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Leisure activities in Prader-Willi syndrome: Implications for health, cognition and adaptive functioning

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Abstract

To this day, I can recite the Sara Sparrow definition of adaptive behavior. To this day, I recall Sara sitting on the other side of a one-way mirror observing me, an inexperienced clinical psychology intern, administer the Vineland Adaptive Behavior Scales to the mother of a child with learning disabilities. Talk about nervous-- the world's expert on adaptive behavior held my very internship and career success in her hands! Even though I stumbled through it, Sara reassured me that I did great...all I needed was more practice. So, thousands of Vineland's later, I was launched.

Both my first and my latest publications in the disability field used assessment tools that I learned from Sara—primarily the Vineland, but also several cognitive tests. Beyond these tools, I cherish key insights from Sara that have stayed with me over the long haul. First and foremost, Sara taught me how to be a real psychologist, how to carefully observe and assess people with standardized tools and with my own eyes and ears. Second, she instilled a practical skill that I still am working on—always be on time even if others are late!

Third, Sara imbued a sense of fun and adventure into our training and she continued to be a source of inspiration and fun in the years after I left Yale. For us data-driven types, the process of research and discovery is inherently fun—it is a total blast. Yet Sara modeled that fun and enjoyment need to come in other ways that are more balanced or well-rounded—that are, in a word, adaptive. It seems a fitting tribute to Sara to submit a paper that related her treasured Vineland Scales to how people with developmental disabilities have fun. Thank you, Sara.

Prader-Willi syndrome (PWS) is a neurodevelopmental disorder associated with a complex and debilitating behavioral phenotype. Key features include mild to moderate intellectual disabilities; repetitive, compulsive behaviors; tantrums; irritability and negative mood; hypotonia; growth hormone dysfunction; hyperphagia; and increased risks of morbid obesity, psychosis, and autism spectrum disorders (Dykens, Roof & Lee, 2011; Whittington & Holland, 2004).

Seen in approximately 1 in 10,000 births, PWS is caused by a lack of paternally-derived imprinted material on chromosome 15q11-q13. Most individuals have paternal deletions that vary in size (Type I deletions are 500bp larger than Type II deletions), or maternal uniparental disomy (mUPD; when both copies of chromosome 15 are maternally inherited). Despite genetic advances in understanding the 15q11-q13 region, PWS remains a life threatening and extremely challenging disorder for professionals and families to manage.

Most behavioral studies in PWS focus on such clinically urgent problems as hyperphagia, obesity, self-injury, and comorbid psychiatric disorders (Soni et al., 2007; Dykens & Shah,

2003). PWS is also characterized by repetitive, compulsive behaviors including skin picking, hoarding, redoing, concerns with exactness, and repeated questioning (Clarke et al., 2002; Dykens, Cassidy & Leckman, 1996). In contrast, few studies have identified the everyday life functioning of individuals with PWS, including their adaptive skills and leisure time activities. Adaptive skills are generally defined as the performance of those behaviors required for personal and social sufficiency (Sparrow, Cicchetti & Balla, 2005) and are best measured by what people actually do, not what they can do.

Three themes have emerged from the scant adaptive behavior literature in PWS. First, salient problems in PWS, including insistence on sameness, compulsivity, irritability and food seeking, often impede optimal social adaptive functioning, as well as academic achievement (Whittington et al., 2004). Parents, teachers and other care providers thus face a constant challenge of how to best promote optimal adaptive functioning, learning, and independence in people with PWS, while also assuring their food safety and supervision (Dykens et al., 1997).

Second, people with PWS may show profiles of relative strengths and weaknesses in their adaptive skills. Previously, we found that adults with PWS had relative strengths in the Vineland's Daily Living Skills domain, especially in personal and domestic subdomains, as well as weaknesses in the Socialization domain, primarily coping skills (Dykens, Hodapp, Walsh & Nash, 1992). More recently, Holland et al. (2003) reported this same profile of Vineland adaptive functioning in a PWS cohort in the UK, though specific strengths were also noted in community daily living skills.

A final and unresolved question relates to differences in adaptive and other behaviors across molecular genetic subtypes of PWS. Those with mUPD generally have better developed expressive language (Roof et al. 2000; Whittington et al., 2004), somewhat poorer visual-spatial functioning (Dykens, 2002; Verdine, Trosseth, Hodapp, & Dykens, 2008), and are at higher risk than their deletion counterparts for autism spectrum disorders and/or severe psychiatric illness (Dykens, Roof & Lee, 2011; Boer et al., 2002; Veltman, Craig, & Bolton, 2005).

