Insurance Coverage of Applied Behavior Analysis for Adults with Autism: A Review of the Evidence

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The term "Autism Spectrum Disorder" is frequently abbreviated to "autism" throughout this document.

Given the context of this report, there is an emphasis on adults with autism who exhibit fewer adaptive skills and greater behavioral challenges.

Request for Clinical Case Statement

At the request of the NJ Department of Banking and Insurance, Autism New Jersey provided the following narrative and research studies to address whether there is clinical evidence to support the use of Applied Behavior Analysis (ABA) for individuals over the age of 21.

Scope of the Problem

The Centers for Disease Control and Prevention (CDC) stated that Autism Spectrum Disorder is an "urgent public health concern" when they announced prevalence rates of 1 in 166 nationally and 1 in 101 in New Jersey, (CDC, 2007, p. 36). These prevalence rates were found in children who were 8 years old in 2000. These children are now 22-year-old adults. In the years since that report, the prevalence has increased. Autism Spectrum Disorder now affects 1 in 68 nationally and 1 in 45 children in New Jersey (CDC, 2014). In addition to the tremendous psychological and financial burden on the individual with autism and his/her family, the societal costs of autism are upwards of $35 billion annually in direct and indirect costs to care for all individuals diagnosed over their lifetime (Ganz, 2007). Furthermore, as the prevalence increases so do the individual, familial, and societal costs.

It is plausible that these high costs are in part due to the significant level of care needed for adults with autism who have poor outcomes. According to Howlin et al. (2004), 58% of adults with autism had poor or very poor outcomes. Similarly, when Billstedt, Gillberg, and Gillberg (2005) conducted a prospective study of 120 individuals with autism from childhood to adulthood for a period of 13-22 years and re-evaluated individuals at ages 17-40 years, they also found a high rate (78%) of poor outcomes among adults with autism. Of the 120 individuals in the study, only four individuals were independent, albeit leading fairly isolated lives. The authors posited that children with autism diagnosed in the 1960s, 1970s, and 1980s may have an even worse psychosocial outcome than previously believed. These findings are incredibly disheartening yet not surprising as the vast majority of adults with autism have not had access to evidence-based intervention. Poor outcomes for this vulnerable population should be considered unacceptable, and without funding for a full range of services, including those that are medically necessary, the plight of adults with autism is unlikely to improve (Gerhardt and Lainer, 2011).

Pervasive Behavioral Deficits and Excesses Associated with Autism

Why are the outcomes for adults with autism so poor? Adults with autism exhibit pervasive behavioral deficits and excesses that require medically necessary treatment that they often do not receive. Behavioral deficits include a broad range of social and communication skills. Without intervention, many adults with autism cannot independently communicate basic wants and needs. Many cannot carry on a basic conversation or exhibit common social courtesies such as eye contact and awareness of others in their surroundings. Deficits in social and communication skills impact every facet of daily life including family and social relationships, employment, and community integration.

Adults with autism also exhibit deficits in a broad range of adaptive behavior. The most critical set of adaptive behavior is safety skills. Many adults with autism unknowingly and frequently place themselves in harm's way at home and in the community, requiring near-constant or constant supervision. Without constant supervision, some individuals with autism ingest poisonous substances, play with sharp objects, drown, and engage in a variety of other life-threatening behavior. In fact, Danish researchers found that individuals with autism were nearly twice as likely to die by age 43 than individuals in the general population (Mouridsen et al., 2008). Epilepsy-related symptoms accounted for one third of the deaths, and an increased risk of accidental deaths due to drowning and suffocation was reported. These findings of higher mortality due to epilepsy and accidents were replicated two years later (Gillberg et al., 2010). Similar findings were reported for common medical conditions. According to researchers from the Cleveland Clinic and Case Western Reserve University, without intervention, adults with autism spectrum disorder appeared to be at significant risk for developing diabetes, coronary heart disease, and cancer by midlife (Tyler et al., 2011). Also of great concern, individuals with autism have a heightened risk for being victims of abuse (Sullivan and Knutson, 2000) given their limited ability to recognize, report, and exit dangerous situations. These behavioral deficits negatively impact the safety, health, and well-being of adults with autism.

More general types of adaptive behavior deficits include learning readiness skills, being responsive to instruction without exhibiting challenging behavior, waiting for progressively longer periods of time, and responding consistently in the absence of motivational systems. More specific types of adaptive behavior deficits include difficulty performing self-care, home, and leisure skills. Those unfamiliar with autism may assume that the development of self-care, home, and leisure skills does not have a place in the context of a report on the medical necessity of autism intervention. Yet, skill development in these domains serves more than the obvious purpose of teaching essential life skills. Doing so is also a constructive and systematic method of directly and indirectly reducing the maladaptive behavior discussed below.

