. To reduce the probability of Type I error, a conservative level of significance was adopted based on a Bonferroni correction (Howell, 1992). Although the parent means were higher for most subdomains (indicating greater skill in the child), only the Daily Living Skills Personal and Community subdomains were significant ($p < .0045$), indicating that parent and teacher report were largely comparable.

The complete set of VABS and DISC raw scores were compared using Pearson correlations. As illustrated in Table 2, the correlation matrix shows a pattern of significant relations in the expected direction with scales measuring similar skills showing the strongest correlations and scales measuring dissimilar skills showing weaker correlations. The DISC Fine and Gross Motor scales are most highly correlated with their counterparts on the VABS and with VABS subdomains involving skills dependent on motor facility, such as caring for personal hygiene and helping with household tasks. The lack of a relationship between motor scales and the written communication subdomain appears to be conceptually inconsistent; however, the easiest two items on the latter measure are at the five year level and emphasize verbal skills (i.e., Recites all letters of the alphabet from memory; Reads at least three common signs). As would be expected, the DISC motor scales are most weakly related to VABS language measures.

Similarly, the DISC language measures are most closely related to parallel VABS language measures and least related to VABS motor skill scores. The DISC language scales are also strongly related to the VABS Socialization subdomains, which are comprised of a number of items requiring verbal skills, such as saying "please" and labeling emotions, and to the Community subdomain of Daily Living Skills, which involves verbal items, such as those pertaining to appropriate telephone use. The Auditory and Visual Attention and Memory Skills scales show a pattern very similar to that of the language scales. The DISC Self-help scale is similar in content to the VABS Personal subdomain and is most highly correlated with that subdomain. Self-help contains items requiring motor skills, such as putting on and fastening clothing and using utensils, so the significant correlation with VABS motor skill subdomains is consistent. Finally, the DISC Social scale is most closely related to the VABS Socialization subdomains and language measures and least related to VABS motor skill measures.

Discussion

The present study investigated the usefulness of the DISC in a preschool rehabilitation setting through comparison with the Vineland, a psychometrically robust measure with demonstrated reliability and validity for this population (e.g., de Bildt, Kraijer et al., 2005). The findings support the concurrent validity of the DISC. The correlation matrix comparing DISC scales and VABS subdomains yielded a pattern of significant and nonsignificant relations that is quite consistent conceptually. The mean age equivalent comparisons of a subset of parallel DISC and VABS scores yielded no significant differences. These results suggest that the DISC provides skill estimates comparable to those provided by the VABS.

Identifying the best tools for assessing young children in rehabilitation can be quite challenging because the children may present with a broad range of skills, from substantially impaired to near age

level in different skill domains. The DISC provides a density of items at the infancy/toddler level, making it possible to obtain a broader sample of the child's skills. The DISC may be particularly useful for older preschool children who are too old for the Bayley, but who have very limited skills in one or more domains.

Additional validity studies are needed to further strengthen the psychometric properties of the DISC. A DISC/Bayley comparison for children in the infancy/toddler range would be useful to investigate concurrent validity of the DISC relative to a commonly used, more extensive individual test of development. The Mullen Scales of Early Learning (Mullen, 1995) provide a measure similar to the DISC in both skills assessed and age range covered, so a concurrent validity study comparing these two measures could provide evidence of validity from birth through five years.

Many of the skill domains and items contained in the DISC are similar to skills assessed on adaptive behaviour measures. The DISC Auditory and Visual Attention and Memory scales are unique and warrant further investigation. In the present study, these two scales correlated most strongly with VABS scales emphasizing verbal skills and least with scales emphasizing motor skills. In a similar study comparing the DISC and Minnesota

Table 2. Correlations between VABS Parent and Teacher Survey Subdomain and DISC Scale Scores