Regarding paternal deletions, some researchers find that people with Type I as opposed to Type II deletions have significantly lower Vineland Adaptive Behavior scores, lower reading and math achievement, as well as more depression and compulsions (Bulter et al., 2004; Hartley et al., 2005; Zarcone et al., 2007). Other groups, however, find no such cross-sectional differences across deletion sizes (Dykens & Roof, 2008; Milner et al., 2005; Varela, Kok, Setian, Kim, & Koiffmann, 2005). In previous work, we proposed that inconsistencies in deletion subtype findings relate to age, and that genetic subtype differences are primarily seen in developmental trajectories, or when behavior is measured over the course of time (Dykens & Roof, 2008).

Beyond adaptive behavior, data are scant on the recreational or leisure activities of those with PWS. Although one subdomain of the Vineland assesses play and leisure, it does not provide an in-depth inventory of specific recreational activities. Daily exercise, for example, is critically important for people with PWS, as regular exercise, along with a reduced calorie diet and restricted access to food, are the most effective ways to curb obesity and maintain a healthy weight in this population. Some individuals with PWS are less motivated to exercise in light of their hypotonia, clumsiness, obesity, lower resting metabolic rates, and excessive daytime sleepiness. As such, studies are needed on the effects of various exercise programs on motivation as well as BMI, muscle tone, metabolism and sleep.

Regarding other leisure activities, many persons with PWS gravitate to jigsaw and word search puzzles. Based on clinical observations, Holm et al. (1993) included facility with

jigsaw puzzles as a supportive criterion in the clinical diagnostic criteria for PWS. Indeed, compared to others with intellectual disabilities, parents of children with PWS reported that they were more likely to engage in puzzle activities and less likely to play physical games or sports (Rosner, Hodapp, Fidler, Sagun & Dykens, 2004; Sellinger, Hodapp, & Dykens, 2006). Previously, we administered jigsaw puzzles to children and adults with PWS, and found that: (1) they relied on a shape-based versus visual approach to puzzle-solving; (2) strengths in solving jigsaw puzzles were not associated with standardized visuo-spatial tasks; and (3) puzzle performance was superior to comparison groups with or without intellectual disabilities (Dykens, 2002; Verdine, Troseth, Hodapp, & Dykens, 2008).

Aside from recommendations to exercise, and an attraction to puzzles, very little is known about the types and correlates of other sources of recreation or leisure in people with PWS. The present study thus examines a wide range of recreational activities in 123 people with PWS aged 4 to 48 years, and relates them to adaptive skills, IQ, age, and genetic subtypes of PWS. In doing so, we provide a view of people with PWS that is less psychopathology-oriented and more balanced or complete.

Methods

Participants

Participants included 123 individuals (54% males, 47% female) with genetically confirmed Prader-Willi syndrome aged 4 to 48 years ($M = 14.35$ years, $SD = 9.65$). Individuals with PWS and their care providers were recruited as part of an ongoing longitudinal study on behavior and development in PWS and other developmental disabilities. The majority of participants lived at home with their parents, or in a few instances, with a grandparent. Eight adults lived in group homes or supported living situations, though parents still accompanied their offspring to the research visit and served as informants, with input as needed from staff.

Participants had, on average, mild levels of delay, with a mean IQ of 65.92 ($SD = 16.52$) as determined by the Kaufman Brief Intelligence Test-2 (KBIT-2; Kaufman & Kaufman, 2004). Based on CDC BMI guidelines, the majority (78%) of adults with PWS aged 21 years and older ($n = 25$) were classified as obese, and 22% as overweight. Among children and youth up to age 20 years ($n = 65$), 29% had average BMI's (between the 5th to 85th percentile for age and gender), 21% were overweight, (85th to 95th percentile) and 50% were obese (above 95th percentile). All adults and the majority of children were thus overweight or obese.

Genetic subtypes of PWS were clarified or established as part of the ongoing longitudinal study. Most participants (51%) had paternal deletions (21% Type I, 30% Type II), and 35% had mUPD. Approximately 14% had more rare genetic causes of PWS (e.g., translocations, imprinting mutations, unique deletions), and given low numbers, were excluded from analyses related to genetic subtypes.