In addition to the difficulty adults with autism have acquiring and maintaining new skills, they often do not spontaneously exhibit learned skills in novel settings or with novel people or materials present. This lack of generalization has a cascading effect on programming and requires significant time, expertise, and intervention to meaningfully address. It is also worthy of mention that as children mature into adulthood, society places increased expectations for self-care and appropriate behavior in community settings (McClannahan, MacDuff, and Krantz, 2002). Yet, many adults with autism function at developmental levels much younger than their chronological age and continue to require treatment to meet age-appropriate expectations essential to maintaining social relationships and community acceptance and involvement.

Coupled with deficits in adaptive behavior, adults with autism also exhibit behavioral excesses such as aggression; self-injury; elopement; pica (ingestion of inedible items); inappropriate sexual behavior; phobic avoidance; insistence on routine; prompt dependence; and vocal, verbal, and motor stereotypies. These behaviors are common in adults with autism. Researchers have documented the high rate of maladaptive behavior in adults with autism and noted the high rates of self-injurious behavior in women with autism (Cohen et al., 2010). More

specifically, 56% of a sample of 1,380 individuals with autism engaged in some form of physical aggression toward caregivers and 32% did so toward non-caregivers at the time of the study (Kanne and Mazurek, 2011). These same researchers also found that 68% of the individuals had a history of behaving aggressively towards caregivers and 49% towards non-caregivers. These findings illustrate the presence of clinically significant behavioral excesses and the need for behavioral assessment and treatment throughout adulthood (Matson and Rivet, 2008).

Medically Necessary Treatment for Adults with Autism

As described above, adults with autism exhibit pervasive and clinically significant behavioral symptoms of autism to varying degrees throughout their lifetimes. The assessment and treatment of these behavioral symptoms are warranted to prevent injury, reduce the behavioral effects of autism, and assist adults with autism to achieve and maintain sufficient functional capacity to perform age-appropriate or developmentally-appropriate daily activities. As will be described below, methods based on the principles and practices of Applied Behavior Analysis (ABA) are the standard of care in autism intervention. Furthermore, there is no other equally effective, more conservative, or substantially less costly course of treatment available.

Evidence that ABA Is an Effective Treatment for Autism

There is a robust body of empirical evidence that demonstrates that methods based on the principles and practices of Applied Behavior Analysis (ABA) effectively treat the behavioral deficits and excesses of autism. ABA-based interventions are the most well documented and empirically validated with decades of research support resulting in more than 500 published reports on the effective use of ABA with individuals with autism (Matson et al., 1996; Rosenwasser and Axelrod, 2001, 2002).

Complementing the research base on focused interventions designed to improve specific behaviors, broad literature reviews on autism intervention have also been conducted. In an analysis of the peer-reviewed literature on autism intervention from 1957-2007, the National Autism Center's National Standards Project (NSP) stated in its 2009 report,

> "Approximately two-thirds of the Established Treatments were developed exclusively from the behavioral literature (e.g., applied behavior analysis, behavioral psychology, and positive behavioral supports). Of the remaining one-third, 75% represent treatments for which research support comes predominantly from the behavioral literature. This pattern of findings suggests that treatments from the behavioral literature have the strongest research support at this time" (p. 52).

Similar results were found by an independent group of investigators affiliated with the National Professional Development Center on Autism Spectrum Disorders[1] (NPDC) who reviewed literature published from 1990-2011 (Wong et al., 2014). They found,

> "Twenty-seven practices met the criteria for being evidence-based. The evidence-based practices consist of interventions that are fundamental applied behavior analysis techniques (e.g., reinforcement, extinction, prompting), assessment and analytic

techniques that are the basis for intervention (e.g., functional behavior assessment, task analysis), and combinations of primarily behavioral practices used in a routine and systematic way that fit together as a replicable procedure (e.g., functional communication training, pivotal response training). Also, the process through which an intervention is delivered defines some practices (e.g., parent-implemented interventions, technology-aided interventions)" (p. 19).

The NPDC further asserted, "Although the NSP and NPDC reviews were conducted independently and their literature searches cover different time periods, their findings are remarkably similar" (p. 5).

It is encouraging to note that the National Autism Center is scheduled to release an updated review and analysis in Fall 2014. According to its website,

> "This will provide an update to the current empirical treatment literature (as published in the National Standards Report in 2009) and will include studies evaluating treatments for adults (22+) which have never been systematically evaluated before now."

Applied Behavior Analysis

An overview of the scope and depth of Applied Behavior Analysis is best described on various pages of the Behavior Analyst Certification Board's (BACB) website.

