HHS Public Access

Author manuscript

Int Rev Psychiatry. Author manuscript; available in PMC 2022 January 27.

Published in final edited form as:

Int Rev Psychiatry. 2018 February ; 30(1): 96–109. doi:10.1080/09540261.2018.1435513.

Treatment of severe problem behaviour in children with autism spectrum disorder and intellectual disabilities

Eli T. Newcomb[a], **Louis P. Hagopian**[b,c]

[a]The Faison Center, Richmond, VA, USA;

[b]Department of Behavioral Psychology, Kennedy Krieger Institute, Baltimore, MD, USA;

[c]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Abstract

Children with autism spectrum disorder (ASD) and intellectual disabilities (ID) present with problem behaviour at rates disproportionately higher than their typically-developing peers. Problem behaviour, such as self-injury, aggression, pica, disruption, and elopement result in a diminished quality-of-life for the individual and family. Applied behaviour analysis has a well-established research base, detailing a number of assessment and treatment methods designed to address behaviour problems in children with ASD and ID. Although the variables that lead to the emergence of problem behaviour are not precisely known, those that are currently responsible for the maintenance of these problems can be identified via functional behaviour assessment, which is designed to identify events that occasion problem behaviour, consequences that maintain it, as well as other environmental factors that exert influence on the behaviour. Corresponding function-based treatment is implemented when environmental determinants are identified, with the aim of decreasing or eliminating problem behaviour, as well as teaching the individual to engage in more appropriate, alternative behaviour. In some cases, when problem behaviour is under the control of both environmental and biological variables, including psychiatric conditions, combining behavioural and pharmacological interventions is viewed as optimal, although there is limited empirical support for integrating these approaches.

Keywords

Applied behaviour analysis; autism spectrum disorder; severe problem behaviour; functional behaviour assessment; intellectual disability; neurobehavioural model

Overview of problem behaviour and prevalence

Children with autism spectrum disorder (ASD) and intellectual disabilities (ID) present with problem behaviour at rates disproportionately higher than their typically-developing peers

✉**CONTACT** Eli T. Newcomb, enewcomb@faisoncenter.org.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

(Gurney, McPheeters, & Davis, 2006). Here, we use the term *problem behaviour* to refer to behaviour that poses risks to self or others and is disruptive to functioning; examples include self-injurious behaviour (SIB; e.g. head banging, skin picking, self-biting, and head hitting), aggression towards others (e.g. hitting, kicking, biting, and scratching others), pica (i.e. the ingestion of nonnutritive substances), disruptive behaviour (e.g. destroying property and throwing items), and elopement (i.e. leaving the presence of a caregiver outside of appropriate contexts). Problem behaviour among individuals with ASD is multifaceted, and presents as a heterogeneous phenomenon. Some individuals may present with only one form of problem behaviour, while others may engage in multiple forms (i.e. aggression, elopement, self-injury, pica, etc.). Problem behaviour can be relatively mild and transient in some, or highly severe, treatment resistant, and chronic. The pattern of occurrence can be episodic or consistent, and it can range from a few occurrences per week to hundreds of occurrences per day. These problem behaviours sometimes co-occur with irritability, generally defined as outbursts expressive of anger, frustration, and distress (McGuire et al., 2016). When these issues occur regularly, cause harm to the individual or others, restrict participation in activities appropriate for the individual's developmental level, and necessitate a higher level of care (e.g. constant supervision, multiple people required to manage when an episode occurs, etc.), they are classified as 'severe'.

Dekker, Koot, Ende, and Verhulst (2002) estimated that ~50% of individuals with ID experience some form of behaviour problems; in 5–10% of these individuals behavioural challenges are characterized as severe (Emerson et al., 2001). Aggression towards others is a common problem reported in individuals with both ASD and ID, although reported more often and to be more problematic within individuals with ASD (Farmer & Aman, 2011). Recently, Soke et al. (2016) identified the prevalence of SIB among children with autism to exceed 28%. Elopement also puts a child at risk for serious harm or death; and one recent parent survey indicated that 49% of children with ASD engaged in elopement after the age of 4 years (Anderson et al., 2012). Among those that reported one or more instances of elopement, 26% were reportedly gone long enough to cause concern, 24% were in danger of drowning, and 69% were at risk of being struck by a motor vehicle. Similar to findings on other forms of problem behaviour, the severity of the child's disability was associated with higher rates of elopement.

Impact of problem behaviour

The presence of problem behaviour can result in a diminished quality-of-life for the child, limit access to community resources, and necessitate a myriad of costly resources to manage the resulting circumstances produced by prevailing problem behaviour (Lowe et al., 2007; National Institutes of Health, 1989). Furthermore, restrictive behaviour management methods are used more often with this population, including increased use of physical restraint (one or more staff or caregivers holding the individual), mechanical restraint (restricting movement through the use of equipment such as arm splints or soft restraints on the extremities and/or head), and seclusionary practices (placing an individual in a separate room when problem behaviour occurs). Moreover, it is more likely that medication will be over-prescribed for this population (Emerson et al., 2000; Sturmey, Lott, Laud, & Matson, 2005).

The negative impact of problem behaviour on the family unit is significant as well. Children with developmental disorders who also exhibit problem behaviour are at higher risk for out-of-home, residential placement (e.g. living in a group home). In the case of individuals with ASD who exhibit aggressive behaviour, daily routines are regularly disrupted, well-being of family members is compromised (e.g. feeling isolated and living in a warzone have been reported), and financial resources are strained as the family exhausts them on extra supports, medical visits and care, crisis-related expenses, etc. Ironically, families with a child who has ASD and exhibits aggressive behaviour also have a difficult time accessing supports specific to the treatment of aggression (Hodgetts, Nicholas, & Zwaigenbaum, 2013).

Risk factors and possible causes

The diagnosis of ASD, psychiatric disorder, deficits in receptive and expressive communication, and severity of intellectual disability are all correlated with the presence of problem behaviour and are, thus, thought to be risk factors for its emergence (McClintock, Hall, & Oliver, 2003). These problems are likely a product of deficits related to ASD and ID, and experiences that reinforce and strengthen these behaviours. Much of early learning is mediated through social interaction, and deficits in communication and social reciprocity may limit establishment of adaptive behaviour. These deficits increase the likelihood of self-stimulatory and socially avoidant behaviour, as well as emotion dysregulation and frustration, which can directly lead to problem behaviour. Because problem behaviours are potentially dangerous, disruptive, and distressing to caregivers, they often react by attempting to calm the individual through redirection, consolation, or interruption. Eventually, they may even eliminate the offending event from their future routines. For example, if a child engages in self-injury when presented with instructional demands, the caregiver may remove those demands in an attempt to calm the child and avoid injury or disruption of the environment; if successful, caregivers may avoid placing similar demands in the future. Both problem behaviour and the well-intended reactions of caregivers may inadvertently be reinforced through operant learning processes.