Procedures

After obtaining informed consent and assent, parents and their offspring with PWS were individually administered a comprehensive test battery during their visit to the Vanderbilt Kennedy Center. The present study included the following measures:

Demographics—To assess demographic characteristics, a questionnaire was administered that tapped family composition, parental educational, employment and health status, as well

as genetic, dietary and health information about the participant with PWS. Current height and weight were ascertained during each participants' physical exam.

Kaufman Brief Intelligence Test-2—(KBIT-2; Kaufman & Kaufman, 2004). The individually administered KBIT-2 was designed for research and screening purposes for individuals aged 4 through 90 years. The KBIT-2 has been successfully used in people with intellectual disabilities, and yields an overall Composite, Verbal and Nonverbal standard scores.

Vineland Adaptive Behavior Scales-II (Sparrow, Cicchetti, & Balla, 2005)—This semi-structured interview with parents or informants identifies the performance of behaviors required for personal or social self-sufficiency. The widely-used Vineland scales assesses adaptive behaviors from infancy through adulthood, and yield standard scores for an Adaptive Behavior Composite, and three domains: Communication (receptive, expressive, written subdomains), Daily Living Skills (personal, domestic, community) and Socialization (interpersonal relations, use of play and leisure, coping skills).

Yale-Brown Obsessive Compulsive Scale—(Y-BOCS; Goodman et al., 1989). Parents completed an informant version of the Y-BOCS that consisted of 30 obsessive, compulsive symptoms that were rated as occurring ever or in the last week. Skin picking was separately analyzed, as is distinct from other compulsions (Feurer et al., 1998). Informants also rated the degree of distress, time, and adaptive impairment caused by symptoms; these were summed as a severity score. The Y-BOCS has been used in other PWS work (Clarke et al., 2002, Dykens et al., 2007).

Recreation and Leisure Questionnaire—This questionnaire was originally developed to assess the leisure activities of children and adults with intellectual disabilities. Items were derived with input from parents, offspring and professionals, and the tool has satisfactory psychometric properties (Sellinger, Hodapp & Dykens, 2006). Even so, factor analyses were conducted to identify meaningful clusters of items for participants in the present study.

Parents use a 5-point scale to rate how frequently their offspring currently plays or engages in 30 specific leisure activities: 0 = *rarely, never*, 1 = *few times a month*; 2 = *1 to 3 times weekly*; 3 = *4 to 6 times weekly*; 4 = *daily*. Some activities were distinct to young versus older ages (e.g., plays with dolls versus goes out shopping for fun), and others were common to all ages, but the content was presumably more complex or challenging in older individuals (e.g., reading, puzzles, watching TV). Given the age range of participants in this study, questionnaire items were not included that tapped infant or toddler activities (e.g., peek-a-boo). Prior to rating the 30 items, respondents first completed an open-ended question: "What does your son/daughter do with free time at home?" Spontaneous responses to this question were analyzed separately.

Results

Recreational Activities

Factor Analysis—Thirty items were subjected to an exploratory factor analysis with varimax rotation. Items were omitted that did not load onto any factor (loadings < .30; e.g., sings in chorus, skateboarding, plays golf or tennis). The final solution included 24 items in seven discrete factors that collectively accounted for 71% of the variance. Table 1 lists these items along with their associated factor labels, loadings, Cronbach's alphas and Eigenvalues. One item that did not load onto any factor, watching TV, was retained for exploratory analyses because it emerged as the most frequently endorsed recreational activity in this

sample. Only two respondents (2%) endorsed rarely watching TV, whereas 74% watched TV daily, and 24% from 1 to 6 times a week.

Frequencies—Table 1 summarizes the mean frequencies of the seven factors derived from the Recreational and Leisure Questionnaire. The top three, most frequent free time activities were watching TV, computer/electronic games, and arts and crafts.

Open-ended Question—A content analysis was conducted of responses to the open-ended recreation question “How does your child spend his/her free time?” Parents were asked to provide three answers, and codes were then established for screen-time activities, as these were the most frequent activity noted by parents. Responses were categorized as: no screen time (25% of sample); computer or electronic games only (25%); TV viewing only (26%); and both TV and computer games (24%). Age differed significantly across these categories (see Table 3) and was thus used as a covariate in ANCOVAs examining screen time in relation to adaptive behavior, IQ and BMI. Table 3 shows that the TV viewing group had significantly lower IQ scores than remaining groups, while those who spent free time watching TV and playing computer games had the highest BMIs.