> "The field of Behavior Analysis grew out of the scientific study of principles of learning and behavior. It has two main branches: experimental and applied behavior analysis. The experimental analysis of behavior is the basic science of this field and has over many decades accumulated a substantial and well-respected body of research literature. This literature provides the scientific foundation for applied behavior analysis, which is both an applied science that develops methods of changing behavior and a profession that provides services to meet diverse behavioral needs. Briefly, professionals in applied behavior analysis engage in the specific and comprehensive use of principles of learning, including operant and respondent conditioning, in order to address behavioral needs of widely varying individuals in diverse settings. Examples of these applications include: building the skills and achievements of children in school settings; enhancing the development, abilities, and choices of children and adults with different kinds of disabilities; and augmenting the performance and satisfaction of employees in organizations and businesses.
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> Applied Behavior Analysis is a well-developed discipline among the helping professions, with a mature body of scientific knowledge, established standards for evidence-based practice, distinct methods of service, recognized experience and educational requirements for practice, and identified sources of requisite education in universities. Although the above definitions provide an overview of key elements within the practice of behavior analysis, there are additional features of applied behavior analysis that should be clarified in order to even briefly define the field. For the purposes of BACB

certifications and examinations, the content of applied behavior analysis is contained in the BACB Task List."

To review the knowledge and skills of Board Certified Behavior Analysts (BCBAs), the reader is referred to the BACB's *Fourth Edition Task List* available at www.bacb.com. Readers unfamiliar with ABA are referred to lay-friendly publications such as *Applied Behavior Analysis and Autism: An Introduction* (Buchanan and Weiss, 2006). From an anecdotal perspective, parents often speak of the life-changing effects ABA produced for their children with autism (Walsh, 2011).

Specifically for adults with autism, the effectiveness of ABA is illustrated in many review articles and experimental studies outlined in *Research Demonstrating the Effectiveness of Applied Behavior Analysis Methods for Adults with Autism* below in Appendix A. (This appendix includes a non-exhaustive list of studies and includes brief descriptions and full citations for each.) As detailed below, twelve literature reviews describe independent analyses of and support for ABA-based assessment and intervention methods. Similarly, fifteen experimental studies provide a body of empirical support for the use of ABA to treat clinically significant behavior.

Conclusion and Recommendation

Many independent research groups across the globe have found that ABA-based assessment and intervention methods are effective in the treatment of behavioral symptoms of autism. These symptoms encompass a broad range of behaviors including aggression, self-injury, elopement, pica, as well as basic safety, communication, and social skills.

The authors of this report acknowledge that systematic reviews of autism intervention for adults with autism are not currently available and recommend that the best available evidence be used to determine the most medically appropriate treatment for adults with autism. The robust empirical support for ABA-based interventions for children with autism combined with the effectiveness of focused ABA-based interventions for adults with autism make a compelling argument to require insurance coverage of ABA-based interventions for adults with autism.

With the astounding results of ABA demonstrated in cost-effectiveness studies of ABA services for children with autism in mind (Jacobson, Mulick, and Green 1998: Chasson, Harris, and Neely, 2007), it is highly encouraging that effective treatment into adulthood could be cost neutral (Hassiotis et al., 2010) and, more importantly, improve the functioning and quality of life of adults with autism.

1 - The NPDC on ASD is a multi-university center that operates through three sites: the FPG Child Development Institute at the University of North Carolina at Chapel Hill, the M.I.N.D. Institute at University of California at Davis Medical School, and the Waisman Center at the University of Wisconsin at Madison.

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Appendix A

Research Demonstrating Effectiveness of

Applied Behavior Analysis Methods for Adults with Autism

-- Select Abstracts --

Literature Reviews (reverse chronological order)

Initial functional analysis outcomes and modifications in pursuit of differentiation: A summary of 176 inpatient cases

Hagopian, Rooker, Jessel, & DeLeon. (2013). *Journal of Applied Behavior Analysis, 46,* 88-100.

The functional analysis (FA) described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) delineated not only a set of specific procedures, but also a model that involves the use of analogue conditions wherein antecedent and consequent variables are systematically manipulated. This consecutive case-series analysis describes FAs of 176 individuals with intellectual disabilities who had been admitted to an inpatient unit for severe problem behavior. Following an initial standardized FA, additional modifications were performed in pursuit of differentiation. Ultimately, a function was identified in 86.9% of the 176 cases and in 93.3% of the 161 cases for which the FA, if necessary, was modified up to 2 times. All modifications were documented and classified as involving changes to antecedents, consequences, or design (or some combination of these). Outcomes for each type of modification are reported. The results support the utility of ongoing hypothesis testing through individualized modifications to FA procedures and provide information regarding how each type of modification affected results.

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Identifying empirically supported treatments for pica in individuals with intellectual disabilities

Hagopian, Rooker, & Rolider. (2011). *Research in Developmental Disabilities 32,* 2114-2120.

