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Problem Behaviors in Autism Spectrum Disorder: Association with Verbal Ability and Adapting/Coping Skills

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Abstract Data from the Autism Inpatient Collection was used to examine the relationship between problem behaviors and verbal ability, which have generally, though not universally, been highly associated. In a comparison of 169 minimally-verbal and 177 fluently-verbal 4 to 20-year-old psychiatric inpatients with ASD, the severity of self-injurious behavior, stereotyped behavior, and irritability (including aggression and tantrums) did not significantly differ, when controlling for age and NVIQ. Verbal ability was not strongly related to the severity of problem behaviors. However, lower adapting/coping scores were significantly associated with increasing severity of each type of problem behavior, even when accounting for verbal ability. Interventions to develop adapting/coping mechanisms may be important for mitigation of problem behaviors across the spectrum of individuals with ASD.

Introduction

The core diagnostic features of autism spectrum disorder (ASD) are impaired social interaction and communication skills and restricted and repetitive interests and behaviors (American Psychiatric Association 2013). However, individuals with ASD frequently experience a range of other emotional and behavioral problems that are generally referred to as "problem behaviors" (Dominick et al. 2007). These problem behaviors, which may also be referred to as externalizing behaviors, include self-injurious behavior (SIB), aggression toward others, temper tantrums, and non-compliance (Allik et al. 2006; Dominick et al. 2007; Zaidman-Zait et al. 2014). These behaviors are typically difficult to ameliorate and make daily living particularly challenging (Blacher and McIntyre 2006; Fox et al. 2002; Lecavalier 2006). The persistence and escalation of these behaviors may also lead families to seek psychological and/or psychiatric services (Mandell 2008).

The prevailing assumption is that individuals with ASD who present with the most severe externalizing behaviors tend to be those who have lower nonverbal IQs and less developed verbal ability (Dominick et al. 2007; Estes et al. 2007; Gray et al. 2012). The inability of an individual with ASD to efficiently and spontaneously communicate their wants and needs in a clear and consistent manner is thought to lead to the use of behaviors such as SIB and aggression when a communication breakdown occurs (Ganz et al. 2009; Hartley et al. 2008). For example, Sigafoos (2000) reported a strong inverse correlation between

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communication ability and the severity of problem behavior in a sample of 13 preschool age children with various developmental disabilities, including four with ASD. Another study that included a relatively large cohort of young children with ASD from France (n = 222, ages 2–7 years) with a range of developmental quotients from profoundly delayed to within normal limits, reported that 53% of the cohort had SIB, and SIB was associated with lower expressive language abilities (Baghdadli et al. 2003). Minimally-verbal (MV) children with ASD have been reported to engage in SIB significantly more often than verbal children with ASD (Ando and Yoshimura 1979) and more often than children with a history of language impairment without ASD (Dominick et al. 2007). However, the association between problem behaviors and communication may actually be more complex then these studies would suggest.

Even though a number of studies support the association between problem behaviors and language/communication skills in children with ASD, this linkage has not been a universal finding. For example, in a study of 17 young children with ASD from Australia and 15 from Taiwan with mild to severe ASD, the severity of ASD was not significantly associated with the frequency of challenging behaviors; however, 50% of the children were observed to use challenging behavior to communicate with others (Chiang 2008). Furthermore, two of these children, who used graphic symbols to communicate, had a *greater* amount of challenging behavior, suggesting that the availability of an alternative means of communicating did not result in a decrease in the undesired behavior (Chiang 2008). Similarly, in a study examining a range of risk factors associated with SIB in 250 children and adolescents with ASD, ages 18 months to 21 years, atypical sensory processing and insistence on sameness reportedly explained most of the variance in the measures of self-injury while functional communication was a small contributor (Duerden et al. 2012). In another study of 168 toddlers and preschoolers (ages 17–36 months) with ASD, Matson et al. (2009) found that *lower* receptive and expressive communication abilities were significantly correlated with *lower* scores for aggression and SIB. However, in a seeming contradiction, this same study reported that *lower* levels of receptive language were associated with *higher* frequency of self-injury in this age group (Matson et al. 2009).

