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ORIGINAL PAPER

Functional Assessment of Problem Behavior in Children with Autism Spectrum Disorders: A Summary of 32 Outpatient Cases

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Abstract The purpose of this study was to examine archival data from an outpatient clinic serving children with autism spectrum disorders to investigate the occurrence of problem behavior functions in this sample. Results indicated that social reinforcement (e.g., attention from others) was involved in maintaining problem behavior for the majority of cases, suggesting that these children lacked socially appropriate responses to access such reinforcement, or that their social environments contained insufficient social reinforcement. Further, the data suggest that problem behavior exhibited by children with autism spectrum disorders can be conceptualized similarly to the problem behavior of children with other developmental disabilities.

Keywords Functional assessment · Functional analysis · Descriptive assessment · Problem behavior · Autism spectrum disorders · Behavioral treatment

The current diagnostic criteria for autism spectrum disorders (ASD) include impairments in reciprocal social interactions and communication, and the presence of stereotyped behavior, interests, and activities (American Psychiatric Association 2000). Although problem behavior other than stereotypy is not an explicit diagnostic criterion, the combination of impaired social and language skills and restricted interests often lead to the development of other problematic behaviors. A substantial number of individuals with ASDs display problem behaviors of concern, including aggression and noncompliance (Farrar-Schneider 1992), stereotypy (MacDonald et al. 2007), and self-injurious behavior (SIB; Oswald et al. 1992).

Research in the assessment and treatment of problem behavior supports the use of pre-treatment functional assessment to identify contingencies of reinforcement that maintain the problem behavior (e.g., Carr et al. 2000; Newcomer and Lewis 2004). The commonly identified contingencies include (a) social-positive reinforcement (i.e., attention, access to a tangible item), (b) social-negative reinforcement (i.e., removal of aversive stimuli such as demands and social interactions), and (c) automatic reinforcement (i.e., sensory stimulation). The three main methods of functional assessment include informant functional assessment (e.g., interviews, rating scales) (O'Neill et al. 1997; Sturmey 1994), descriptive assessment with direct observation in the natural environment and recording of events that immediately precede and follow problem behavior (Lalli and Goh 1993), and experimental functional analysis. Functional analyses involve repeated observations of an individual across several well-defined analogue conditions (Iwata et al. 1994a/1982) in which putative reinforcers are delivered contingent on problem behavior.

The use of functional assessment procedures to determine the motivation for problem behavior and guide treatment selection has several important benefits for clinical practice. First, identifying the function of a behavior generally allows the clinician to directly address

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or even eliminate the response-reinforcer contingency with a function-based intervention, rather than simply overpowering it with a treatment matched solely to behavioral topography (Iwata et al. 1993). Second, functional assessment can also identify treatment approaches that are irrelevant or even contraindicated (e.g., time out for behavior maintained by escape from demands). Finally, identification of the means by which behavior problems are acquired and maintained enhances our understanding of problem behaviors and facilitates development of a comprehensive approach to preventing them (Carr et al. 1999; Iwata et al. 1993).

Herzinger and Campbell (2007) assessed published studies on functional assessment methods in terms of their identification of behavioral function and subsequent treatment selection and found that treatments based on functional analyses were often more effective than treatments based on other functional assessment methods. Similarly, Didden et al. (1997) conducted a meta-analysis of empirical studies on the treatment of problem behavior among individuals with mental retardation, and found that performing a pretreatment functional analysis made a significant contribution to treatment effectiveness. Additionally, Carr et al. (1999) found that the success rates for problem behavior interventions nearly doubled when the intervention was based on a prior functional assessment. Additionally, although selected interventions were based on identified functions, there was no relationship between behavioral function and specific treatment (e.g., functional communication training) or treatment category (reinforcement only). Furthermore, the method of functional assessment was not related to the identified function (i.e., functions were equally distributed across assessment methods). While such studies are beneficial, their conclusions are limited by the fact that they do not provide a representative sample of problem behavior, but rather a sample of problem behavior that was subjected to research attention.