The purpose of the current study was to critically examine the existing literature on the treatment of pica displayed by individuals with intellectual disabilities. Criteria for empirically supported treatments as described by Divisions 12 and 16 of APA, and adapted for studies employing single-case designs were used to review this body of literature. A total of 34 treatment studies were identified, 25 of which were well designed and reported at least an 80% reduction in pica (21 studies reported 90% or greater reduction in pica). Results indicated that behavioral treatments in general, and treatments involving the combination of reinforcement and response

reduction procedures in particular, can be designated as well-established treatments for pica exhibited by individuals with intellectual disabilities.

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Evidence to practice: Treatment of anxiety in individuals with autism spectrum disorders

Lang et al. (2011). *Neuropsychiatric Disease and Treatment, 7,* 27–30.

What treatment improves social interactions and reduces reports of anxiety symptoms in individuals with autism spectrum disorders (ASD) and a co-occurring anxiety disorder? Systematic reviews and randomized clinical trials suggest that cognitive behavior therapy in tandem with direct instruction of social skills using applied behavior analysis intervention components may be effective for treating anxiety in individuals with high functioning ASD. For individuals with ASD, an anxiety disorder, and an intellectual disability, systematic desensitization may be effective. Intervention should emphasize teaching social skills. Reinforcers (i.e., rewards based upon the client's interests) should be used to encourage participation in therapy. Treatment should incorporate visual aides and family involvement. Intervention components involving abstract concepts, visualization, and discussions of emotions are less useful given difficulties in abstract reasoning and communication inherent to ASD.

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A review of research on procedures for teaching safety skills to persons with developmental disabilities

Dixon, Bergstrom, Smith, & Tarbox. (2010). *Research in Developmental Disabilities, 31,* 985–994.

Safety skills are an important but often neglected area of training for persons with developmental disabilities (DD). The present study reviewed the literature on teaching safety skills to persons with DD. Safety skills involve a variety of behaviors such as knowing how to cross the street or what to do in case of a house fire. A number of studies have been conducted on teaching these skills to individuals with DD. The studies reviewed have varying degrees of success and demonstrate varying degrees of generalization, but the general finding has been that prompting, reinforcement, and role-playing are effective teaching procedures across a variety of participants, skills, and settings.

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Social skills interventions for individuals with autism: Evaluation for evidence-based practices within a best evidence synthesis framework

Reichow & Volkmar. (2010). *Journal of Autism and Developmental Disorders, 40,* 149–166.

This paper presents a best evidence synthesis of interventions to increase social behavior for individuals with autism. Sixty-six studies published in peer-reviewed journals between 2001

and July 2008 with 513 participants were included. The results are presented by the age of the individual receiving intervention and by delivery agent of intervention. The findings suggest there is much empirical evidence supporting many different treatments for the social deficits of individuals with autism. Using the criteria of evidence-based practice proposed by Reichow et al. (Journal of Autism and Developmental Disorders, 38:1311– 1318, 2008), social skills groups and video modeling have accumulated the evidence necessary for the classifications of established EBP and promising EBP, respectively. Recommendations for practice and areas of future research are provided.

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Treatment of elopement in individuals with developmental disabilities: A systematic review

Lang et al. (2009). *Research in Developmental Disabilities 30,* 670–681.

We reviewed studies involving the treatment of elopement in individuals with developmental disabilities. Systematic searches of three electronic databases, journals, and reference lists identified 10 studies meeting the inclusion criteria. These studies were evaluated in terms of: (a) participants, (b) procedures used to assess elopement, (c) intervention procedures, (d) results of the intervention, and (e) certainty of evidence. Across the 10 studies, intervention was provided to a total of 53 participants aged 3–47 years. Assessment procedures included anecdotal staff reports, participant interviews, direct observation, and modified analog functional analysis. Intervention approaches included differential reinforcement, extinction, functional communication training, response blocking, non-contingent reinforcement, shaping, and scheduled exercise. Positive outcomes were reported in 80% of the reviewed studies. The evidence base suggests that function-based assessment (e.g. functional analysis procedures) and function-based treatments (e.g. functional communication training) may be most effective in the treatment of elopement.

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Technical review of published research on applied behaviour analysis interventions for people with autism spectrum disorders: Auckland Uniservices Ltd.

Mudford et al. (2009). Wellington, New Zealand: Ministry of Education.

The current review demonstrated that ABA interventions can produce meaningful and desirable behavioural change in individuals with ASD, and taken as a whole, there is strong support for the effectiveness of ABA interventions in the treatment of ASD. Significant benefit was also consistently illustrated at the level of specific behavioural categories; with evidence at this level either meeting the criterion of 'emerging evidence' or 'strong support' for the conclusion of intervention effectiveness. It is important that agencies charged with providing resources for the treatment and education of people with ASD take notice of these findings.