Although reinforcing problem behaviour increases its *future probability*, the *immediate effect* of reinforcement is often the temporary cessation of problem behaviour. This temporary effect offers relief to the caregiver, which, in turn, reinforces their reactive behaviour. This interaction leads to the establishment and maintenance of maladaptive caregiver–child interaction patterns during which child problem behaviour is reinforced by caregiver behaviour, and their act of reinforcing problem behaviour is, in turn, reinforced by the temporary cessation of problem behaviour (Addison & Lerman, 2009; Carr, Taylor, & Robinson, 1991; Sloman et al., 2005; Stocco & Thompson, 2015). Over time, these patterns can result in parental accommodation, whereby they learn to avoid situations that may upset their child and provoke problem behaviour; in some cases they even accommodate bizarre requests on the part of the child to avoid problem behaviour (Bowman, Fisher, Thompson, & Piazza, 1997; Storch et al., 2015). These interaction patterns can further impair functioning, as the avoidance generalizes and can be a source of chronic stress for parents.

The emergence and maintenance of problem behaviour is not caused by reinforcement alone—it is a product of interactions between deficits associated with ASD and learning

experiences that establish problem behaviour through operant learning processes (Furniss & Biswas, 2012; McClintock et al., 2003). For any given case, the historical events that led to establishment of problem behaviour cannot be directly examined; however, the variables that *presently* maintain problem behaviour can be identified through functional behavioural assessment. These behavioural assessment procedures can precisely identify events in the environment that occasion problem behaviour (antecedents) and the reinforcers that strengthen those behaviours (consequences). Identification of the controlling variables of problem behaviour is foundational to the development of individualized behavioural interventions and can inform pharmacological intervention (Hagopian & Caruso-Anderson, 2010; Wachtel & Hagopian, 2006).

A transdisciplinary approach to problem behaviour

As is the case with core deficits associated with ASD, these impairments in adaptive behaviour likely set the stage for problem behaviour to emerge and potentially be strengthened by operant learning processes. Although the determinants of problem behaviour can be broadly categorized as environmental and biological, these factors interact in a highly complex and dynamic manner. When one considers the full spectrum of autism, the impact of intellectual impairment in many individuals, and the complexities of social interactions surrounding problem behaviour, it becomes clear that research and treatment of this heterogeneous and multifaceted issue requires collaboration across disciplines (Hagopian & Frank-Crawford, 2017).

It has become increasingly important for paediatricians as primary care providers to detect the presence of problem behaviour and initiate assessment and treatment. One model developed by a transdisciplinary team of professionals is referred to as a *practice pathway* for individuals with ASD presenting with problem behaviour (McGuire et al., 2016). This pathway advises an initial assessment for problem behaviour, as well as an assessment for environmental safety. Then, a review of the patient's history prior to and following the emergence of problem behaviour is carried out, after which the behaviour(s) of greatest concern is prioritized for treatment. A more thorough analysis of the behavioural aetiology is then conducted, taking into consideration medical problems, psychosocial events and stressors, and co-occuring psychiatric disorders. In addition, an assessment as to the environmental aetiology of behaviour is carried out, examining variables such as maladaptive patterns of reinforcement and deficits in communication and adaptive behaviour. Following this practice pathway, other appropriately qualified professionals are enlisted to address issues within their respective areas of expertise.

A transdisciplinary approach to clinical care that integrates behavioural and pharmacologic treatment has also been described elsewhere (see Hagopian & Caruso-Anderson, 2010; Mace & Mauk, 1995; Pyles, Muniz, Cade, & Silva, 1997; Thompson, Egli, Symons, & Delaney, 1994; Wachtel & Hagopian, 2006). These models—termed 'biopsychosocial', 'biobehavioural', or 'neurobehavioural'—recognize that problem behaviour likely has multiple determinants, including genetic abnormalities, psychiatric and neurological dysfunction, environmental variables including the availability of reinforcement, and the social interactions that may occasion and reinforce problem behaviour. It follows that the

assessment process should attempt to identify the role of these contributing factors and use that information to design individualized interventions. Generally speaking, this integrative approach advocates the use of (a) behavioural interventions to address problems that stem from social and environmental variables, behavioural histories of reinforcement for problem behaviour, and skill deficits, and(b) pharmacological agents to address problems stemming from neuropsychiatric dysfunction.

Behaviour analytic procedures—which will be further described here—can, with a high degree of objectivity and precision, identify the antecedents and consequences that occasion and reinforce problem behaviour in most cases. Below, we summarize how knowledge of operant reinforcing functions of problem behaviour informs the design of individualized behavioural interventions. However, knowledge of the function of problem behaviour also informs psychiatric assessment and pharmacological treatment. Identifying an operant reinforcing function can assist with differential diagnosis, as can the outcome of a behavioural treatment. For example, a child may present as highly irritable and agitated, suggesting mood dysregulation. If behavioural assessment findings determine that problem behaviour and irritability occur exclusively during instructional demands, a behavioural intervention should be applied first. If providing additional reinforcement for compliance and teaching the child to request assistance or a break from work eliminates this problem, then the concern of mood dysregulation may be ruled out.

In addition to ruling out psychiatric conditions, results of behavioural assessment and treatment might point to psychiatric conditions that may have been masked previously. For example, a behavioural intervention targeting problem behaviour related to schoolwork may result in the child working for longer periods of time; however, this result may then reveal that the child has difficulties with sustaining attention. In such cases, a medication targeting these problems might be indicated and then evaluated in the same context in which they were observed (that is, during school work with the behavioural treatment being applied) so the combined effects of the behavioural treatment and medication could be ascertained. It has been suggested that this type of combined, targeted approach may lead to lower prescribed doses of medication and improved sustainability over time (Hagopian & Caruso-Anderson, 2010). Behavioural assessments also might assist in clarifying a potential psychiatric problem. For example, if behavioural assessment reveals that the problem behaviour and emotional outbursts have no clear environmental antecedents or reinforcers and rapidly cycle across time and contexts, then that would suggest the presence of mood dysregulation (which could then be targeted with medication). Although such an approach is widely viewed as optimal, research examining behavioural and pharmacological methods seldom examines these combined interventions.

Behaviour analytic approaches

For half a century, applied behaviour analysis (ABA) has generated an extensive body of literature detailing a number of procedures shown to be effective in treating a range of problem behaviours in children with ASD and ID. ABA is a discipline that utilizes principles of learning and behavioural science for the purpose of addressing problems of social significance (Baer, Wolf, & Risley, 1968). As a field, ABA grew out of the experimental

analysis of behaviour, and is rapidly becoming more independent of the broader field of psychology. While a small number of behaviour analysts still practice under the supervision of a psychologist (e.g. those in the state of North Carolina), this has become the exception rather than the norm. In 1998, the Behaviour Analyst Certification Board® (BACB®) was established and began to issue internationally recognized credentials that define educational and continuing education requirements for certification of individuals to hold the title 'Board Certified Behaviour Analyst' (BCBA). The BCBA-D designation refers to those that have doctoral-level degrees. To date, there are over 25,000 board certified behaviour analysts across the globe, and, in the last decade, various states have begun to recognize credentials issued by the BACB®, as well as adopt legislation to regulate the practice of behaviour analysis at the state level though licensure. As of December 2017, 29 of 50 states licensed behaviour analysts at the local level.

ABA-based treatment for individuals with ASD, ID, and other developmental disorders can be broadly characterized into two categories of intervention: (a) Comprehensive; and (b) Problem-Focused. The current discussion is on problem-focused ABA, but a brief summary of this distinction is provided. Comprehensive ABA intervention is designed to establish a range of adaptive skills that impact global measures of functioning when applied over an extended period (30 +h per week over a span of years is not uncommon). This approach, when implemented early, is often referred to using terms such as early intensive behavioural intervention (Eikeseth, Klintwall, Jahr, & Karlsson, 2012). Typically, comprehensive ABA services are carried out in educational settings. To date, research supports the application of a comprehensive intervention at a young age, as early treatment is associated with more robust results and improvement to various global measures of function (e.g. Sallows & Graupner, 2005; Smith, Groen, & Wynn, 2000).