Correlates

Gender and Age—A single gender difference was found on the Recreation and Leisure Questionnaire: males were more likely to engage in action-oriented pretend play; $t(110) = 3.12, p < .01$. No gender differences emerged on any other measure. Age was significantly correlated with several Recreational and Leisure Questionnaire factors, as well as with the Vineland-II and KBIT-II standard scores. As such, age was used as a covariate in all analyses.

Adaptive Behavior and IQ—Table 3 presents partial correlations between recreation factors and the Vineland and KBIT-II domains, with age as a covariate. Given the wide range of recreation activities, separate correlations were conducted for participants above and below 18 years of age (M ages = 27.23 and 9.23 years, respectively). Age 18 was selected as it typically marks the exit from high school and a transitional period that presumably entails major changes in recreational opportunities, daily activities, and leisure time. Given the number of analyses performed, a more stringent $p < .01$ was adopted.

Among adults, the Computer/Electronic Games factor was positively correlated with the Vineland’s Communication domain, and with all domains of the KBIT-2. Among children and youth, significant correlations were found between Physical Activities, Puzzles and Games, and Computer/Electronic games with various adaptive and IQ domains (see Table 3).

Genetic subtypes—ANCOVAs assessed if Recreation and Leisure factors differed across the three major PWS genetic subtypes (Type I or Type II deletions, mUPD). No differences were found. ANCOVAs also compared IQ and adaptive behavior across subtypes, with age as a covariate. Those with Type I deletions scored significantly lower than their counterparts on the Vineland’s Socialization domain at the $p < .05$ level. No other significant differences were found.

Repetitive Behaviors—Covarying for age, Physical Activities for the group as a whole was associated with less skinpicking and lower BMI’s, $r(113) = -.58$ and $-.45$, respectively, $p < .001$. Puzzles/Games and Watching TV were positively correlated with skinpicking, $r(111) = .37$ and $.39$, respectively, $p < .001$. Watching TV was also associated

with YBOCS Obsessions, Compulsions, Symptom Severity, $r(109) = .32, .31, .39$, respectively, $p < .01$ and $.001$.

Discussion

Most behavioral studies in PWS focus on salient problems that pose management challenges to parents and professionals alike. This study took a different approach, and is the first to probe everyday leisure activities in PWS and how they relate to adaptive functioning, IQ, age and compulsivity. Several provocative findings demonstrate the promise of examining everyday recreational activities in future phenotypic studies in PWS and other developmental disabilities.

First, the most frequently endorsed recreational activity in this sample was a decidedly sedentary one -- watching TV. This activity was not associated with other leisure time pursuits, or any cognitive or adaptive advantages. Instead, TV viewing was correlated with increased skin picking, and more frequent and severe compulsive-like behaviors. Skin picking is a prevalent, repetitive, self-injurious behavior in PWS that ranges from mild to severe, and may lead to serious medical complications (e.g., infections, picking at surgery sites). Anecdotally, parents report that skin picking increases during down time, such as TV or bedtime. This behavior may also serve as a maladaptive response to anxiety, transitions, and social or behavioral demands (Didden, Korziliuz, & Curfs, 2010).

Relations between TV and obsessive-compulsive symptoms in PWS may be explained in several ways. First, some people with PWS may become “obsessed” with specific TV shows or characters. Also, the rigidity and insistence on sameness in routines often seen in PWS may be expressed around TV, e.g., we watch the same TV shows, at the same times, sitting in the same chair. Finally, watching TV itself may contribute to anxiety and distress. Growing evidence links TV viewing to poorer mental health in both children and adults in the general population, as indexed by symptoms of anxiety, depression, and distress (Hamer, Stamatakis, & Mishra, 2009, 2010).

Among people in general, watching TV is one of several factors contributing to the current obesity epidemic, along with such associated behaviors as less physical activity, being sedentary for periods of time, and consuming calorie dense snacks while watching TV (e.g., Foster, Gore & West, 2006; Fulton et al., 2009). Rates of TV viewing have yet to be widely studied in people with intellectual disabilities. However, given many barriers to inclusive recreation opportunities in communities and schools (Frey et al., 2005), watching TV at home may be even more frequent in the intellectual disability versus general population. Those with PWS or other intellectual disabilities may thus experience even more pronounced effects of watching TV on weight, a sedentary life style, snack food consumption, reduced physical fitness, and poorer mental health.