The assumption of a strong inverse relationship between communication ability and problem behaviors is also challenged by the exhibition of problem behaviors by more verbally-able children and adults with ASD. Even though some of these individuals with ASD have intellectual functioning in the average range and more facility with spoken language, they continue to demonstrate problem behaviors that affect their ability to function and interact with others

(Kaat and Lecavalier 2013). For example, in a large study of more than 1600 children with ASD, other psychiatric disorders, and typical development between the ages of 6–16 years, the problem behavior scores for the group of 302 children with ASD with IQs ≥80 did not differ significantly from those for the 133 children with ASD and IQs below 80 (Mayes et al. 2012). In another large sample of children with ASD between the ages of 4 and 17 years, measures of intellectual functioning, language ability, and severity of ASD (operationalized as a Calibrated Severity Score based on Gotham et al. 2009) were not predictive of aggressive behaviors, suggesting that these behaviors did not arise from reduced cognitive or communication abilities (Kanne and Mazurek 2011).

Despite inconclusive evidence, the observed inverse relationship between the ability to communicate and problem behaviors such as aggression and SIB in individuals with various developmental disabilities, including ASD, has led to the development of intervention programs such as functional communication training that focus on substituting more socially appropriate forms of communication for the problem behavior (Kurtz et al. 2003; Reeve and Carr 2000; Wacker et al. 1998; Wong et al. 2015). The positive outcomes from several of these interventions lend support to the assumed association between communication or ability to use spoken language and the control of problem behaviors. However, an increase in communication or spoken language is not always successful in reducing problem behaviors, possibly because, for individuals with ASD, the problem behavior does not necessarily have a social motivation and may be controlled by multiple variables (O'Reilly et al. 2010; Sigafoos et al. 1994).

Functions for problem behaviors other than communication have been proposed. What may be considered problem behaviors by individuals who are interacting or living with individuals with ASD, have been argued to actually be "coping behaviors" (Groden et al. 1994), meaning they are not necessarily externally-directed communication but are responses to perceived increases in undesirable physiological reactions. Repetitive patterns in play or communication, vocal stimulation such as humming or echolalia, SIB such as biting, or excessive avoidance may serve to reduce anxiety in an individual with ASD (Ladd 2007), thereby serving a coping function.

The majority of research on coping has focused on higher-functioning, verbal cohorts, using self-report measures of specific types of coping strategies. In general these studies support an association between coping skills and problem behavior, such that effortful coping strategies such as problem-solving and thinking more positively about the situation are associated with fewer problems, whereas youth who shut down or remained aroused in response to stressors tend to have higher

rates of emotional and behavioral problems (e.g., Khor et al. 2014; Mazefsky et al. 2014). Although this line of research has focused on forms of coping that overlap with traditional emotion regulation strategies, coping strategies can be more broadly defined to include any active response to the perception of stress or threat (Carver et al. 1989). This conceptualization implies that the ability to flexibly and appropriately respond to environmental demands is an indicator of adaptive coping, and emphasizes the importance of matching responses to the context (Carr et al. 1996). In this framework, if problem behaviors serve an escape-related communicative function (Groden et al. 1994), the development of a more appropriate means of communication would be considered a more socially acceptable coping behavior, giving emphasis to the coping mechanism rather than communication per se (Ladd 2007).

In summary, problem behaviors may be a means of communication for MV youth with ASD as supported by the findings of some research studies and the positive outcomes of intervention programs that emphasize the development of alternative means of communication to replace problem behaviors. However, the association between problem behaviors and ability to use spoken language has not been definitively established as indicated by the results of other studies suggesting multifaceted contributors to problem behaviors, the failure to find a linkage between problem behaviors and measures of language and communication in some studies, and the presentation of problem behaviors in verbal individuals with ASD. An individual's ability to cope or respond flexibility to environmental demands may also be a powerful predictor of problem behaviors in ASD. Therefore, further examination of the relationship between problem behaviors in individuals with ASD with differing ability to produce spoken language is warranted. Examination of the association between problem behaviors, verbal ability, and adapting/coping behaviors in a large sample of children, adolescents, and young adults with ASD who are exhibiting a range of problem behaviors could inform the design of intervention programs for these individuals.

Data gathered by the Autism Inpatient Collection (AIC) provides an opportunity to examine the association between problem behaviors, verbal ability, and adaptive coping mechanisms in a population sample that is, by design, particularly challenged in behavioral presentation given that the children, adolescents, and young adults included in the sample have all required psychiatric hospitalization due to serious emotional or behavioral challenges. Furthermore, the sample is composed of individuals who have a range of spoken language skills, allowing examination of the types of problem behaviors that are being exhibited by these individuals with ASD in relationship to their facility with spoken language.