Problem-focused ABA interventions target specific problems, most often problem behaviour (e.g. self-injurious behaviour, aggression towards others, pica, disruptive behaviour, elopement). In contrast to comprehensive ABA, problem-focused interventions are carried out for shorter periods of time with narrower goals, usually to target problem behaviour, which can be characterized in terms of a psychiatric diagnosis. The goal of these interventions is to reduce problem behaviour, while also establishing and strengthening adaptive behaviours. Whether comprehensive or problem-focused, ABA interventions share several common features. Both utilize procedures based on empirically validated learning principles (operant and respondent conditioning), adhere to objective measurement of behaviour using direct observation of behaviour, and carefully control environmental variables for the purpose of pinpointing specific determinants of the severe problem behaviour and isolating operative components of behavioural interventions.

Empirical support for ABA

Research on both comprehensive and problem-focused ABA treatment is broad, and provides strong support for the effectiveness of this approach. Group designs (including randomized controlled trials) are more often used to evaluate comprehensive ABA treatment (e.g. Sallows & Graupner, 2005), while single-case experimental designs (SCED) are used more commonly to examine problem-focused ABA interventions (assessment and treatment

of problem behaviour). SCEDs are perfectly suited to evaluate problem-focused ABA interventions, because these are highly individualized and applied by including additional treatment components as needed, based on ongoing evaluations of the individual's response to treatment. These rigorous studies entail hours of direct observation of behaviour, and have robust internal validity because they enable a demonstration of experimental control of treatment components within each participant. The reversal design involves establishing a baseline, applying treatment, withdrawing it, and then reapplying it to demonstrate that it was responsible for the observed effects; other types of SCEDs are used when treatment cannot be withdrawn because it would be unsafe or the effects are not easily reversible. Because SCEDs routinely involve only a few participants, the external validity of behavioural assessment and treatment procedures for any individual study is limited. However, many cross-study replications illustrate the external validity of these methods across a variety of problem behaviours and populations (Beavers, Iwata, & Lerman, 2013).

Of late, researchers have begun to amplify the external validity of SCEDs by carrying out consecutive controlled case series (CCCS) designs. This design involves compiling a series of consecutively encountered cases for which an SCED was employed to evaluate outcomes related to a specific behavioural treatment and/or a specific form of problem behaviour. Most importantly, all cases are included, regardless of outcomes, to minimize any potential for bias favouring a particular outcome (Hagopian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998). CCCS designs have been used to provide further support for specific behavioural assessment procedures (Hagopian, Rooker, Jessel, & DeLeon, 2013); treatments such as functional communication training (Greer, Fisher, Saini, Owen, & Jones, 2016; Rooker, Jessel, Kurtz, & Hagopian, 2013) and non-contingent reinforcement (Phillips, Iannaccone, Rooker, & Hagopian, 2017); as well as more general behavioural assessment and treatment of severe problem behaviour within clinical and home settings (Kurtz, Fodstad, Huete, & Hagopian, 2013). These studies also show that the behavioural literature may not be subject to publication bias favouring positive outcomes, as there is correspondence between previously conducted small-n studies and subsequent related CCCS designs (e.g. findings from Phillips et al. (2017) corresponds to a review by Carr, Severtson, and Lepper (2009)).

Researchers have used meta-analyses to statistically quantify effect size, which allows for cross-study comparisons when applied treatments are similar in scope, thus resulting in more empirical evidence for widely published treatments that have been shown to be effective. Several meta-analyses have been conducted examining focused treatment methods and found, for example, that ABA procedures were effective in decreasing rates of multiple types of problem behaviour for persons with ID (e.g. Harvey, Boer, Meyer, & Evans, 2009; Heyvaert, Maes, Van Den Noortgate, Kuppens, & Onghena, 2012). In addition to quantitative analyses, review papers have been particularly useful in providing consolidated summaries of the existing literature related to particular sub-topics within the treatment of problem behaviour. A number of these papers have been published, and have summarized work related to the treatment of aggression in individuals with developmental disabilities (Brosnan & Healy, 2011), behavioural treatment of SIB and elopement, (Kahng, Iwata, & Lewin, 2002; Lang et al., 2009), and severe problem behaviour treatment for children and adolescents with autism and related developmental disorders (Dawson & Burner, 2011; Doehring, Reichow, Palka, Phillips, & Hagopian, 2014), to name a few.

A number of human service disciplines and special interest groups have become increasingly invested in developing objective methods by which treatments and treatment efficacy can be appraised. Systematic evaluative reviews are aimed at influencing clinical practice, establishing standards of care, and providing evidence to various stakeholders on the most supported treatments available. By conducting these types of reviews and applying standard criteria, the clinicians, families, funders of services, and the public at large can be informed as to what treatments are considered 'evidence-based', 'established', 'well-established', etc. Various standard-setting groups have been formed to develop such criteria, as well as the terminology used to classify treatments in terms of their effectiveness and level of research support. Of particular note and highlighting the support for and effectiveness of ABA-based treatment of problem behaviour are the Autism Evidence-Based Practice Review Group (Wong et al., 2013), The National Standard Project (National Autism Center, 2009), and the Task Force Promoting Dissemination of Psychological Procedures (American Psychological Association, 1993).

Behavioural assessment

There is considerable agreement that *functional behaviour assessment* (FBA) represents the most widely supported practice for identifying environmental antecedents and consequences controlling problem behaviour (Kalachnik et al., 1998; Rush & Frances, 2000). Findings obtained via functional behaviour assessment provide a foundation from which individualized behavioural treatments are derived. Functional behaviour assessment is a client-driven process that often involves multiple methods aimed at determining the specific environmental variables (i.e. reinforcers) that maintain or exacerbate problem behaviour and the conditions under which it is more likely to occur. Irrespective of the methods used, a functional behavioural assessment starts with clear operational definitions of the targeted problems to permit objective and accurate data collection, and a description of the antecedent and consequent variables around the behaviour.

Indirect functional behavioural assessment methodology involves the gathering of information from individuals who have directly observed the problem behaviour through open-ended and unstructured interviews, as well as formal questionnaires such as the Functional Analysis Screening Tool (FAST) (Iwata & DeLeon, 1995) or Questions About Behavioural Function (QABF) (Matson & Vollmer, 1995). While psychometric analyses of behavioural questionnaires have shown some utility in the assessment of function, they are limited in that the assessor has no opportunity to observe the behaviour first hand or to control for extraneous variables during assessment (Healy, Brett, & Leader, 2013; Matson, Tureck, & Rieske, 2012; Nicholson, Konstantinidi, & Furniss, 2006; Zaja, Moore, Van Ingen, & Rojahn, 2011).

Descriptive methods involve directly observing the behaviour in its natural context, examining variables such as related antecedent and consequence events, time of occurrence, and intensity and topography of the behaviour (e.g. Lalli, Browder, Mace, & Brown, 1993; Symons, McDonald, & Wehby, 1998). Research on descriptive assessment methods indicates that they have limited validity relative to methods involving both the direct observation and systematic experimental analysis of behaviour (Lerman & Iwata, 1993;

Noell, VanDerHeyden, Gatti, & Whitmarsh, 2001; Thompson & Iwata, 2007). In light of their limitations, findings from indirect and descriptive methods should be interpreted with some caution.