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Identifying empirically supported treatments for phobic avoidance in individuals with intellectual disabilities

Jennet & Hagopian. (2008). *Behavior Therapy, 39,* 151-161.

This paper reviews the literature regarding the treatment of phobic avoidance in individuals with intellectual disabilities. Criteria for classifying interventions as empirically supported, developed by the American Psychological Association (APA) Division 12 Task Force on Promotion and Dissemination of Psychological Procedures, were used. For studies employing single case experimental designs, criteria developed by APA Division 16 (Kratochwill & Stoiber, 2002; Shernoff, Kratochwill,& Stoiber, 2002) were used to supplement Division 12 criteria. Results indicate that behavioral treatment can be designated as a well-established treatment for phobic avoidance in individuals with intellectual disabilities.

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An analysis of functional communication training as an empirically supported treatment for problem behavior displayed by individuals with intellectual disabilities

Kurtz, Boelter, Jarmolowicz , Chin, & Hagopian. (2007). *Research in Developmental Disabilities, 32,* 2935–2942.

This paper examines the literature on the use of functional communication training (FCT) as a treatment for problem behavior displayed by individuals with intellectual disabilities (ID). Criteria for empirically supported treatments developed by Divisions 12 and 16 of the American Psychological Association (Kratochwill & Stoiber, 2002; Task Force, 1995) and adapted by Jennett and Hagopian (2008) for evaluation of single-case research studies were used to examine the support for FCT. Results indicated that FCT far exceeds criteria to be designated as a well-established treatment for problem behavior exhibited by children with ID and children with autism spectrum disorder, and can be characterized as probably efficacious with adults.

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Management of children with autism spectrum disorders

Myers, Johnson, & The Council on Children with Disabilities. (2007). *Pediatrics, 120,* 1162-1182.

Pediatricians have an important role not only in early recognition and evaluation of autism spectrum disorders but also in chronic management of these disorders. The primary goals of treatment are to maximize the child's ultimate functional independence and quality of life by minimizing the core autism spectrum disorder features, facilitating development and learning, promoting socialization, reducing maladaptive behaviors, and educating and supporting families. To assist pediatricians in educating families and guiding them toward empirically supported interventions for their children, this report reviews the educational strategies and associated therapies that are the primary treatments for children with autism spectrum disorders. Optimization of health care is likely to have a positive effect on habilitative progress, functional outcome, and quality of life; therefore, important issues, such as management of associated

medical problems, pharmacologic and nonpharmacologic intervention for challenging behaviors or coexisting mental health conditions, and use of complementary and alternative medical treatments, are also addressed. [States specifically that ABA interventions are effective for adults with ASD]

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Use of a short-term inpatient model to evaluate aberrant behavior: Outcome data summaries from 1996 to 2001

Asmus, Ringdahl, Sellers, Call, Andelman, & Wacker. (2004). *Journal of Applied Behavior Analysis, 37,* 283–304.

Previous outcome studies have provided descriptions of functional analyses conducted in outpatient clinics (Derby et al., 1992), long-term inpatient programs (Iwata, Pace, et al., 1994), and home environments (Wacker et al., 1998). This study provides a description of 138 children and adults with and without developmental disabilities who were evaluated and treated for aberrant behaviors on a short-term inpatient unit. The results indicated that the functional analyses conducted during a short-term inpatient evaluation were successful for 96% of the participants in identifying maintaining reinforcers of aberrant behavior and leading to an 80% or greater reduction in aberrant behavior for 76% of the participants in an average of 10 days.

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Efficacy of behavioral interventions for reducing problem behavior in persons with autism: A quantitative synthesis of single-subject research

Campbell. (2003). *Research in Developmental Disabilities 24,* 120-138.

The efficacy of behavioral interventions for problem behavior in persons with autism was reviewed. One hundred and seventeen published articles representing 181 individuals with autism were examined. Articles were selected from 15 journals. Participant, treatment, and experimental variables were evaluated. Three effect sizes were calculated for each article. Behavioral treatments are effective in reducing problematic behaviors in individuals with autism. Type of target behavior and type of treatment did not moderate the average effect of treatment. As measured by percentage of zero data (PZD), three variables were predictive of behavioral suppression beyond that accounted for by behavioral topography and treatment type. Reliability of observation and number of treatment data points were positively related to PZD scores. Treatments based on experimental functional analysis (EFA) produced higher average PZD scores than treatments that did not include an EFA. The implications of the findings, study limitations, and suggestions for future research are discussed.