VABS Subdomain	DISC Scale							
	Fine Motor (n=9)	Gross Motor (n=9)	Receptive (n=25)	Expressive (n=25)	Auditory (n=24)	Visual (n=24)	Self Help (n=22)	Social (n=22)
Receptive	-.21/.33	-.44/.28	.55**/.60**	.26/.34	.25/.56**	.20/.51*	-.05/.27	.42/.82**
Expressive	.08/.19	-.02/.11	.67**/.69**	.84**/.80**	.83**/.84**	.63**/.68**	.45*/.54*	.59**/.69**
Written	.28/.48	.02/.38	.36/.41*	.43*/.44*	.45*/.37	.36/.36	.33/.42	.43*/.46*
Personal	.77*/.81**	.84**/.84**	.26/.25	.35/.29	.36/.33	.32/.38	.86**/.88**	.45*/.46*
Domestic	.71*/.59	.71*/.67*	.11/.03	.24/.23	.42*/.26	.38/.23	.54**/.67**	.32/.19
Community	.13/-.01	.12/-.09	.56**/.53**	.61**/.51**	.61**/.50*	.48*/.42*	.32/.38	.55**/.55**
Interpersonal	.07/.47	.08/.23	.58**/.56**	.76**/.41*	.76**/.47*	.62**/.44*	.38/.36	.74**/.68**
Relationships								
Play	.54/.20	.60/.02	.56**/.38	.53**/.21	.66**/.41*	.64**/.44*	.49*/.40	.48*/.62**
Coping Skills	.21/.00	.23/.04	.55**/.44*	.61**/.54**	.70**/.63**	.60**/.50*	.48*/.69**	.45*/.54*
Gross Motor Skills	.88**/.84**	.94**/.91**	.09/.04	-.02/.07	.10/.24	.18/.26	.72**/.86**	.08/.21
Fine Motor Skills	.86**/.68*	.72*/.69*	.29/.12	.30/.20	.41*/.41*	.49*/.40	.76**/.84**	.20/.25

Note. The first number in each cell represents a correlation between the DISC and the VABS Parent Survey, and the second number in each cell represents a correlation between the DISC and the VABS Teacher Survey.

Receptive = Receptive Language; Expressive = Expressive Language; Auditory = Auditory Attention and Memory; Visual = Visual Attention and Memory.

*p<.05; **p<.01.

Child Development Inventory (MCDI), Hopchin and Erickson (1997) reported that the Auditory and Visual Attention and Memory scales were most strongly related to the MCDI General Development scale. These results suggest that the Attention and Memory scales may serve as general indicators of ability. Comparison with relevant measures to investigate this possibility is recommended.

Previous studies have reported that the DISC tends to identify more children as delayed compared to other measures (Hopchin & Erickson, 1997; Parker et al., 1990). In the present study, a subset of five similar DISC and VABS scales were compared, and no statistically significant differences were found. In fact, for three of these nonsignificant comparisons, the DISC actually had a higher mean (i.e., would identify fewer children as delayed). The inconsistency with previous studies likely reflects a difference in population studied. The previous studies cited included children with a broad range of abilities, whereas the present study involved children restricted to a lower range of abilities. In the present study setting, the DISC and VABS seem to provide comparable skill estimates.

The use of multiple informants and testing techniques is often recommended, particularly for young children with disabilities (e.g., Carter et al., 2004). The DISC and VABS appear to be two measures that might be used together for comparison and corroboration. The DISC provides direct observation of the child's skills, relatively uncontaminated by parental report bias, while the VABS enable the examiner to take advantage of the parent's experiences with the child in a broad array of contexts. The present study results suggest that the DISC and VABS will yield fairly comparable skill estimates for young children with significant disabilities.

Although the focus of the present study is not on the VABS, some discussion of the VABS findings is warranted. It is typically reported in the literature that when differences are found between teacher and parent report, it is generally the parent reporting greater skill in the child (e.g., Hauser-Cram, Krauss, Warfield, & Steele, 1997). In the present study, parents reported more skill than did teachers on most VABS subdomains, but only 2 of 11 comparisons were significant. Consistent with previous research comparing parent and teacher report for low functioning children (e.g., Voelker et al., 2000), parent and teacher report was essentially comparable in the present study. The two areas in which parents reported greater skill (community and personal daily living skills) may reflect the different environments in which parents and teachers typically observe the children.

Administration of the questionnaire version of the VABS Survey to teachers yields more useful information for this population than does the standard Classroom Edition (Voelker et al., 2007) while retaining the more efficient administration of the Classroom Edition checklist format. The most recent edition of the VABS (Sparrow, Cicchetti, & Balla, 2005) has a checklist version for the Survey Form, but it has not been investigated using teacher report. Research with the previous VABS edition, including the present study, suggests that this would be a useful direction of investigation.

In summary, the DISC is a practical assessment tool developed out of clinical need that is used across Canada (e.g., Darrach et al., 2003) despite limited information about its psychometric properties (e.g., Watson & Henington, 1998). The present study results suggest that the DISC fills a gap in individual assessment of older preschoolers with significant disabilities and that it compares favourably with the VABS, a well-established, informant-report measure.

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