Based on prior work in this area, and the population sample being studied, the prediction was that overall the children, adolescents, and young adults with lower spoken language output would have increased severity/frequency of problem behaviors. In addition, because the sample is drawn from an inpatient population, we expected that the verbal individuals would also exhibit problem behaviors, but that differing ability to use spoken language may result in the demonstration of different types of problem behavior. Given earlier work on the multifaceted nature of problem behaviors in ASD and the possibility that communication and problem behaviors are efforts to cope with or adapt to environmental demands, we hypothesized that verbal ability would be a contributing predictor to the severity/frequency and type of problem behaviors, but that the individual's adaptive coping skills would be a more significant predictor of problem behaviors. In other words, a measure of the ability to flexibly and adaptively respond to environmental demands would be inversely related to the frequency of problem behaviors and would be more predictive of the severity and frequency of problem behaviors than verbal ability alone.

Method

Participants

Participants included 346 psychiatric inpatients with confirmed ASD from the Autism Inpatient Collection (AIC), which is a six-site study of children, adolescents, and young adults admitted to specialized inpatient psychiatric units for youth with ASD and other developmental disorders. The full methods of the AIC have been published previously (Siegel et al. 2015). Briefly, patients between the ages of 4–20 years old with a score of ≥12 on the *Social Communication Questionnaire* (SCQ; Rutter et al. 2003) or high suspicion of ASD from the inpatient clinical treatment team were eligible for enrollment. Inclusion required confirmation of ASD diagnosis by research-reliable administration of the *Autism Diagnostic Observation Schedule-2* (ADOS-2; Lord et al. 2012). Exclusion criteria included not having a parent available who was proficient in English or the individual with ASD having prisoner status.

Participants were classified into verbal ability groups based on their required ADOS-2 module. ADOS-2 module determinations were made by research-reliable ADOS-2 administrators after observing the child for a language sample and receiving input from clinical staff familiar with the individual, in accordance with ADOS-2 guidelines. Briefly, ADOS-2 Module 1 is intended for children 31 months and older who do not consistently use phrase speech, Module 2 is for children who use phrase speech but are not fluent,

and modules 3 and 4 are for fluently verbal children/adolescents and adolescents/adults respectively. Participants were considered MV if they required an ADOS-2 module 1 or 2 (48.8%, *n* = 169) or verbal if they required ADOS-2 modules 3 or 4 (51.2%, *n* = 177). As expected, the MV group also had significantly less expressive communication as measured by parent report on the Expressive Language subscale of the *Vineland Adaptive Behavior Scales-II* (VABS-II; Sparrow et al. 2005), *t* (251) = 43.328, *p* < .001.

The demographic characteristics of participants are provided in Table 1, for the full sample, and broken down by verbal ability group. The MV group had lower NVIQ and Vineland Coping skills than the verbal group, but with overlapping ranges in both groups. The household incomes ranged from less than $20,000 to over $160,000, and the mean family income category corresponded to the $36,000 to $50,000 range for both groups. There was also a wide range of parental education, from less than 8th grade to post-graduate degree; the mean level of education category corresponded to some college or associates degree in both groups.

Measures

Dependent Measures

Parent-report questionnaires of problem behaviors were completed within seven days of the participant's admission. On each measure, higher scores are indicative of more problematic behavior. The measures included: (1) *Repetitive Behavior Scale-Revised* (RBS-R) self-injury subscale, which is an 8-item Likert scale (Lam and Aman

2007; Lewis and Bodfish 1998); (2) *Aberrant Behavior Checklist* (ABC; Aman et al. 1985a, b) Stereotypy subscale, which is a 7-item Likert scale that can be broadly categorized as a measure of stereotypy that includes both repetitive behaviors (e.g., "meaningless, recurring body movements"), as well as more general atypical behaviors ("odd, bizarre behavior"); (3) ABC irritability subscale, which contains 15 items tapping tantrums, aggression and SIB; (4) VABS-II Parent/Caregiver Survey Form externalizing subscale, which is a broad measure of externalizing problems that includes 10 items tapping aggression, impulsivity, oppositional and inconsiderate behavior, and irritability.