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Experimental Studies

Effects of two variations of differential reinforcement on prompt dependency

Cividini-Motta & Ahearn. (2013). *Journal of Applied Behavior Analysis, 46,* 640-650.

Prompt dependency is an often referenced but little studied problem. The current study evaluated 2 iterations of differential reinforcement (DR) for overcoming prompt dependency and facilitating skill acquisition with 4 individuals who had been diagnosed with an autism spectrum disorder (ASD). Preference and reinforcer assessments were conducted to determine moderately and highly preferred reinforcers for each participant. Three sets of word-picture relations were taught to each of the participants using 1 of 3 DR procedures. Reinforcement for independent responses entailed delivery of the highest preference stimulus across all 3 procedures. Consequences for prompted responses entailed delivery of the highest preference stimulus (no DR), delivery of the moderately preferred stimulus (DR high/moderate), or no delivery of reinforcers (DR high/extinction). Results indicated that the DR high/moderate condition was most effective for 3 of 4 participants, whereas the DR high/extinction condition was most effective for the remaining participant.

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Some indirect effects of positive practice overcorrection

Peters & Thompson. (2013). *Journal of Applied Behavior Analysis, 46,* 613-625.

We evaluated the effects of positive practice overcorrection (PP OC) on levels of motor stereotypy and appropriate engagement in the activity practiced during treatment with 3 young men with autism. We also measured preference for the practiced activities during preference probes to determine if these activities might acquire aversive properties as a result of the frequent pairing with PP OC. Treatment reduced motor stereotypy for all 3 participants, and engagement increased for 2 of the 3 participants. Relative preference for the activities was not disrupted by the implementation of PP OC, although overall contact with the activities decreased for 1 participant. Results from 1 participant suggest that PP OC may be less effective when stereotypy results in access to a more highly preferred activity.

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Assessment and treatment of foot-shoe fetish displayed by a man with autism

Dozier, Iwata, & Worsdell. (2011). *Journal of Applied Behavior Analysis, 44,* 133-137.

Results of a functional analysis indicated that a man diagnosed with autism engaged in bizarre sexual behavior in the presence of women wearing sandals. Several treatments proved to be ineffective or impractical. By contrast, a response-interruption/time-out procedure quickly eliminated the problem behavior in multiple settings.

An evaluation of antecedent exercise on behavior maintained by automatic reinforcement using a three-component multiple schedule

Morrison, Roscoe, & Atwell. (2011). *Journal of Applied Behavior Analysis, 44,* 523-541.

We evaluated antecedent exercise for treating the automatically reinforced problem behavior of 4 individuals with autism. We conducted preference assessments to identify leisure and exercise items that were associated with high levels of engagement and low levels of problem behavior. Next, we conducted three 3-component multiple-schedule sequences: an antecedent-exercise test sequence, a noncontingent leisure-item control sequence, and a social-interaction control sequence. Within each sequence, we used a 3-component multiple schedule to evaluate preintervention, intervention, and postintervention effects. Problem behavior decreased during the postintervention component relative to the preintervention component for 3 of the 4 participants during the exercise-item assessment; however, the effects could not be attributed solely to exercise for 1 of these participants.

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Applied behaviour analysis and standard treatment in intellectual disability: 2-year outcomes

Hassiotis, Canagasabey, Robotham, Marston, Romeo, & King. (2010). *British Journal of Psychiatry. Published online Dec. 15, 2010; abstract viewed on bjp.rcpsych.org on September 15, 2014.*

Applied behaviour analysis by a specialist team plus standard treatment for adults with intellectual disability displaying challenging behaviour was reported to be clinically and cost-effective after 6 months. In a 2-year follow-up of the same trial cohort, participants receiving the specialist intervention had significantly lower total and subdomain Aberrant Behavior Checklist scores than those receiving usual care alone. After adjustment for baseline covariates there was no significant difference in costs between the trial arms.

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Randomized, single-blind, controlled trial of a specialist behavior therapy team for challenging behavior in adults with intellectual disabilities.

Hassiotis, Robotham, Canagasabey, Romeo, Langridge, Blizard, Murad, & King. (2009). *American Journal of Psychiatry, 166,* 1278-85.