Correlations between TV watching and BMI were difficult to ascertain in our PWS sample due to a ceiling effect or constricted range in both parameters: most participants watched TV daily, and most were overweight or obese. However, we were able to examine BMI in relation to spontaneous responses from parents that were coded for TV and other screen-time activities. Controlling for age, those who watched TV *and* played computer games had significantly higher BMIs than all others, suggesting an association between more screen time and degree of obesity. At the same time, computer/electronic games were positively associated with IQ, as reflected in both a lower IQ among those who watched TV only, and in positive correlations between computer/electronic games and verbal and nonverbal IQ.

These computer game and IQ associations are intriguing, and mirror findings from more rigorous intervention studies in the general population. Mackey, Hill, Stone and Bunge (2011) found that, among 7 to 9 year olds in a two-month afterschool program, nonverbal IQ scores increased significantly after subjects played with electronic and other games that tapped planning and higher-order reasoning skills. In contrast, children who played games that recruited processing speed showed improvements in a speed-based decoding symbols task, but not in higher-order reasoning. Certain fluid reasoning skills can thus be enhanced in typically-developing children (e.g., processing speed, planning, thinking logically to solve novel problems), and such positive effects may also exist in those with intellectual disabilities.

Associations between electronic games and IQ were found in both children and adults, but were particularly strong in adults with PWS. Perhaps computer/electronic games become more beneficial as a source of cognitive stimulation in the post-schooling years, when academic learning formally ends and service systems instead emphasize vocational or practical life skills. Relations also emerged between the Puzzles/Games domain and socialization skills and IQ, but only in children and youth, suggesting a possible shift in correlates of games across development. Controlled intervention studies are needed on the impact of playing different types of electronic and other games on the cognitive functioning of persons with PWS and other disabilities, over the course of time.

Another set of findings relate to physical activities. Participants who engaged in more physical activities had lower BMIs, an expected but reassuring finding, and they also had less frequent skin picking, which was unexpected. A by-product of increased physical activities is less sedentary down time, which is when picking often occurs. Exercise may also disrupt physiological or neural systems that underpin self-injury (e.g., dopaminergic or endogenous opioid peptide systems), thus altering the behavioral and neural networks that sustain these troublesome behaviors.

Among children with PWS, physical activities were also associated with enhanced cognitive and adaptive skills. Importantly, links between physical activity and improved cognition have been made in children and adults in the general population. In a meta-analysis, Lambourne and Tomporowski (2010) found that cognition significantly improved after exercising, especially mental processing speed, memory storage and retrieval. Repeated exercise sessions thus impact memory, executive functioning, planning and goal directed behaviors, and over time these set the stage for enhanced learning. Such positive outcomes depend on the type of exercise, when cognition is measured, and the types of cognitive tasks administered.

Relative to others, people with intellectual disabilities are less apt to get the recommended 30 minutes a day of physical activity (Frey, 2004). When enrolled in exercise studies, participants with disabilities show improved BMI, cardiovascular functioning, bone density, and lipid profiles (Rimmer, Chen, McCubbin, Drum & Peterson, 2010), enhanced quality of life (Frey, Buchanan & Sandt, 2005), and reduced behavior problems (Dykens, Rosner & Butterbaugh, 1998). Expanding these outcomes, future studies should consider the effects of exercise on specific cognitive processes in people with PWS and other intellectual disabilities.

A final set of findings relate to genetic subtypes of PWS. No subtype differences in recreation activities were found, and none of the significant associations between leisure activities, age, IQ and adaptive skills varied by genetic status. Those with Type I deletions had significantly lower Vineland Socialization domain scores, which may relate to age-related increases in withdrawal and passivity in this subtype (Dykens & Roof, 2008). Even

so, such cross-sectional comparisons may not be the best way to identify subtype differences, which are instead better assessed in developmental trajectories, over the course of time.