Independent Measures

(1) *Verbal ability* was dichotomously defined as described above under the *Participants* section. (2) *Nonverbal intellectual ability* was measured by the nonverbal intelligence quotient (NVIQ) standard score of the *Leiter International Performance Scale—Third Edition* (Leiter-3; Roid et al. 2013). (3) Demographic variables including age, gender, and ethnicity were gathered on a demographic form completed by caregivers. (4) VABS-II Adapting subdomain (also referred to as the Coping Skills subscale) is a 30 item scale of how well individuals adapt to environmental demands, including items tapping manners, adherence to rules, and flexibility; higher scores indicate greater ability to flexibly adapt to environmental demands.

Table 1 Comparison of demographic variables by verbal ability

	Overall sample (N=346)	Minimally verbal (N=169)	Verbal (N=177)	*p* value
Age (years) [M(SD), range]	12.9 (3.3), 4–21	13.0 (3.7), 4–21	12.8 (2.8), 5–20	.434
Gender (male) (N/%)	275 (78.6%)	132 (78.1)	140 (79.1)	.896
Race (Caucasian) (N/%)	276 (79%)	124 (73%)	149 (84%)	.017
Non-verbal IQ (N=274) [M(SD), range]	76.4 (29.1), 30–145	51.5 (18.1), 30–99	93.3 (21.8), 33–145	<.001
Intellectual disability (NVIQ ≤ 70) (N/%)	116 (42%)	95 (82%)	21 (18%)	<.001
Expressive communication subscale (Vineland-2) (N=256) [M(SD), range]	7.1 (4.5), 1–24	4.0 (2.7), 1–11	10.2 (3.6), 1–24	<.001
Coping subscale (vineland-2) (N=256) [M(SD), range]	7.8 (2.3), 4–16	6.9 (2.0), 4–16	8.8 (2.2), 4–16	<.001
Adaptive behavior composite (vineland-2) (N=220) [M(SD), range]	57.5 (15.1), 25–118	48.1 (11.4), 25–78	66.7 (11.8), 41–118	<.001
ADOS-2 comparison score [M(SD), range]	7.8 (1.7), 4–19	7.8 (1.6), 4–11	7.8 (1.8), 4–19	.992
ADOS-2 module administered (N=346) (N/%)				
1	127 (36%)	126 (75%)	NA	NA
2	42 (12%)	43 (25%)	NA	
3	144 (42%)	NA	143 (80%)	
4	33 (10%)	NA	34 (20%)	

Analyses

Two analytic approaches were utilized to address the hypotheses. First, Analysis of Covariance (ANCOVA) was used to compare the mean of problem behavior severity for each dependent variable between minimally verbal and verbal participants. Given that both NVIQ and age have been significantly associated with problem behaviors (e.g., Anderson et al. 2011; Gray et al. 2012), they were included as covariates in these analyses. Second, a series of hierarchical linear regressions were conducted to determine the incremental explanatory power of each independent variable, with a focus on the added explanatory power of the VABS-II Adapting/Coping scale. In each regression model, the independent variables were entered separately in their own step, in the following order: age, NVIQ, verbal ability, VABS-II Adapting/Coping.

Raw scores were utilized in all analyses with the exception of NVIQ. For the regression analyses, verbal ability was dummy coded with the MV group as the reference group; thus positive betas indicate more problem behaviors for the verbal group, and negative betas indicate more problem behaviors for the MV group.

Results

Results of the ANCOVA analyses indicated that MV and verbal participants did not significantly differ in ABC Stereotypy or ABC irritability after controlling for age and NVIQ, all $p > .05$. The only problem behavior that significantly differed between MV and verbal participants after controlling for age and NVIQ was VABS-II externalizing behaviors, $F(1) = 37.05$, $p < .001$; however, the effect size was small, partial eta squared $= .163$. Between-subjects results are summarized in Table 2, and raw means, as well as marginal means comparing MV and verbal individuals, holding NVIQ and age constant at the mean, are included in Table 3 for each problem behavior.