Community-based specialist behavior therapy teams may be helpful in managing challenging behavior, but evidence of their effectiveness is limited. This study was designed to examine the effectiveness and costs associated with treatment by a specialist behavior therapy team. This was a parallel-group, randomized, single-blind controlled trial carried out in an intellectual disabilities service in England. Participants were 63 male and female service users with mild to severe intellectual disability who presented with challenging behavior. The interventions were standard treatment plus applied behavioral analysis (N=32) and standard treatment only (N=31). The primary outcome measure was challenging behavior, as measured by total and subscale scores on the Aberrant Behavior Checklist 3 and 6 months after

randomization. Secondary outcome measures were psychiatric comorbidity assessed at 3 and 6 months using the Psychiatric Assessment Schedule for Adults With a Developmental Disability Checklist (PAS-ADD) and total costs recorded at 6 months. Multilevel modeling was used to compare square root transformations of Aberrant Behavior Checklist scores. Significant differences were found in the transformed total scores on the Aberrant Behavior Checklist (difference=-0.89, 95% CI=-1.74 to -0.04) and transformed lethargy and hyperactivity subscale scores (common intervention effect=-0.56, 95% CI=-0.97 to -0.15). Standard care participants fared worse on the PAS-ADD comorbid organic disorder subscale. There was a clear trend for lower overall costs of the intervention. Use of a specialist behavior therapy team in addition to standard treatment appears to be more effective in improving challenging behavior and may have financial advantages over standard treatment.

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Functional analysis and treatment of rumination using fixed-time delivery of a flavor spray

Wilder et al. (2009). *Journal of Applied Behavior Analysis, 42,* 877-882.

Rumination consists of regurgitating previously ingested food products and reswallowing the stomach contents in a repetitive manner. A functional analysis suggested that rumination exhibited by an adult with autism was maintained by automatic reinforcement. Next, a preference assessment with three flavor sprays (i.e., flavored sprays used by dieters) showed that apple pie spray was most preferred. Finally, the effects of fixed-time delivery of the apple pie spray on levels of rumination were evaluated. The spray reduced rumination, and the participant was taught to self-administer the spray.

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The effects of errorless learning and backward chaining on the acquisition of internet skills in adults with developmental disabilities

Jerome, Frantino, & Sturmey. (2007). *Journal of Applied Behavior Analysis, 40,* 185–189.

An important area in the learning and development of individuals with disabilities is the acquisition of independent, age-appropriate leisure skills. Three adults with autism and intellectual disability were taught to access specific Internet sites using backward chaining and most-to-least intrusive prompting. The number of independent steps completed in the task analysis increased following training.

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Functional analysis and treatment of verbal perseverations displayed by an adult with autism

Rehfeldt & Chambers. (2003). *Journal of Applied Behavior Analysis, 36,* 259-261.

The function of perseverative speech for an adult man who had been diagnosed with autism and intellectual disability was examined. Results showed that verbal perseverations were

maintained by social attention. An intervention consisting of differential reinforcement of appropriate verbal responses and extinction of perseverative verbal responding was effective in decreasing verbal perseverations.

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The use of symmetrical "do" and "don't" requests to interrupt ongoing activities

Adelinis & Hagopian. (1999). *Journal of Applied Behavior Analysis, 32,* 519-523.

The results of a modified functional analysis demonstrated that aggression, displayed by a 27-year-old man, was occasioned by the use of "don't" requests to interrupt the client's ongoing and often inappropriate activities (e.g., lying on the floor, pica, inappropriate touching of others). Subsequent analyses demonstrated that aggression was lower when ongoing activities were interrupted with symmetrical "do" requests than with "don't" requests. An intervention utilizing symmetrical "do" requests (i.e., prompting an individual to engage in an incompatible behavior) to interrupt such activities resulted in reduced levels of aggression.

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Clarifying an ambiguous functional analysis with matched and mismatched extinction procedures

Kuhn, DeLeon, Fisher, & Wilke. (1999). *Journal of Applied Behavior Analysis, 32,* 99-102.

Results of functional analysis were ambiguous in suggesting that self-injurious behavior (SIB) was maintained by escape, sensory reinforcement, or both. To help clarify these results, we compared escape extinction, sensory extinction, and the combined treatments. Sensory extinction proved to be a necessary and sufficient treatment, whereas escape extinction failed to decrease SIB. These analyses helped to clarify the function of SIB and to identify an effective and efficient treatment.

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The effects of advance notice of activity transitions on stereotypic behavior

Tustin. (1995). *Journal of Applied Behavior Analysis, 28,* 91-92.

Using an A-B-A-B design, two procedures for requesting a change of activity were compared for their effect on the stereotypic behavior of a man with autism. One procedure requested immediate change of activities, whereas the second procedure gave advance notice of a change. Less stereotypy occurred when advance notice of change was given. The study showed that giving advance notice of change reduced stereotypy, supporting previous research showing that stereotypy may be reduced by signaling changes. Furthermore, the advance notice condition resulted in increased initiations of the second task in a timely manner.

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Multiple functions of problem behaviors: assessment and intervention

Day, Horner, & O'Neill. (1994). *Journal of Applied Behavior Analysis, 27,* 279-289.