One means to obtain a representative sample of participants and problem behavior involves investigating large samples drawn from a single environment (Derby et al. 1992; Iwata et al. 1994b; Reese et al. 2003). Such aggregated data allows examination of potential differences in behavioral functions of different topographies of behavior for differing populations. In addition, studies that include multiple methods of assessment permit the examination of any potential influence of assessment method on the variables mentioned above. Such studies allow evaluation of the consistency in function across conditions (e.g., population, topography), which may then allow us to generalize the results to other similar conditions. Consequently, when circumstances prevent use of a functional analysis (e.g., low-rate problem behavior), epidemiological profiles may facilitate educated hypotheses about probable behavior function and development of appropriate treatment. Further, results of aggregate functional analysis data may allow clinicians or educators to design conditions in the home or classroom to prevent the occurrence of certain problem behavior functions.

Iwata et al. (1994b) presented one of the first epidemiological analyses of common functions of SIB. Experimental functional analysis data were examined for 152 individuals with mental retardation treated in an inpatient unit. The most common function of SIB was social negative reinforcement (38%), although a fairly high proportion of social positive reinforcement functions (26%) were identified as well. It is important to note that this study also reported that treatment plans were developed for each participant based on the results of their functional analysis and observed success rates above 80% for almost all function-based interventions. This approach to aggregating functional analysis data has been replicated in outpatient settings, with a variety of individuals, behaviors, and accompanying treatments (e.g., Asmus et al. 2004; Hagopian et al. 1998).

Several conclusions can be drawn from the existing epidemiological literature on individuals with developmental disabilities. First, individuals with developmental disabilities more commonly exhibit problem behavior than individuals without such disabilities (e.g., Didden 2007; Reese et al. 2005). Second, there appears to be a relation between the setting of functional analyses and the most common behavioral function, such that behaviors assessed in inpatient settings are most often maintained by social-negative reinforcement while the results are mixed for outpatient settings (e.g., Derby et al. 1992; Iwata et al. 1994b; Kurtz et al. 2003). Third, lengthier functional analyses result in quite small proportions of undifferentiated results when compared to briefer assessments (e.g., Iwata et al. 1994b). All of the existing epidemiological literature, however, is based on individuals with a variety of developmental disabilities. Therefore, no conclusions can be drawn about differences that might exist in terms of the functions of problem behavior across specific diagnoses. In order to evaluate these potential differences, data must be aggregated for specific diagnostic subgroups (e.g., autism, Asperger's disorder).

In an analysis of perseverative behavior of children diagnosed with autism, Reese et al. (2003) discovered that gaining access to preferred perseverative activities and escaping other demands while engaged in such activities frequently contributed to problem behavior as a maintaining variable. In an extension of that study, Reese et al. (2005) compared the functional characteristics of problem behavior in children with and without autism. The results indicated that among children with autism, problem behavior often occurred to gain or maintain access to items with which to engage in repetitive behavior, while among

children without autism problem behavior occurred for more common social functions such as gaining caregiver attention or escaping caregiver demands. These studies suggest that the functions of problem behavior for children with autism spectrum disorders may differ from the functions commonly seen among children with other developmental disabilities. However, these studies are limited by their exclusive use of informant functional assessment methods. To date, no studies have aggregated functional assessment data with children with ASDs using more rigorous methods of assessment. Existing research, however, suggests that assessing the problem behavior of children with autism is warranted, both with respect to topography (Bodfish et al. 2000) and behavioral function (Reese et al. 2003, 2005). Thus, the purpose of the present study is to examine archival data from an outpatient clinic serving children with ASDs to investigate potential relations between the function of problem behavior as determined by a descriptive or experimental functional assessment, participant diagnosis, and functional assessment method.

Method

Participants and Setting

Participants were clients of a small, university-based outpatient training clinic serving children aged 2–12 years diagnosed with autism, Asperger's disorder, or Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS). See Table 1 for more demographic information about the participants. Client records from 32 cases seen over a 4-year period were drawn from the clinic's problem behavior service for the present analysis. In this service, problem behavior was evaluated using functional assessment procedures followed by development of function-based treatment recommendations and proficiency-based training for caregivers.