A controlled *functional analysis* (FA), another FBA methodology, involves systematic manipulation of environmental conditions, which is the most valid and scientifically rigorous method, because it directly examines how problem behaviour changes as a function of environmental antecedents and consequences. An FA involves arranging at least one test and one control condition such that hypothesized contingencies of reinforcement and related antecedent events can be carefully examined; typically, these conditions are replicated until a clear pattern emerges. The aim is to simulate the circumstances under which problem behaviour is hypothesized to occur, and to then deliver the relevant consequences accordingly, thus allowing the behaviour to occur for short periods of time, while also testing which reinforcer (or reinforcers) is responsible for its occurrence and persistence. For example, if a child's problem behaviour is hypothesized to be maintained by attention from a caregiver, the FA test condition would involve arranging a low-attention situation with the caregiver present. While the condition is carried out, the caregiver would provide attention only when the child emits the problem behaviour. In contrast, the FA control condition in this case would involve the caregiver providing attention freely. If problem behaviour occurs more frequently when attention is contingent on its occurrence than when it is freely provided, it would indicate the maintaining reinforcer is caregiver attention. If, however, no difference was observed, other types of reinforcers might be tested. By obtaining this type of information, the clinician is now positioned to confirm (or disconfirm) the hypotheses and, if necessary, undertake other analyses by observing and comparing rates of problem behaviour across other assessment conditions. The FA can be further illustrated using a medical analogy, specifically the type of testing performed by an allergist. Ultimately, the existence of an allergy is confirmed by exposing the patient to the hypothesized allergens through elimination dieting or, most efficaciously, through skin testing in the doctor's office. Briefly and in small amounts, the patient is exposed to suspected allergens and their biological reaction is observed; similar to FAs for environmentally maintained behaviour, confirming results through direct exposure to the hypothesized variables responsible and, by replicating the effects, providing better internal validity of the findings.

In terms of the reinforcing contingencies, problem behaviour can be classified as socially mediated (occasioned and reinforced though the interactions of others), or as non-socially mediated. Some of the most common and widely observed socially mediated reinforcers for children with problem behaviour include obtaining attention from adults or peers, escaping from or avoiding unpleasant circumstances (e.g. demands placed on them by a parent or teacher), and acquiring or gaining access to preferred items, activities, etc. In contrast, non-socially mediated problem behaviour persists, independent of interactions with others, and presumably via some unknown biological process. That is, the act of engaging in the problem behaviour directly produces consequences independent of social interaction that are presumed to be reinforcing in some way (the term 'automatic reinforcement' is used to describe this broad class of behaviour). Automatic reinforcement is more common with self-injurious behaviour and pica, relative to other problems behaviours such as aggression. While not all published cases successfully determined the function, a review of the literature

indicates that the function of SIB is socially mediated in approximately two-thirds to three-quarters of cases and non-socially mediated (i.e. automatically reinforced in approximately one-quarter of cases (Beavers et al. 2013; Hanley, Iwata, & McCord, 2003; Iwata, Dorsey, Slifer, Bauman, & Richman, 1994). Results of functional behaviour assessment are essential for designing individualized *function-based* treatment for problem behaviour.

Pre-treatment assessment and identifying alternative reinforcers

Supplemental to assessing the function of problem behaviour, it is routine to identify stimuli that the child prefers and may serve to augment reinforcement-based procedures used in treatment. Stimulus preference assessment methodologies are well researched (DeLeon & Iwata, 1996; Fisher et al., 1992) and are used to identify prospective reinforcers, which are then delivered in carefully devised response–reinforcer contingencies. Another type of pre-treatment assessment used is termed the *competing stimulus assessment* (CSA), which is used to identify stimuli that compete with frequently occurring problem behaviour (Hagopian, Contrucci-Kuhn, Long, & Rush, 2005; Jennett, Jann, & Hagopian, 2011; Piazza, Adelinis, Hanley, Goh, & Delia, 2000; Rapp, 2006). During the CSA, the behaviour analyst arranges assessment trials so that the child has free access to a stimulus for a pre-specified period of time and while the degree to which engagement with the stimulus and problem behaviour occur. The aim of pre-treatment clinical activities such as stimulus preference assessments and CSAs is to identify items, activities, and other stimuli that may be used to strengthen new, more appropriate behaviour and/or to compete with the reinforcing effects produced by engaging in the problem behaviour.

Behavioural treatment

As the term connotes, *function-based treatment* (FBT) leverages what the clinician has come to understand about the problem behaviour's function and environmental variables relevant to problem behaviour into a behavioural treatment plan. At the most basic level, FBT has two component principles at work: (1) the withholding of reinforcement that maintains the targeted problem behaviour (operant extinction); and (2) the precise use of consequences to strengthen an appropriate alternative behaviour (reinforcement). As the problem behaviour becomes more complex (e.g. multiple topographies of problem behaviour and/or multiple functions), so does the intervention. It is not uncommon for treatment to involve several components, each designed to address one or more of the complex presentations of the problem behavior.

Extinction

Broadly speaking, *extinction* involves the discontinuation of reinforcement for problem behaviour (Iwata, Pace, Cowdery, & Miltenberger, 1994). The application of extinction requires first precisely identifying the maintaining reinforcer(s) for problem behaviour (via functional analysis), and then applying an intervention where the reinforcer is withheld when problem behaviour occurs. Extinction is seldom used in isolation for treatment of problem behaviour, in part because it can induce emotional reactivity and responding on the part of the child, extinction bursts(i.e. temporary increases in frequency, duration, or intensity of the problem behaviour at the onset of implementation), and spontaneous

recovery (i.e. sudden recurrence of the problem behaviour after treatment effects have been observed) (see the review performed by Lerman, Iwata, & Wallace, 1999). However, most treatments include extinction as a component, because the continued reinforcement of problem behaviour can compete with alternative reinforcement contingencies.

Non-contingent reinforcement

Non-contingent reinforcement (NCR) is another FBT shown to be effective in the treatment of problem behaviour, and it has been extensively researched, such that it has been characterized as an empirically supported treatment (Carr et al., 2009). NCR, like most interventions, is typically used in combination with extinction, particularly for cases with socially mediated problem behaviour where the reinforcer can be withheld. Meta-analysis of NCR (Richman, Barnard-Brak, Grubb, Bosch, & Abby, 2015), literature reviews (Carr et al., 2009), and a recent CCCS study reporting on 27 applications of NCR (Phillips et al., 2017) provide strong support for the effectiveness of this intervention. NCR involves the response-independent delivery of reinforcers responsible for maintaining problem behaviour at fixed or variable times during treatment, thus attenuating motivation for problem behaviour. Like extinction, NCR has been shown to be effective in reducing problem behaviour maintained by socially mediated (Kodak, Miltenberger, & Romaniuk, 2003; Van Camp, Lerman, Kelley, Contrucci, & Vorndran, 2000) and non-socially mediated reinforcers (Piazza et al., 2000; Rapp, 2006). Schedule thinning, which reduces the density of reinforcement over time, is also integrated into treatment, as problem behaviour is reduced to more manageable levels, thus bringing it under greater control within the circumstances that more closely resemble the client's natural environment. NCR is also often paired with other interventions specifically designed to train a more appropriate replacement behaviour, such as *differential reinforcement*.