Three individuals with severe intellectual disabilities participated in separate analyses of problem behavior. In each case, a functional analysis was conducted under two parallel conditions. In one condition, self-injury or aggression resulted in escape from difficult tasks; in the second condition, the same problem behavior resulted in access to preferred items. Results indicated that the problem behaviors for each participant were maintained by both types of contingencies. Functional communication training was then delivered first in one condition and then in the second. After each participant was trained in a functionally equivalent mode of communication for one condition, levels of problem behavior decreased in that condition but not in the untrained condition. Only after separate communication forms were trained in both conditions was problem behavior reduced to clinically acceptable levels. These results document three examples of problem behaviors under multiple control, and emphasize the need to organize interventions that address different contingencies of reinforcement that maintain the same problem behavior.

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Increasing requests by adults with developmental disabilities using incidental teaching by peers

Farmer-Dougan. (1994). *Journal of Applied Behavior Analysis, 27,* 533-544.

A peer-delivered incidental-teaching procedure was used to instruct appropriate requesting in adults with moderate to severe intellectual disability or autism. Three pairs of group-home residents participated in an incidental-teaching procedure to increase appropriate requesting, prompting, and responding of residents during lunch-preparation sessions. An increase in the number of incidental-teaching episodes during dinner was obtained, and remained high when lunch-making training sessions were withdrawn. In addition, during the incidental-teaching phase, an increase in appropriate requests and overall verbalizations occurred for the peer learners. Changes in appropriate requesting and overall verbalizations also remained higher than baseline when training was withdrawn.

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Some direct and generalized effects of replacing an autistic man's echolalia with correct responses to questions

McMorrow & Foxx. (1986). *Journal of Applied Behavior Analysis, 19,* 289-297.

We extended the use of operant procedures to decrease immediate echolalia and increase the appropriate responding to questions of a 21-year-old autistic man. Three experiments were conducted in which the overall plan was to encourage the subject to remain quiet before, during, and after the presentation of questions and teach him to use environmental cues (i.e., word cards or a model's responses) to increase the likelihood of responding correctly. Multiple baseline designs demonstrated that echolalia was rapidly replaced with correct stimulus-specific

responses. In addition, there were a variety of generalized improvements in the subject's verbal responses to questions. The procedures and results are contrasted to previous research in an attempt to explain the encouraging findings.

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Additional Studies

Behavior analysis and intervention for adults with autism

McClannahan, MacDuff, & Krantz. (2002). *Behavior Modification, 26,* 9-26.

This article describes a behavioral intervention program for adults with autism, suggests that preparation for adulthood should begin in early childhood, asserts that the curriculum should be just as comprehensive and evaluation criteria just as rigorous in programs for adults as in programs for children, and proposes that close examination of adults' repertoires may lead to key modifications of services delivered to children. Along the way, the authors provide some data on the progress of 15 people who are now adults and whom they have known for 15 to 25 years. ABA methods were effective for 78% of behavior change programs. Finally, the authors argue that, because of the diversity of skills and skill deficits displayed by adults with autism, a program model that prevents "falling through the cracks" must provide an array of options--from training center to supported employment.

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"Harry": A ten year follow-up of the successful treatment of a self-injurious man

Foxx. (1990). *Research in Developmental Disabilities, 11,* 67-76.

The successful treatment of a self-injurious man is reported in a ten year follow-up. The client, Harry, is a 32-year-old man who was treated for self-injurious behavior (SIB) ten years ago with a multiphased program that included a) reinforcement with physical restraint for increasingly longer periods of noninjury and timeout from restraint for SIB, b) fading restraint, c) substituting appropriate forms of restraint, d) token reinforcement for adaptive behavior, and e) parent and vocational training. After ten years Harry's SIB remains infrequent and rarely results in any tissue damage. No negative consequences have been used for his SIB for over nine years. Harry now works all day in a community workshop, earns approximately $45.00 per month, visits his parents' home virtually every weekend and accompanied them two years ago on a four and a half week vacation by car that covered 7500 miles. Conceptual and practical considerations related to the client's success are discussed.

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A scatter plot for identifying stimulus control of problem behavior

Touchette, MacDonald, & Langer. (1985). *Journal of Applied Behavior Analysis, 18,* 343-351.

Line graphs that average response frequency over long periods obscure the major rate changes that indicate sources of behavioral control. A scatter plot can make patterns of responding identifiable and, in turn, suggest environmental features that occasion undesirable behavior. Use of scatter diagrams is illustrated in three cases. Tom was 23 years old and lived with other autistic adults in a community residence. He had been hospitalized with recurrent septisemia resulting from self-inflicted face and hand wounds. His irreparable detached retina was thought to be secondary to head hitting. Tom wore a helmet and face guard to prevent further injury. Scatter plot identified plausible environmental modifications to reduce the self-injurious behavior.

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