Functional Assessment and Function-based Treatment Selection

At least two types of functional assessment were conducted for each case. See Fig. 1 for a flowchart depicting the progression of methods in the problem behavior service. The first step of functional assessment involved obtaining informant reports using the Functional Assessment Screening Tool, a rating scale used to gather information about the frequency of certain antecedents and consequences that may be functionally related to the target problem behavior (Iwata 1995). Second, a semi-structured interview was conducted with the primary caregiver to collect further information about common antecedents and consequences, as well as when, where, and with whom the problem behavior typically occurred. Further, informants were asked about physiological conditions (e.g., sleep habits, dietary issues) that might influence problem behavior, and the rate at which the problem behavior typically occurred.

The prior informant assessments led to a decision point about subsequent methods. Specifically, the results were reviewed during clinic staff meetings to determine the potential behavioral functions based on the informant assessments. If the informant assessments indicated a relatively low rate of problem behavior, a descriptive assessment was conducted. Caregivers were trained to record the environmental events that occurred contiguously with each instance of problem behavior in the natural environment using either narrative recording (i.e., brief narrative records of events) or structured recording (i.e., a checklist of individualized antecedents and consequences; see Miltenberger 2004). If the informant assessment indicated a relatively high rate of problem behavior (i.e., likely to occur during a 10-min session), an experimental functional analysis was conducted (see Carr and LeBlanc 2003). The conditions included in each analysis were determined based on information gathered during informant assessment. To increase the degree of correspondence with the natural environment and its associated contingencies, the child's caregiver typically provided the relevant antecedents and consequences during sessions while supervised by clinic staff. To increase the likelihood of differentiated outcomes, visual cues (i.e., distinctly colored poster boards) were associated with each condition (Conners et al. 2000).

To determine the behavioral function from descriptive assessment or functional analysis, data were examined during the time of service delivery by one or both of the clinic's directors. One director was a doctoral-level Board Certified Behavior Analyst, and the other was a doctoral-level licensed clinical psychologist. For descriptive assessment data, the directors evaluated graphs depicting the frequency of each antecedent-consequence relation (i.e., the putative contingency) identified in the assessment. Figure 2 illustrates one of the descriptive assessment data sets from the sample. These sample data depicts a likely attention function as the four most frequently occurring antecedent-consequence relations all involved the child receiving attention contingent on the occurrence of problem behavior.

To determine behavioral function from a functional analysis, the directors evaluated graphs depicting the target behavior during each session of the analysis, and compared response rates in each test condition to that of the control condition. Consistent separation between a test-condition

Table 1 Participant demographic information

Participant #	Age (years:months)	Gender	Diagnoses	Problem behavior
1	9:02	Male	Autism	Vocal stereotypy
2	4:03	Male	Autism	Vocal stereotypy
3	4:10	Male	Autism	Aggression & vocal stereotypy
4	5:04	Female	PDD-NOS	Tantrums & self-injury
5	6:10	Male	Autism	Aggression
6	6:06	Male	PDD-NOS, Fragile X	Aggression
7	7:06	Male	Asperger's	Aggression
8	4:09	Male	Autism	Aggression
9	9:09	Male	Autism	Elopement
10	3:08	Male	Autism	Tantrums & screaming
11	7:03	Female	Autism	Food stealing
12	3:05	Male	Autism	Tantrums
13	14:00	Male	Autism	Aggression & property destruction
14	5:05	Male	Autism	Aggression
15	5:01	Male	Asperger's	Food refusal
16	6:04	Male	Autism	Tantrums
17	6:02	Male	PDD-NOS, cerebral palsy	Pica
18	4:11	Male	Autism	Aggression
19	9:03	Female	Autism	Aggression
20	11:08	Male	Autism, bipolar, impulsive control disorder	Aggression
21	7:07	Male	Autism	Aggression
22	10:06	Female	Autism, mental retardation	Aggression & tantrums
23	8:06	Male	Autism, mitochondrial disorder	Aggression
24	10:11	Male	Autism, mental retardation	Aggression
25	6:05	Male	Autism	Self-injury
26	7:06	Male	Asperger's	Vocal aggression
27	7:06	Male	Asperger's	Property destruction
28	9:09	Male	Autism	Dropping to floor
29	6:00	Male	Autism	Self-injury
30	5:01	Male	Asperger's	Tantrums
31	7:00	Male	Autism	Pica
32	6:02	Male	PDD-NOS, cerebral palsy	Aggression

data path and the control-condition data path was deemed evidence of a reinforcement function. Figure 3 illustrates a tangible function from one of the functional analyses in the sample.