Differential reinforcement

Differential reinforcement interventions combine the procedure of operant extinction with reinforcement of more appropriate and socially acceptable behaviour. It is one of the most widely used interventions for reducing problem behaviour (Vollmer, Iwata, Zarcone, Smith, & Mazaleski, 1993) and has multiple variations, all of which are designed to reduce problem behaviour and increase socially acceptable behaviour. While the scope of this paper is not intended to provide an exhaustive review of the various permutations of differential reinforcement procedures (including differential reinforcement of other, alternative, incompatible, low rates, and high rates of behaviour), differential reinforcement of alternative (DRA) behaviour has been extensively researched and shown to be particularly effective, therefore it warrants further description.

DRA may be used as an independent treatment, but is often used in tandem with other procedures, such as NCR. It involves the selection of an alternative response for the client to emit in lieu of problem behaviour. Initially, the alternative response is reinforced at each occurrence, while the problem behaviour targeted for decrease undergoes operant extinction. Hence, the problem behaviour decelerates while being replaced by the more appropriate alternative (Piazza, Moes, & Fisher, 1996). As treatment progresses and the pattern of behaviour described above unfolds, the use of extinction is continued, while

schedule thinning is instituted by gradually exposing the child to more instances in which the reinforcer is not delivered contingent upon emission of the alternative response. Other means by which reinforcement schedule thinning is carried out include teaching the child (through signals) when the response will be reinforced vs when not, training them to wait for a delay in delivery of the reinforcer, and so on.

Functional communication training (FCT) is a type of DRA procedure that involves establishing an appropriate communication response that the individual can use to obtain the reinforcer that historically maintained problem behaviour. Described in well over 100 studies, FCT exceeds criteria as an empirically supported treatment (Kurtz et al., 2003), and has been shown to be highly effective in three large-scale CCCS studies (Greer et al., 2016; Hagopian et al., 1998; Rooker et al., 2013). It has been shown to be effective in over three-quarters of cases at reducing problem behaviour by 80% from levels observed in baseline. Development of this treatment followed the advent of the aforementioned experimental functional analysis and involves the systematic training of a communicative response related to the reinforcer maintaining problem behaviour (Carr & Durand, 1985; Durand & Carr, 1991). For example, if functional analysis results reveal that a child's severe aggression is maintained by accessing parental attention, FCT would involve training the child to emit an alternative and more appropriate communicative response to gain their parent's attention. The alternative communicative response would be selected based on the child's current repertoire of communication skills and accordingly targeted as the replacement behaviour during the training. As with other focused ABA interventions, the ultimate goal of FCT is to train the child to emit more appropriate communicative behaviour, as conditions are gradually shifted to closely replicate their natural environment. While FCT is initiated by reinforcing each instance of the new communicative response (e.g. attention will be delivered every time the alternative response is emitted), the child is eventually taught to wait for the delivery of the reinforcer, and/or to discriminate when the reinforcer will and will not be available.

Other interventions

Other behaviourally-based interventions and variations of the aforementioned treatment technologies abound, including those designed to build new skills and behavioural repertoires (using discrimination training, shaping, chaining, and various schedules of reinforcement) such as teaching tolerance for delays to reinforcement (i.e. waiting), compliance training, conditioning new reinforcers, and teaching leisure skills, and many more.

In some cases, and particularly at the onset of treatment, other methods may be used to decrease the likelihood that problem behaviour will occur (e.g. providing treatment away from settings or stimuli known to evoke severe problem behaviour) or mitigate its effects. A procedure referred to as *response blocking* (interrupting the completion of the response) has been shown to be effective in disrupting the response–consequence relationship in non-socially mediated problem behaviour and to prevent occurrences of dangerous problem behaviour (Hagopian & Adelinis, 2001). Due to the topography and/or intensity, other methods may be used to assist in keeping the child (and those around them) safe during

episodes of severe problem behaviour or to mitigate and lessen its physical ramifications. There are a number of studies detailing the use procedures involving safety equipment and brief physical holds, some of which also examine their effects on problem behaviour over time (Dorsey, Iwata, Reid, & Davis, 1982; Hanley, Piazza, Fisher, & Maglieri, 2005; Moore, Fisher, & Pennington, 2004; Perry, & Fisher, 2001).

In some instances, reinforcement- and extinction-based procedures do not result in clinically meaningful changes to the problem behaviour. When this occurs, additional consequence-based procedures may be needed to achieve treatment goals and produce positive outcomes for the child, including the use of punishment. *Timeout from reinforcement* is a negative punishment-based procedure used for decreasing behaviour maintained by a socially mediated reinforcer. This procedure involves decreasing or eliminating the individual's access to reinforcement for a pre-determined brief period of time (e.g. 30 s to 1 min) contingent on problem behaviour. It has been shown to be effective when withdrawing both functional (e.g. Durand & Carr, 1992) and non-functional reinforcers (e.g. Falcomata, Roane, Hovantez, Kettering, & Keeney, 2004). Timeout has been shown to be particularly effective when combined with other procedures aimed at teaching a replacement behaviour (Bean & Roberts, 1981). Another common punishment-based procedure is referred to as *response cost*; similar to timeout, it is a negative-punishment procedure. Different than timeout, response cost involves the loss of a specific *amount* of a reinforcer (as opposed to restricting reinforcer access for a specific amount of time) contingent on the occurrence of problem behaviour. Applications may include terminating a preferred activity, or access to a primary reinforcer; however, it is most often implemented in the context of a token economy (e.g. Iwata & Bailey, 1974; Reisinger, 1972). The difference between time out from reinforcement and response cost is subtle, but in either case it is critical to their success to ensure that the reinforcer can be effectively removed as soon as the problem behaviour occurs.

Generalization of treatment effects

Fundamental to ABA is the generality of its interventions designed to bring about socially significant change (Baer et al., 1968). Correspondingly, successful application of function-based treatment also involves fading the intensity of interventions to the maximum extent possible, thus preparing the child for what they can and should expect in their home, school, and community settings. While not exhaustive, a few note-worthy examples include components that teach the child to wait to access reinforcement, tolerate the unavailability of reinforcement, and demonstrate appropriate behaviour in the presence of unpleasant and/or non-preferred circumstances (e.g. Fisher, Thompson, Hagopian, Bowman, & Krug, 2000; Rooker et al., 2013). These objectives are achieved through systematic thinning of reinforcement, teaching the child in various settings and with various people, and teaching discrimination with the myriad of stimuli they will come in contact with in their natural settings (Stokes & Baer, 1977). In the treatment of problem behaviour in children, it is paramount to train parents to carry out interventions, which, whenever possible, should be devised in a manner that is transportable to the home setting following discharge. Models for parent training differ depending on the treatment setting (in-patient, out-patient, or in-home treatment); however, the most common practice used within each is referred

to as *behavioural skills training* (Miles & Wilder, 2009; Shayne & Miltenberger, 2013). Behavioural skills training utilizes the sequence of instructions, modelling, rehearsal, and feedback to teach parents how to implement the behavioural contingencies, including how to deliver reinforcement and when to withhold it, how to block and redirect problem behaviour, and other treatment components, as directed.