Given that the verbal group had a significantly higher percentage of Caucasians, the ANCOVA analyses were repeated separately for Caucasians and non-Caucasians to ensure that race was not driving the findings, and the results were identical. Finally, the analysis was repeated without the participants who received ADOS-2 module 2 (for those with phrase speech but not fluent speech) to determine if the degree of verbal impairment influenced the findings; in other words, this analysis compared those who received module 1 of the ADOS-2, which is intended for those who are pre-verbal or have single words, to the verbally fluent group that was previously described. Similar to the original analysis, the only indicator of problem

Table 2 Analysis of covariance between-subjects effects

Covariate/IV	RBS-R SIB		ABC stereotypy		ABC irritability		VABS externalizing		VABS internalizing	
	F (p value)	Eta	F (p value)	Eta	F (p value)	Eta	F (p value)	Eta	F (p value)	Eta
Age	.00 (.978)	.000	**4.70 (.032)**	.028	**8.43 (.004)**	.049	1.57 (.212)	.009	**4.16 (.043)**	.025
NVIQ	3.24 (.074)	.019	**6.21 (.014)**	.036	**11.89 (.001)**	.068	**7.97 (.005)**	.046	1.23 (.268)	.007
Verbal ability	.89 (.348)	.005	2.30 (.131)	.014	1.60 (.208)	.010	**30.86 (<.001)**	.158	.93 (.336)	.006

Significant differences are in bold

Table 3 Marginal means accounting for age and nonverbal IQ and unadjusted means for problem behaviors, by verbal ability

Variable	Minimally verbal			Verbal		
	Marginal mean (SE)	95% CI	Unadjusted mean (SD)	Marginal mean (SE)	95% CI	Unadjusted mean (SD)
RBS-R SIB (n = 300)	8.11 (.86)	6.40–9.82	8.84 (5.58)	6.93 (.65)	5.64–8.22	6.40 (5.49)
ABC stereotypy (n = 294)	8.56 (.81)	6.98–10.16	9.78 (5.34)	6.79 (.61)	5.59–7.80	6.32 (5.38)
ABC irritability (n = 293)	25.54 (1.39)	22.81–28.27	27.80 (9.24)	28.08 (1.05)	26.01–30.15	27.08 (9.58)
VABS externalizing (n = 232)	8.46 (.69)	7.10–9.82	9.72 (3.23)	14.62 (.54)	13.56–15.67	13.75 (5.70)

Complete names and possible ranges: *Repetitive Behavior Scale-Revised* (RBS-R) self-injury subscale: 0 to 24; *Aberrant Behavior Checklist* (ABC) stereotypy subscale: 0 to 21; ABC irritability scale: 0 to 45; *Vineland Adaptive Behavior Scale-2* (VABS) externalizing scale: 0 to 20; *SE* standard error, *CI* confidence interval, *SD* standard deviation, Marginal means hold age constant at 12.9 years and *Leiter* nonverbal IQ at 77.2

behavior that significantly differed between those who are nonverbal (received ADOS-2 module 1) and verbal was VABS-II externalizing domain, $F(1) = 24.84$, $p < .001$. The effect size remained small (partial eta squared $= .134$).

To explore the alternative hypothesis that coping skills or the ability to flexibly adapt to environmental contexts was a stronger predictor of problem behaviors than verbal ability, a series of regressions were performed with separate models for each of the dependent measures (i.e., SIB, stereotyped behavior, irritability, externalizing scores). For each regression, age, IQ, and verbal ability (dummy coded; with MV as the reference group) were entered sequentially in separate steps, followed by VABS-II Adapting/Coping in the final step in order to be able to delineate the additional amount of variance accounted for by each factor. The results are summarized in Table 4. In brief, Adapting/Coping was a significant predictor in every model, accounting for a significant amount of variance above and beyond age, NVIQ, and verbal ability. Adapting/Coping remained significant in the final model for each problem behavior domain, always in the direction of lower Adapting/Coping

scores associated with greater problem behaviors. Verbal ability accounted for an additional 21.3% of the variance in externalizing problems above and beyond age and NVIQ IQ, $p < .001$, but it did not account for a significant amount of additional variance for any other problem behavior domain. Verbal ability was a significant predictor in the final models for ABC irritability and VABS-II externalizing behavior, with the verbal group having more irritability and externalizing problems.