Coding Variables

Two trained graduate students coded all variables by examining the records for each case. Each client record was coded for several demographic variables, including age of the client at intake, diagnosis, and the topography of the target problem behavior (see Table 2 for a summary of the sample characteristics). Three variables were coded with respect to the results of informant assessment for every case. First, the results of the FAST rating scale were coded by recording the score for each potential behavioral function endorsed by each informant (Iwata 1995). Second, the results of the clinic's functional assessment interview with respect to the likely behavioral functions were also recorded. Third, the hypothesized behavioral functions noted in the progress notes for the case were recorded.

Two variables were coded for cases in which descriptive assessment was conducted (i.e., cases with low-rate problem behavior). The number of events reported (mean 18.1, range 5–34) and the identified functions of the target behavior were recorded. For those cases in which a functional analysis was conducted (i.e., cases with high-rate problem behavior), the behavioral functions were also

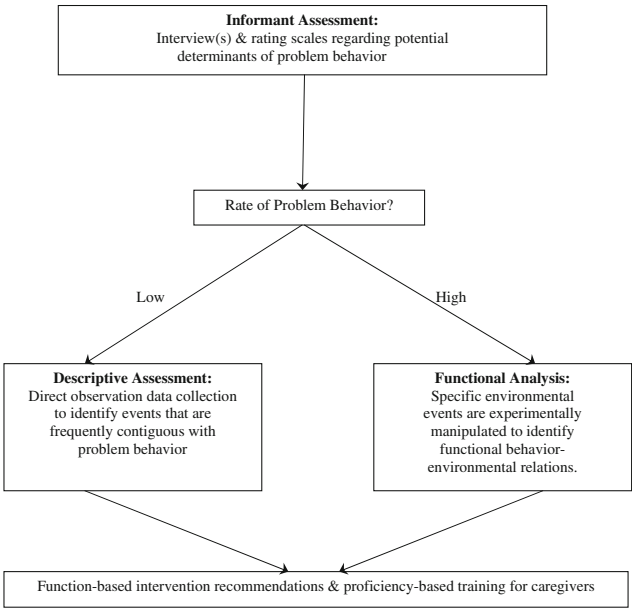

Fig. 1 Problem behavior service flowchart

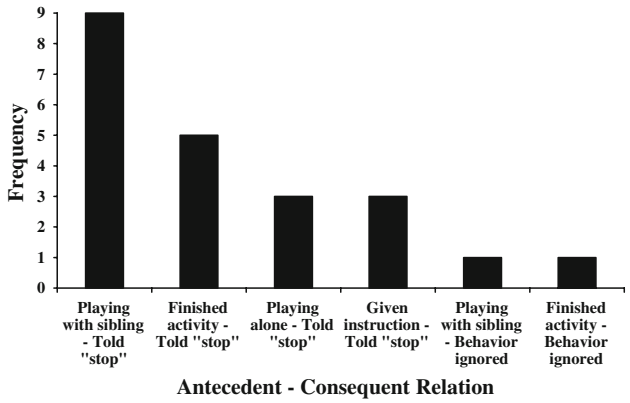

Fig. 2 Sample descriptive assessment data displaying a probable attention function