Summary

Problem behaviour among children with ASD and ID is a highly complex, heterogeneous phenomenon. In addition to the presence of a developmental disability, there are a variety of other factors that increase the risk for the emergence and maintenance of problem behaviour. Ultimately, problem behaviour is often the product of the interaction of biological factors including medical or psychiatric conditions with experiences that strengthen problem behaviour through operant learning processes. Research shows that, in most cases, problem behaviour is maintained by social reinforcement contingencies, but deficits in adaptive behaviour and psychiatric conditions likely play a role in many cases. A neurobehavioural model of care recognizes that problem behaviour likely has multiple determinants, including genetic abnormalities, psychiatric and neurological dysfunction, environmental variables including availability of reinforcement, and the social interactions that may occasion and reinforce problem behaviour. It follows that the assessment process should attempt to identify the role of these contributing factors and use that information to design individualized interventions. Generally speaking, this integrative approach advocates the use of (a) behavioural interventions to address problems that arise from social and environmental variables, behavioural histories of reinforcement for problem behaviour, and skill deficits, and (b) pharmacological agents to address problems originating from neuropsychiatric dysfunction. Additional research is needed to examine how these interventions interact and can be applied most efficiently.

Funding

This work was funded by Intellectual and Developmental Disabilities Research Center [U54 HD079123] and Eunice Kennedy Shriver National Institute of Child Health and Human Development [R01 HD076653].

References

Addison L, & Lerman DC (2009). Descriptive analysis of teachers' responses to problem behavior following training. Journal of Applied Behavior Analysis, 42, 485–490. doi:10.1901/jaba.2009.42-485 [PubMed: 19949540]

American Psychological Association. (1993). Task force on promotion and dissemination of psychological procedures. In the Meeting of the American Psychological Association.

Anderson C, Law JK, Daniels A, Rice C, Mandell DS, Hagopian L, & Law PA (2012). Occurrence and family impact of elopement in children with autism spectrum disorders. Pediatrics, 130, 870–877. doi:10.1542/peds.2012-0762 [PubMed: 23045563]

Baer DM, Wolf MM, & Risley TR (1968). Some current dimensions of applied behavior analysis. Journal of Applied Behavior Analysis, 1, 91–97. doi:10.1901/jaba.1968.1-91 [PubMed: 16795165]

Bean AW, & Roberts MW (1981). The effect of timeout release contingencies on changes in child noncompliance. Journal of Abnormal Child Psychology, 9, 95–105. doi:10.1007/BF00917860 [PubMed: 7217541]

Beavers GA, Iwata BA, & Lerman DC (2013). Thirty years of research on the functional analysis of problem behavior. Journal of Applied Behavior Analysis, 46, 1–21. doi:10.1002/jaba.30 [PubMed: 24114081]

Bowman LG, Fisher WW, Thompson RH, & Piazza CC (1997). On the relation of mands and the function of destructive behavior. Journal of Applied Behavior Analysis, 30, 251–265. doi:10.1901/jaba.1997.30-251 [PubMed: 9210305]

Brosnan J, & Healy O (2011). A review of behavioral interventions for the treatment of aggression in individuals with developmental disabilities. Research in Developmental Disabilities, 32, 437–446. doi:10.1016/j.ridd.2010.12.023 [PubMed: 21239140]

Carr EG, & Durand VM (1985). Reducing behavior problems through functional communication training. Journal of Applied Behavior Analysis, 18, 111–126. doi:10.1901/jaba.1985.18-111 [PubMed: 2410400]

Carr EG, Taylor JC, & Robinson S (1991). The effects of severe behavior problems in children on the teaching behavior of adults. Journal of Applied Behavior Analysis, 24, 523–535. doi:10.1901/jaba.1991.24-523 [PubMed: 1752841]

Carr JE, Severtson JM, & Lepper TL (2009). Noncontingent reinforcement is an empirically supported treatment for problem behavior exhibited by individuals with developmental disabilities. Research in Developmental Disabilities, 30, 44–57. doi:10.1016/j.ridd.2008.03.002 [PubMed: 18467073]

Dawson G, & Burner K (2011). Behavioral interventions in children and adolescents with autism spectrum disorder: A review of recent findings. Current Opinion in Pediatrics, 23, 616–620. doi:10.1097/MOP.0b013e32834cf082 [PubMed: 22037220]

Dekker MC, Koot HM, Ende JVD, & Verhulst FC (2002). Emotional and behavioral problems in children and adolescents with and without intellectual disability. Journal of Child Psychology and Psychiatry, 43, 1087–1098. doi:10.1111/1469-7610.00235 [PubMed: 12455929]

DeLeon IG, & Iwata BA (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. Journal of Applied Behavior Analysis, 29, 519–533. doi:10.1901/jaba.1996.29-519 [PubMed: 8995834]

Doehring P, Reichow B, Palka T, Phillips C, & Hagopian L (2014). Behavioral approaches to managing severe problem behaviors in children with autism spectrum and related developmental disorders. Child and Adolescent Psychiatric Clinics, 23, 25–40. doi:10.1016/j.chc.2013.08.001

Dorsey MF, Iwata BA, Reid DH, & Davis PA (1982). Protective equipment: Continuous and contingent application in the treatment of self-injurious behavior. Journal of Applied Behavior Analysis, 15, 217–230. doi:10.1901/jaba.1982.15-217 [PubMed: 7118755]

Durand VM, & Carr EG (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. Journal of Applied Behavior Analysis, 24, 251–264. doi:10.1901/jaba.1991.24-251 [PubMed: 1890046]

Durand VM, & Carr EG (1992). An analysis of maintenance following functional communication training. Journal of Applied Behavior Analysis, 24, 251–264. doi:10.1901/jaba.1992.25-777

Eikeseth S, Klintwall L, Jahr E, & Karlsson P (2012). Outcome for children with autism receiving early and intensive behavioral intervention in mainstream pre-school and kindergarten settings. Research in Autism Spectrum Disorders, 6, 829–835. doi:10.1016/j.rasd.2011.09.002

Emerson E, Kiernan C, Alborz A, Reeves D, Mason H, Swarbrick R, … Hatton C (2001). The prevalence of challenging behaviors: A total population study. Research in Developmental Disabilities, 22, 77–93. doi:10.1016/S0891-4222(00)00061-5 [PubMed: 11263632]

Emerson E, Robertson J, Gregory N, Hatton C, Kessissoglou S, Hallam A, & Hillery J (2000). Treatment and management of challenging behaviours in residential settings. Journal of Applied Research in Intellectual Disabilities, 13, 197–215. doi:10.1046/j.1468-3148.2000.00036.x

Falcomata TS, Roane HS, Hovantez AN, Kettering TL, & Keeney KM (2004). An evaluation of response cost in the treatment of inappropriate vocalizations maintained by automatic reinforcement. Journal of Applied Behavior Analysis, 37, 83–87. doi:10.1901/jaba.2004.37-83 [PubMed: 15154219]

Farmer CA, & Aman MG (2011). Aggressive behavior in a sample of children with autism spectrum disorders. Research in Autism Spectrum Disorders, 5, 317–323. doi:10.1016/j.rasd.2010.04.014

Fisher W, Piazza CC, Bowman LG, Hagopian LP, Owens JC, & Slevin I (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. Journal of Applied Behavior Analysis, 25, 491–498. doi:10.1901/jaba.1992.25-491 [PubMed: 1634435]