Discussion

This study sought to investigate the association between verbal ability and problem behaviors in a large sample of participants who are diverse in their verbal ability, NVIQ and age. In addition, the hypothesis that coping/adapting to environmental demands may be more strongly associated with problem behavior than verbal ability was explored. Given that the source of the population sample was psychiatric inpatients, as expected, both the MV and verbal children with ASD had significant severity/frequency of problem behaviors. Although differences between MV and verbal groups varied across the type of problem behavior, the results did not support a higher frequency or severity of problem behaviors in the MV group as hypothesized. The finding of similar severity/frequency of problem behaviors for individuals more and less challenged with the use of verbal communication was consistent with earlier work that indicated that communication ability was not strongly related to the occurrence of problem behaviors (Chiang 2008; Duerden et al. 2012).

The roughly equivalent severity/frequency of problem behaviors, and higher scores for externalizing problems in verbal as compared to MV youth, suggests that having more verbal skills does not necessarily mitigate the behavioral challenges for individuals with ASD. Communication is not simply important as a means to express wants and needs, it is also important for responding to and controlling the responses of others. Communication used in this manner can be either socially positive or negative. Individuals with ASD who are verbal might use their expressive abilities in some negative ways, resulting in a high frequency of occurrence of externalizing problem behaviors such as aggression and anger (Farmer and Aman 2011; Quek et al. 2012).

In contrast to the relatively weak and inconsistent association between verbal ability and problem behaviors, adapting/coping skills explained a significant amount of variance in each type of problem behavior, above and beyond NVIQ, age, and verbal ability. Specifically, lower adapting/coping scores were associated with greater problem behaviors.

Table 4 Regression analyses predicting problem behaviors from age, NVIQ, verbal ability and adapting/coping skills

IV	R^2 Change	F^{Change} (p value)	B	t (p value)
RBS-R SIB overall model: $F(4, 210) = 5.56$, $p < .001$, $R^2 = .096$				
Age	.000	.002 (.968)	−.055	−.84 (.400)
NVIQ	.069	**15.66 (.002)**	−.163	−1.78 (.077)
Verbal ability	.002	.371 (.543)	−.066	−.71 (.478)
Adapting	.025	**5.89 (.016)**	−.296	**−4.21 (<.001)**
ABC stereotyped behavior overall model: $F(4, 210) = 12.06$, $p < .001$; $R^2 = .187$				
Age	.004	.79 (.374)	−.234	**−3.36 (.001)**
NVIQ	.100	**23.64 (<.001)**	−.206	**−2.12 (.035)**
Verbal ability	.014	3.44 (.065)	−.100	1.05 (.295)
Adapting	.069	**17.75 (<.001)**	−.243	**−3.39 (.001)**
ABC irritability overall model: $F(4, 194) = 10.31$, $p < .001$; $R^2 = .154$				
Age	.021	**4.47 (.036)**	−.147	**−2.21 (.028)**
NVIQ	.037	**8.43 (.004)**	−.304	**−3.26 (.001)**
Verbal ability	.018	**4.42 (.041)**	.308	**3.26 (.001)**
Adapting	.077	**19.14 (<.001)**	−.314	**−4.38 (<.001)**
VABS externalizing overall model: $F(4, 192) = 18.07$, $p < .001$; $R^2 = .274$				
Age	.009	1.76 (.187)	−.099	−1.53 (.128)
NVIQ	.016	3.18 (.076)	−.331	**−2.18 (<.001)**
Verbal ability	.213	**53.91 (<.001)**	.739	**5.94 (<.001)**
Adapting	.036	**9.46 (.022)**	−.214	**−3.61 (.002)**

ANOVA results for the overall model are presented followed by the change statistics for each step and final model standardized betas and t-test statistics for each independent variable; each variable was entered in its own step. Significant findings ($p < .05$) are in bold

The items that are included in the Adapting/Coping Skills subdomain of the VABS-II indicate that, although these behaviors are generally described as evidence of "responsibility and sensitivity to others" (Sparrow et al. 2005), many of the items require the individual to demonstrate flexibility and differential responsiveness to contextual demands as well as cognitive control. Therefore, it is not surprising that individuals for whom these behaviors are positively affirmed, regardless of their verbal ability, would exhibit an overall lower severity of problem behaviors. That is, the individuals who had the ability to change their behavior in response to other persons and contextual information, had fewer problem behaviors. This finding is consistent with previous work that has indicated that the ability to flexibly form concepts is particularly important for better adaptive functioning in individuals with ASD (Williams et al. 2014).