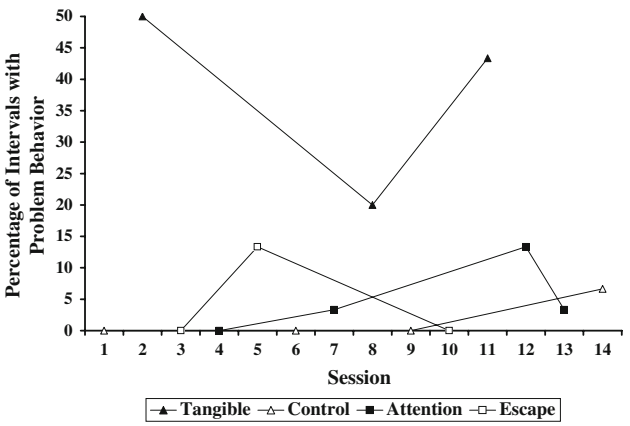

Fig. 3 Sample functional analysis data displaying a tangible function

Table 2 Sample characteristics

	Number of cases	Percentage of total sample
Diagnosis		
Autism	23	71.8
Asperger's disorder	5	15.6
PDD-NOS	4	12.5
Problem behavior		
Aggression	16	50
Tantrums	6	18.8
Self-injury	3	9.4
Vocal stereotypy	3	9.4
Pica	2	6.3
Property destruction	2	6.3
Dropping to the floor	1	3.1
Elopement	1	3.1
Food refusal	1	3.1
Food stealing	1	3.1
Functional assessment		
Descriptive assessment	10	31.3
Functional analysis	22	68.7

coded. Behavioral functions were coded as follows: (a) *attention/tangible*—for cases in which verbal or physical attention, or access to a tangible item maintained problem behavior (i.e., problem behavior maintained by social positive reinforcement), (b) *escape*—for cases in which escape from demands or social interaction maintained problem behavior (i.e., problem behavior maintained by social negative reinforcement), (c) *automatic reinforcement*—for cases in which the problem behavior was maintained independent of social consequences, (d) *activity restoration*—for cases in which the interruption of preferred activities with a demand occasioned problem behavior, the occurrence of which resulted in both the removal of the demand and access to the preferred activity (Hagopian et al. 2007), or (e) *undifferentiated*—for cases in which no clear behavioral function was identified. Finally, the interventions selected for each behavioral function were coded.

Inter-coder Agreement

An agreement was defined as both independent coders recording the same response on a given variable. Inter-coder agreement was assessed for all variables for 31% of cases and was calculated using point-by-point agreement (number of agreements divided by the number of agreements plus disagreements, multiplied by 100%) for each case. Mean inter-coder agreement was 95.4% (range, 81.8–100%).

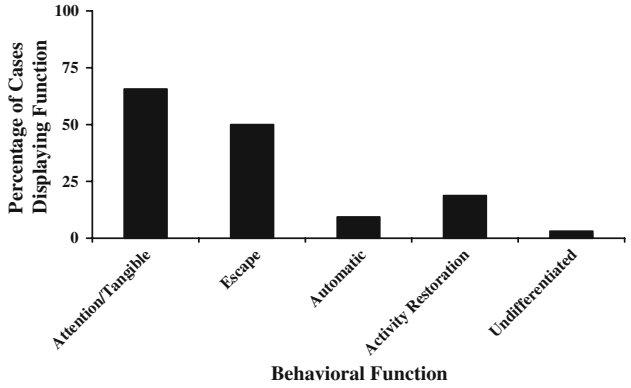

Fig. 4 Percentage of cases displaying each behavioral function

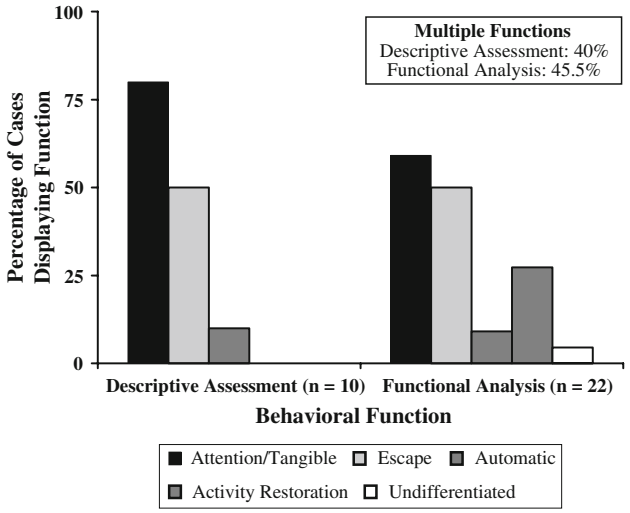

Fig. 5 Distribution of behavioral function for problem behavior assessed with descriptive assessment (left side) compared to problem behavior assessed with functional analysis (right side)

Results

Figure 4 depicts the proportion of cases displaying each behavioral function. These data indicate that the problem behavior of children with ASDs seems to be maintained largely by social reinforcement (88%). In addition, 45% of the cases had multiply-controlled problem behavior which represents a much higher proportion compared to previous epidemiological data.