Several limitations of this study need to be considered. First, many infants and young children with PWS receive growth hormone therapy that targets their hypotonia and growth hormone dysfunction, however, we did not have adequate or detailed growth hormone data on participants. Second, the Recreation and Leisure Questionnaire only offered a preliminary view, and did not provide nuanced information about the type, duration, or even enjoyment of leisure time activities. Finally, although the sample size of 123 was adequate, it was not ideal for exploratory factor analyses of a 30-item measure (Costello & Osborne, 2005). Still, given this context, the questionnaire performed extremely well: 45% of factor loadings were above .80, just 3 items were in a lower range of .52 to .59, and the tool accounted for a full 71% of variance.

Despite study limitations, findings provide an important first glimpse into how people with PWS spend their time, and point to a need to examine leisure activities in others with intellectual disabilities. Such work complements standardized measures of adaptive skills such as the Vineland Scales, and provide, as Dr. Sparrow often noted, a spotlight on everyday successes. Beyond promoting fun and quality of life, intervention studies are needed that assess the impact of specific physical activities and electronic or other games on health and cognitive and adaptive functioning. These interventions, though relatively unexplored, hold considerable promise for enhancing the overall well-being of those with intellectual disabilities.

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Table 1

Factor loadings, alphas, eigenvalues, % variance for the Recreation and Leisure Questionnaire.

	Factor	Alpha	Eigenvalue	% Variance	Mean, SD
Pretend-Nurturance	I	.83	4.73	21.56%	.91 (1.01)
School, hairdresser, doctor	.89				~1 to 3 times a month
Imaginary friend	.85				
House, dress-up	.80				
Baby dolls	.62				
Arts and Crafts	II	.75	2.78	12.65%	1.94 (1.21)
Arts and crafts	.82				~1 to 3 times a week
Colors, draws	.78				
Reads picture books	.53				
Physical Activities	III				
Jungle gym, swings	.82	.76	2.28	12.02%	.88 (.74)
Hide-and-seek	.80				~1 to 3 times a month
Tag, run, chase games	.81				
Swimming	.57				
Pretend-Action	IV	.68	2.11	9.60%	.55 (.60)
Cars & trucks	.87				~rarely to 1-3 times a month
Action figures	.65				
Legos, blocks	.69				
Puzzles and Games	V	.63	1.60	7.25%	.98 (.74)
Checkers and chess	.74				~1 to 3 times a month
Jigsaw puzzles	.68				
Word search puzzles	.65				
Cards and board games	.63				
Plugged In	VI	.71	1.24	5.65%	1.83 (1.30)
Electronic games	.86				~1 to 3 times a week
Computer games	.82				
Going Out	VII	.52	1.15	5.22%	.78 (.61)
Out with friends	.85				~rarely to few times a month
Reads magazines	.79				

	Factor	Alpha	Eigenvalue	% Variance	Mean, SD
Shopping for fun	.62				
Talks on phone with friends	.52				

Table 2

Age, BMI and IQ comparisons across screen time categories derived from parental spontaneous responses.

	No Screen Time		Computer/ Electronics		TV Viewing		Computer/Electronics & TV Viewing		F and p
	M	SD	M	SD	M	SD	M	SD	
Age	9.31	6.26	12.24	7.40	19.56	13.51	20.54	12.76	6.25**
BMI	22.52	8.41	25.95	11.08	27.72	8.47	35.24	12.66	2.79*
KBIT-II									
Verbal	77.75	17.64	76.31	19.58	63.71	20.71	78.53	15.97	2.23
Matrices	68.18	19.64	67.26	16.62	55.95	18.99	72.13	10.39	3.15*
Composite	70.06	18.38	68.89	18.16	58.10	16.80	73.06	11.83	2.60*

Note:

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

Age was used as a covariate in between-group comparisons. Categories based on parental responses to the open-ended question, "How does your child spend free time at home?"

Table 3

Correlations between Recreation Factors and the Vineland-II and KBIT-2.

	Physical Activities	Computer/Electronic	Puzzles/Games
Vineland-II	<18 yrs > 18 yrs	<18 yrs > 18 yrs	<18 yrs > 18 yrs
Communication	.42**	.15	.38** .40*
Daily Living Skills	.34**	.23	.43*** .37
Socialization	.45***	.35	.38** .08
KBIT-2			
Verbal IQ	.27	.32**	.67*** .19
Nonverbal IQ	.32**	.18	.34** .64*** .42***
Composite IQ	.34**	.26	.37** .69*** .32**

Note:

- * p < .05;
- ** p < .01;
- *** p < .001.