The current findings lend support to the proposal that the important factor may be the development of a socially appropriate adapting/coping strategy no matter what the form rather than the development of communication per se (Ladd 2007). The reason increasing communication skills can have a positive effect on behavior may be because the child's repertoire of coping skills has increased. The proper focus may be on the use of communication for coping, not only as a means to get needs met or to interact socially. The success of programs such as SCERTS® (Prizant et al. 2006) that emphasize both the development of emotional regulation and the development of communication to reduce problem behaviors in children with ASD is consistent with this assertion.

A question that was not addressed by the current analysis is the potential effect of the use of an augmentative/alternative form of communication (AAC) by the individuals with ASD who were MV. Prior research has demonstrated that the introduction of an alternative form of communication such as a Picture Exchange Communication System (PECS: Frost and Bondy 2002) or voice output communication aid (VOCA) may decrease the occurrence of problem behaviors for MV children with ASD (Ganz et al. 2009; Mirenda 2003). Unfortunately, in the initial AIC sample, limited information on AAC use was collected, making it difficult to assess the relationship to problem behaviors. More detailed information about AAC use in this population is now being collected.

A limitation of the current study is that the population sample was children with ASD who had problems significant enough to require hospitalization. Therefore, the results may not be generalizable to individuals with ASD who have less challenging problem behaviors. The problem behaviors were also measured using parent-report instruments that are susceptible to the subjective bias of the respondent. There are several directions for future research

that could build off this work. In particular, the VABS-II adapting/coping scale is a rather broad scale including items that tap flexibility and ability to modify behavior to fit environmental contexts. More specific assessment of flexibility and coping skills, particularly assessments that are valid across the verbal ability and IQ range, might provide additional avenues to consider for treatment targets. In addition, a more nuanced approach to understanding these emotional and cognitive characteristics associated with problem behavior may provide insight into within group differences that could help with treatment specificity. For example, a recent study that examined flexibility in youth with ASD with and without intellectual disability found that higher behavioral inflexibility was related to challenging behavior in higher-functioning individuals when it was maintained by automatic reinforcement, which was a different profile than they found for those with intellectual disability (Liddon et al. 2016).

Future efforts to pinpoint the role of adapting/coping in problem behavior may also benefit from considering the role of emotion regulation, which is a highly related construct. Some argue that coping differs from emotion regulation in that coping occurs in direct response to an environmental stressor (Saarni et al. 2007). However, other researchers consider them to be interchangeable (e.g., Brenner and Salovey 1997) and there is reason to believe that emotion regulation may play a role in effective coping with both internal and external stimuli. For example, it may be that the inability to effectively modulate emotional reactions to meet environmental demands leads to sustained physiological arousal, which in turn leads to problem behaviors (Mazefsky et al. 2013). It may also be that although there is a not a simple association with verbal ability (e.g. MV youth do not have more problem behavior just because of poor communication), language and communication impairments common in ASD may interfere with development of regulatory abilities given that language competence and emotional competence are often strongly associated (Mazefsky and White 2014).

Given that many problem behaviors occur within the context of interactions with others, related research streams that focus on the perceptions and/or the effects on others, particularly caregivers, may be relevant here. Of particular significance is a line of research that has found that mothers who use cognitive reframing to react more positively to the stresses related to their child's autism and associated challenging behaviors have less depression and a higher level of general well-being than mothers who use other coping strategies (Benson 2010). Therefore, similar to communication interventions that are more efficacious when communication partners are trained (Schneider et al. 2008; Shire and Jones 2015), interventions developing coping strategies in children

with ASD may be more efficacious if caregivers are simultaneously trained in the use of positive cognitive strategies to manage their own responses to the child's behavior.

In sum, the results of this study indicate that the ability to adapt/cope and verbal ability are potentially both important for the mitigation of problem behaviors in children, adolescents, and young adults with ASD. Intervention programs may need to focus not just on readjustments of environments or antecedent events, the substitution of a more appropriate means of communication, or the use of specific strategies such as the provision of visual supports and visual schedules to reduce problem behaviors in individuals with ASD (Mirenda and Brown 2007). Intervention may also need to emphasize the development of appropriate adapting/coping strategies that help the individual with ASD regulate their emotional responses.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed involving human participants were in accordance with the ethical standards of the institutional research committees where the data was collected and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in this study.

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