Fisher WW, Thompson RH, Hagopian LP, Bowman LG, & Krug A (2000). Facilitating tolerance of delayed reinforcement during functional communication training. Behavior Modification, 24, 3–29. doi:10.1177/0145445500241001 [PubMed: 10641365]

Furniss F, & Biswas AB (2012). Recent research on aetiology, development and phenomenology of self-injurious behaviour in people with intellectual disabilities: A systematic review and implications for treatment. Journal of Intellectual Disability Research, 56, 453–475. doi:10.1111/j.1365-2788.2012.01534.x [PubMed: 22369696]

Greer BD, Fisher WW, Saini V, Owen TM, & Jones JK (2016). Functional communication training during reinforcement schedule thinning: An analysis of 25 applications. Journal of Applied Behavior Analysis, 49, 105–121. doi:10.1002/jaba.265 [PubMed: 26482103]

Gurney JG, McPheeters ML, & Davis MM (2006). Parental report of health conditions and health care use among children with and without autism: National survey of children's health. Archives of Pediatrics and Adolescent Medicine, 160, 825–830. doi:10.1001/archpedi.160.8.825 [PubMed: 16894082]

Hagopian LP, & Adelinis JD (2001). Response blocking with and without redirection for the treatment of pica. Journal of Applied Behavior Analysis, 34, 527–530. doi:10.1901/jaba.2001.34-527 [PubMed: 11800195]

Hagopian LP, & Caruso-Anderson ME (2010). Integrating behavioral and pharmacological interventions for severe problem behavior displayed by children with neurogenetic and developmental disorders. In: Shapiro BK, & Accardo PJ (Eds.), Neurogenetic syndromes: Behavioral issues and their treatment (p. 217–239). Baltimore, MD: Paul H. Brookes Publishing.

Hagopian LP, Contrucci-Kuhn SA, Long ES, & Rush KS (2005). Schedule thinning following communication training: Using competing stimuli to enhance tolerance to decrements in reinforcer density. Journal of Applied Behavior Analysis, 38, 177–193. doi:10.1901/jaba.2005.43-04 [PubMed: 16033165]

Hagopian LP, Fisher WW, Sullivan MT, Acquisto J, & LeBlanc LA (1998). Effectiveness of functional communication training with and without extinction and punishment: A summary of 21 inpatient cases. Journal of Applied Behavior Analysis, 31, 211–235. doi:10.1901/jaba.1998.31-211 [PubMed: 9652101]

Hagopian LP, & Frank-Crawford MA (2017). Classification of self-injurious behaviour across the continuum of relative environmental–biological influence. Journal of Intellectual Disability Research. doi: 10.1111/jir.12430

Hagopian LP, Rooker GW, Jessel J, & DeLeon IG (2013). Initial functional analysis outcomes and modifications in pursuit of differentiation: A summary of 176 inpatient cases. Journal of Applied Behavior Analysis, 46, 88–100. doi:10.1002/jaba.25 [PubMed: 24114088]

Hanley GP, Iwata BA, & McCord BE (2003). Functional analysis of problem behavior: A review. Journal of Applied Behavior Analysis, 36, 147–185. doi:10.1901/jaba.2003.36-147 [PubMed: 12858983]

Hanley GP, Piazza CC, Fisher WW, & Maglieri KM (2005). On the effectiveness of and preference for punishment and extinction components of function-based interventions. Journal of Applied Behavior Analysis, 38, 51–66. doi:10.1901/jaba.2005.6-04 [PubMed: 15898474]

Harvey ST, Boer D, Meyer LH, & Evans IM (2009). Updating a meta-analysis of intervention research with challenging behaviour: Treatment validity and standards of practice. Journal of Intellectual and Developmental Disability, 34, 67–80. doi:10.1080/13668250802690922 [PubMed: 19234980]

Healy O, Brett D, & Leader G (2013). A comparison of experimental functional analysis and the Questions About Behavioral Function (QABF) in the assessment of challenging behavior of individuals with autism. Research in Autism Spectrum Disorders, 7, 66–81. doi:10.1016/j.rasd.2012.05.006

Heyvaert M, Maes B, Van Den Noortgate W, Kuppens S, & Onghena P (2012). A multilevel meta-analysis of single-case and small-n research on interventions for reducing challenging behavior in persons with intellectual disabilities. Research in Developmental Disabilities, 33, 766–780. doi:10.1016/j.ridd.2011.10.010 [PubMed: 22100975]

Hodgetts S, Nicholas D, & Zwaigenbaum L (2013). Home sweet home? Families' experiences with aggression in children with autism spectrum disorders. Focus on Autism and Other Developmental Disabilities, 28, 166–174. doi:10.1177/1088357612472932

Iwata BA, & DeLeon IG (1995). The functional analysis screening tool (FAST). Unpublished manuscript, University of Florida.

Iwata BA, & Bailey JS (1974). Reward versus cost token systems: An analysis of the effects of students and teacher. Journal of Applied Behavior Analysis, 7, 567–576. doi:10.1901/jaba.1974.7-567 [PubMed: 4443323]

Iwata BA, Dorsey MF, Slifer KJ, Bauman KE, & Richman GS (1994). Toward a functional analysis of self-injury. Journal of Applied Behavior Analysis, 27, 197–209. Reprinted from Analysis and Intervention in Developmental Disabilities, 2(1), 3–20, 1982). doi:10.1016/0270-4684(82)90003-9 [PubMed: 8063622]

Iwata BA, Pace GM, Cowdery GE, & Miltenberger RG (1994). What makes extinction work: An analysis of procedural form and function. Journal of Applied Behavior Analysis, 27, 131–144. doi:10.1901/jaba.1994.27-131 [PubMed: 8188555]

Jennett H, Jann K, & Hagopian LP (2011). Evaluation of response blocking and re-presentation in a competing stimulus assessment. Journal of Applied Behavior Analysis, 44, 925–929. doi:10.1901/jaba.2011.44-925 [PubMed: 22219542]

Kahng S, Iwata BA, & Lewin AB (2002). Behavioral treatment of self-injury, 1964 to 2000. American Journal on Mental Retardation, 107, 212–221. doi:10.1352/0895-8017(2002)107<0212:BTOSIT>2.0.CO;2 [PubMed: 11966334]

Kalachnik JE, Leventhal BL, James DH, Sovner R, Kastner TA, Walsh K, … Klitzke MG (1998). Guidelines for the use of psychotropic medication. Psychotropic medications and developmental disabilities: The international handbook (pp. 45–72). Columbus, Ohio: Ohio State University Nisonger Center.