The distribution of behavioral functions from cases utilizing descriptive assessment and cases utilizing functional analysis are presented in Fig. 5, and are quite similar. Specifically, a Chi-square test on the functions and assessment type indicated that the relation between these two variables was not statistically significant, $F(4) = 3.268$, $p > 0.05$. The one notable difference in the

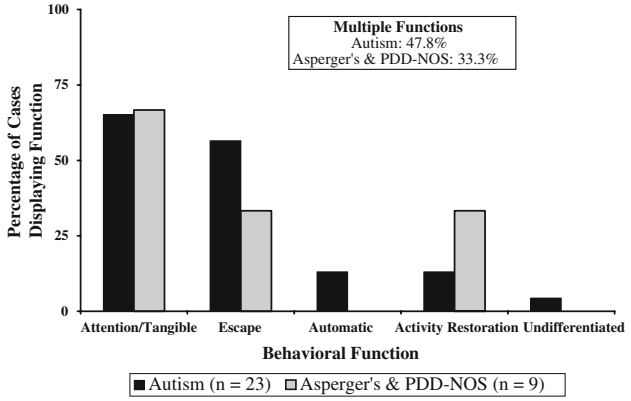

Fig. 6 Distribution of behavioral function by participant diagnosis

Table 3 Relation between behavioral function hypothesized from informant assessment and behavioral function identified through descriptive assessment or functional analysis (percentage of cases)

Relationship	Attention/ Tangible		Escape		Automatic	
True positive	61.3		41.9		9.7	
True negative	12.8		25.8		80.6	
False positive		19.4		22.6		9.7
False negative		6.5		9.7		0
Total	74.1	25.9	67.7	32.3	90.3	9.7

results from these two methods of assessment is in the lack of identified activity-restoration functions identified via descriptive assessment.

The distribution of behavioral function by diagnosis is presented in Fig. 6. Participants with Asperger's disorder and PDD-NOS were combined to increase the size of this sub-sample to allow for a more meaningful comparison to participants with autism. There are two notable differences between these sub-samples with respect to the distribution of behavioral function. First, although the difference is not statistically significant ($z = 1.23$, $p = .109$), children with Asperger's disorder or PDD-NOS were less likely than children with autism to display problem behavior maintained by escape. Second, children with Asperger's disorder or PDD-NOS were more likely than children with autism to display problem behavior maintained by activity restoration. Again, this difference was not statistically significant ($z = 1.18$, $p = .119$).

The relation between hypothesized behavioral functions from informant assessments and the behavioral functions identified through subsequent assessment (i.e., descriptive assessment, functional analysis) was analyzed using a signal-detection approach within each behavioral function category. The results are presented in Table 3. Results are not presented for the activity restoration function, as this

function was never hypothesized from informant assessment. The FAST rating scale does not directly assess for this function, so this condition was selected for inclusion in functional analyses only the interview results indicated that both escape from demands and the return to a previously interrupted activity might be relevant consequences for problem behavior.

A result was determined to be a *true positive* if the informant assessment identified the function and it was identified in a subsequent assessment. Similarly, a result was coded as a *true negative* if informant assessment did not identify the function and the function was not identified in subsequent assessment. A *false positive* was coded for cases in which a function was identified by informant assessment but was not found in subsequent assessments. Finally, a *false negative* was coded for cases in which a function was not identified in informant assessment but was identified by subsequent assessment. The notable results indicate that the proportion of cases in which the relationship can be described as a true positive or true negative is significantly higher than the proportion of cases that represent false positives and false negatives ($z = 9.07$, $p < 0.001$). Further, the proportion of false positives is significantly higher than the proportion of false negatives ($z = 2.76$, $p < 0.05$).

Discussion

The finding that problem behavior in children with ASDs is largely maintained by social reinforcement may be a result of the fact that these children have not acquired socially appropriate means to gain access to social reinforcement, or that the environments in which they behave do not include sufficient social reinforcement (Iwata et al. 1994b). Further, these findings are quite similar to the results of other epidemiological research involving individuals with a variety of developmental disabilities. For example, Iwata et al. (1994b) found that 64% of individuals with mental retardation displayed problem behaviors maintained by social reinforcement, and Asmus et al. (2004) identified social reinforcement functions in 89% of cases among individuals with developmental delays. This suggests that the problem behavior exhibited by children with ASDs can be conceptualized similarly to the problem behavior of children with other developmental disabilities. This is likely a result of the fact that all of these children generally have deficits in communication and other adaptive behaviors, and that caregivers within this culture provide relatively similar consequences to problem behavior. Thus, although the data come from a relatively small clinic-based sample, these findings emphasize the importance of teaching these children socially appropriate responses to gain access to social reinforcement, as well as carefully designing their environments (e.g., instructional settings) so as to avoid creating conditions that make the occurrence of problem behavior more likely.

It may seem somewhat counter-intuitive that social reinforcement was the most common function for the problem behaviors of children with autism spectrum disorders, as these children are typically considered to be more socially avoidant. However, it is important to remember that the relevant consequences for the participants in this study most often involved attention from caregivers, not peers. Receiving attention from a caregiver requires relatively little response effort on the part of the child, and may not involve any reciprocal social interactions. Thus, a child who is highly avoidant when it comes to social interactions with peers may still be motivated by caregiver attention.

The finding that a substantial proportion of cases displayed multiply controlled problem behavior might indicate that these results are characteristic of problem behavior in this population. In other words, these children are sensitive to many types of consequences that may come to maintain problem behavior and potentially lack the skills to contact these consequences in socially appropriate ways. It is also possible that the finding is an artifact of the functional analysis methodology used. More than two-thirds of these cases were assessed with a brief functional analysis, which may falsely identify multiple behavioral functions. Kahng and Iwata (1999) examined the correspondence between full and brief functional analyses and found that while results from brief functional analyses corresponded with results from full functional analyses for 66% of cases, results from brief functional analyses were more likely to identify behavioral functions that were not supported by the results of full analyses (i.e., false positives). Thus, it is possible that with longer functional analyses, some of the behavioral functions that appear to be relevant at the beginning of the analysis may actually drop out as the analysis continues and the individual has more contact with the experimental conditions.

It is interesting that the only substantial difference between the distribution of behavioral functions for cases assessed with descriptive assessment compared to cases assessed with functional analysis was with respect to activity-restoration functions. It should be noted, however, that descriptive assessment and functional analysis are not simply different methods of assessing the function of a given behavior, but are also associated with different rates of problem behavior at the clinic from which the present data were obtained. That is, low-rate problem behavior was assessed using descriptive assessment while high-rate problem behavior was assessed using functional analyses. Thus, the lack of identified activity-restoration functions

from descriptive assessments may indicate that behavior maintained by restoration of an activity or ritual typically occurs at higher rates.

The finding that children with Asperger's disorder or PDD-NOS seem less likely than children with autism to display escape-maintained problem behavior may stem from the fact that children with Asperger's disorder or PDD-NOS, as a group, tend to be higher functioning than children with autism, and typically have more developed language skills. Therefore, these children may be better equipped to deal with demands and be more likely to have a socially appropriate escape response in their repertoire. Further, age may play a role in the finding that children with Asperger's disorder or PDD-NOS seem more likely to display problem behavior maintained by activity restoration, in that older children tend to display more developed rituals, the disruption of which may lead to problem behavior. For example, Gray and Tonge (2001) found that infants and preschool aged children rarely exhibit ritualistic or stereotyped behaviors, while older children and adults tend to exhibit those behaviors more frequently. Further, younger children with autism often display motor and sensory stereotypic behavior while older children display more complex ritualized behavior such as obsessions and compulsions (Militerni et al. 2002). Although the average ages in the two sub-samples in the present study did not differ substantially, it is interesting to note that of the six cases displaying an activity restoration function, only one case involved a child under the age of 6.

The proportion of cases in which the relation between the behavioral function hypothesized following informant assessment and the function identified through subsequent assessment that can be described as a true positive or true negative are significantly higher than the proportion of cases that represent false positives and false negatives—a promising finding. Further, the finding that the proportions of false positives are significantly higher than the proportions of false negatives suggests that the informant assessment is thorough in identifying all potential antecedents or consequences relevant to the target problem behavior, and that subsequent assessments are successful in discounting the consequences that are not actually involved in the maintenance of problem behavior.

The present study provides some noteworthy improvements over previously published studies of epidemiological data on problem behavior. First, this study provides data from children with a single class of diagnoses, and further analyzed results according to sub-classes of diagnosis. As compared to previous studies in which the data from individuals with multiple types of developmental disability were analyzed together, the approach taken here allows us to draw tentative conclusions regarding relations that may exist between an individual's diagnosis and the function of the problem behavior they exhibit. Findings from the current study, for example, provide preliminary support for the conclusion that the problem behavior of children with Asperger's disorder or PDD-NOS is less likely to be maintained by escape and more likely to be maintained by activity restoration than children with autism.

Second, the current study included data from descriptive assessments, procedures commonly used for low-rate behavior that cannot be easily assessed through functional analysis. The finding that the distribution of behavioral function from cases utilizing descriptive assessment was similar to the distribution from cases utilizing functional analysis provides preliminary indirect support for descriptive assessment methodology in identifying the functions of low-rate problem behavior.

Despite these strengths, there are some important limitations to the present study that must be noted. First, the conditions utilized in the functional analyses were determined based on information collected during informant assessment. Therefore, it is possible that other behavioral functions were present and were simply not analyzed in the functional analysis if those potential functions were not identified through informant assessment. Second, the cases assessed in this study represented families who willingly sought services for their children. It is quite possible that the distribution of behavioral functions as well as the relation between hypothesized and identified functions would look different if our sample had included cases involving milder problem behaviors that might not motivate caregivers to seek services (i.e., a community-based sample). In other words, the generalizability of these results may be limited as a result of the clinic-based sample. Third, the brief functional analysis methodology might have resulted in inflated identification of problem behavior maintained by multiple functions. It is possible that more extended analyses would have eliminated some of these potentially inaccurate identifications of function. In previously published epidemiological data on problem behavior, however, the rates of multiply controlled problem behaviors vary considerably across studies utilizing both brief and extended analyses (e.g., Asmus et al. 2004; Hagopian et al. 1998; Iwata et al. 1994b). Thus, no firm conclusions can be made at this time regarding the relation between the duration of the analysis and the identification of multiple behavioral functions. Fourth, the combination of participants with Asperger's disorder and PDD-NOS into a single sub-sample may have resulted in a relatively heterogeneous group. In other words, although individuals with Asperger's disorder or PDD-NOS are generally higher functioning and have stronger language skills then individuals with autism, without direct assessment of these skills it is possible that substantial variability existed within this sub-sample. Finally, this study relied on a relatively small sample size of cases that represents a

heterogeneous group of children. A larger sample size would have provided more power, and a more homogeneous group would have allowed for potential generalization of results to similar individuals.

An important benefit of epidemiological investigations of functional assessment data is that they allow us to understand and potentially predict the probability of behavioral functions under certain conditions. In order to reap the most benefit from such data, it is recommended that future researchers continue to analyze aggregate data in this manner. Specifically, in order to evaluate differences in the distribution of behavioral function across diagnoses, future investigations should to assess and present data according to specific diagnoses. Second, research comparing the distributions of behavioral function from individuals referred for services or whose families willingly sought services and those individuals whose families did not seek services might indicate important relations between the severity of problem behavior and its corresponding function. Such analyses could be conducted in clinical or educational settings in which a wide range of problem behaviors are likely to occur. Third, based on the finding that brief functional analyses are more likely to result in false-positive identification of behavioral functions while within-session analyses are more likely to result in false-negatives, future research and clinical practice could benefit from combining these two methods in order to increase the accuracy of functional analysis (Kahng and Iwata 1999). Finally, the overwhelming proportion of cases displaying problem behavior maintained by social reinforcement emphasizes the importance of teaching these children socially appropriate responses to gain access to social reinforcement, or teaching caregivers how to teach their children basic communicative responses, as well as carefully designing their environments to avoid creating conditions that make the occurrence of problem behavior more likely.

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