Kodak T, Miltenberger RG, & Romaniuk C (2003). The effects of differential negative reinforcement of other behavior and noncontingent escape on compliance. Journal of Applied Behavior Analysis, 36, 379–382. doi:10.1901/jaba.2003.36-379 [PubMed: 14596581]

Kurtz PF, Chin MD, Huete JM, Tarbox RS, O'Connor JT, Paclawskyj TR, & Rush KS (2003). Functional analysis and treatment of self-injurious behavior in young children: A summary of 30 cases. Journal of Applied Behavior Analysis, 36, 205–219. doi:10.1901/jaba.2003.36-205 [PubMed: 12858985]

Kurtz PF, Fodstad JC, Huete JM, & Hagopian LP (2013). Caregiver-and staff-conducted functional analysis outcomes: A summary of 52 cases. Journal of Applied Behavior Analysis, 46, 738–749. doi:10.1002/jaba.87 [PubMed: 24114788]

Lalli JS, Browder DM, Mace FC, & Brown DK (1993). Teacher use of descriptive analysis data to implement interventions to decrease students' problem behaviors. Journal of Applied Behavior Analysis, 26, 227–238. doi:10.1901/jaba.1993.26-227 [PubMed: 8331019]

Lang R, Rispoli M, Machalicek W, White PJ, Kang S, Pierce N, … Lancioni G (2009). Treatment of elopement in individuals with developmental disabilities: A systematic review. Research in Developmental Disabilities, 30, 670–681. doi:10.1016/j.ridd.2008.11.003 [PubMed: 19118975]

Lerman DC, & Iwata BA (1993). Descriptive and experimental analyses of variables maintaining self-injurious behavior. Journal of Applied Behavior Analysis, 26, 293–319. doi:10.1901/jaba.1993.26-293 [PubMed: 8407680]

Lerman DC, Iwata BA, & Wallace MD (1999). Side effects of extinction: Prevalence of bursting and aggression during the treatment of self-injurious behavior. Journal ofApplied Behavior Analysis, 32, 1–8. doi:10.1901/jaba.1999.32-1

Lowe K, Allen D, Jones E, Brophy S, Moore K, & James W (2007). Challenging behaviours: Prevalence and topographies. Journal of Intellectual Disability Research, 51, 625–636. doi:10.1111/j.1365-2788.2006.00948.x [PubMed: 17598876]

Mace FC, & Mauk JE (1995). Bio-behavioral diagnosis and treatment of self injury. Mental Retardation and Developmental Disabilities Research Reviews, 1, 104–110. doi:10.1002/mrdd.1410010206

Matson JL, & Vollmer TR (1995). User's guide: Questions about behavioral function (QABF). Baton Rouge, LA: Scientific Publishers, Inc.

Matson JL, Tureck K, & Rieske R (2012). The Questions About Behavioral Function (QABF): Current status as a method of functional assessment. Research in Developmental Disabilities, 33, 630–634. doi:10.1016/j.ridd.2011.11.006 [PubMed: 22155537]

McClintock K, Hall S, & Oliver C (2003). Risk markers associated with challenging behaviours in people with intellectual disabilities: A meta-analytic study. Journal of Intellectual Disability Research, 47, 405–416. doi:10.1046/j.1365-2788.2003.00517.x [PubMed: 12919191]

McGuire K, Fung LK, Hagopian L, Vasa RA, Mahajan R, Bernal P, … Veenstra-VanderWeele J (2016). Irritability and problem behavior in autism spectrum disorder: A practice pathway for pediatric primary care. Pediatrics, 137(Supplement 2), S136–S148. doi:10.1542/peds.2015-2851L [PubMed: 26908469]

Miles NI, & Wilder DA (2009). The effects of behavioral skills training on caregiver implementation of guided compliance. Journal of Applied Behavior Analysis, 42, 405–410. doi:10.1901/jaba.2009.42-405 [PubMed: 19949532]

Moore JW, Fisher WW, & Pennington A (2004). Systematic application and removal of protective equipment in the assessment of multiple topographies of self-injury. Journal of Applied Behavior Analysis, 37, 73–77. doi:10.1901/jaba.2004.37-73 [PubMed: 15154217]

National Institutes of Health. (1989, September). Treatment of destructive behaviors in persons with developmental disabilities. NIH Consensus Statement online. Retrieved December 5, 2008.

National Autism Center. (2009). National Standards Report. Randolph, MA: National Autism Center.

Nicholson J, Konstantinidi E, & Furniss F (2006). On some psychometric properties of the questions about behavioral function (QABF) scale. Research in Developmental Disabilities, 27, 337–352. doi:10.1016/j.ridd.2005.04.001 [PubMed: 16043323]

Noell GH, VanDerHeyden AM, Gatti SL, & Whitmarsh EL (2001). Functional assessment of the effects of escape and attention on students' compliance during instruction. School Psychology Quarterly, 16, 253. doi:10.1521/scpq.16.3.253.19892

Perry AC, & Fisher WW (2001). Behavioral economic influences on treatments designed to decrease destructive behavior. Journal of Applied Behavior Analysis, 34, 211–215. doi:10.1901/jaba.2001.34-211 [PubMed: 11421313]

Phillips CL, Iannaccone JA, Rooker GW, & Hagopian LP (2017). Noncontingent reinforcement for the treatment of severe problem behavior: An analysis of 27 consecutive applications. Journal of Applied Behavior Analysis, 50, 357–376. doi:10.1002/jaba.376 [PubMed: 28177118]

Piazza CC, Adelinis JD, Hanley GP, Goh H, & Delia MD (2000). An evaluation of the effects of matched stimuli on behaviors maintained by automatic reinforcement. Journal of Applied Behavior Analysis, 33, 13–27. doi:10.1901/jaba.2000.33-13 [PubMed: 10738949]

Piazza CC, Moes DR, & Fisher WW (1996). Differential reinforcement of alternative behavior and demand fading in the treatment of escape-maintained destructive behavior. Journal of Applied Behavior Analysis, 29, 569–572. doi:10.1901/jaba.1996.29-569 [PubMed: 8995837]

Pyles DAM, Muniz K, Cade A, & Silva R (1997). A behavioral diagnostic paradigm for integrating behavior-analytic and psychopharmacological interventions for people with a dual diagnosis. Research in Developmental Disabilities, 18, 185–214. doi:10.1016/S0891-4222(97)00003-6 [PubMed: 9220544]

Rapp JT (2006). Toward an empirical method for identifying matched stimulation for automatically reinforced behavior: A preliminary investigation. Journal of Applied Behavior Analysis, 39, 137–140. doi:10.1901/jaba.2006.37-05 [PubMed: 16602394]

Reisinger JJ (1972). The treatment of "anxiety-depression" via positive reinforcement and response cost. Journal of Applied Behavior Analysis, 5, 125–130. doi:10.1901/jaba.1972.5-125 [PubMed: 16795330]

Richman DM, Barnard-Brak L, Grubb L, Bosch A, & Abby L (2015). Meta-analysis of noncontingent reinforcement effects on problem behavior. Journal of Applied Behavior Analysis, 48, 131–152. doi:10.1002/jaba.189 [PubMed: 25754894]

Rooker GW, Jessel J, Kurtz PF, & Hagopian LP (2013). Functional communication training with and without alternative reinforcement and punishment: An analysis of 58 applications. Journal of Applied Behavior Analysis, 46, 708–722. doi:10.1002/jaba.76 [PubMed: 24114463]

Rush AJ, & Frances A (2000). Expert consensus guideline series: Treatment of psychiatric and behavioral problems in mental retardation. American Journal on Mental Retardation, 105, 159–228. [PubMed: 10907489]

Sallows GO, & Graupner TD (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. American Journal on Mental Retardation, 110, 417–438. doi:10.1352/0895-8017(2005)110[417:IBTFCW]2.0.CO;2 [PubMed: 16212446]

Shayne R, & Miltenberger RG (2013). Evaluation of behavioral skills training for teaching functional assessment and treatment selection skills to parents. Behavioral Interventions, 28, 4–21. doi:10.1002/bin.1350

Sloman KN, Vollmer TR, Cotnoir NM, Borrero CS, Borrero JC, Samaha AL, & Peter CCS (2005). Descriptive analyses of caregiver reprimands. Journal of Applied Behavior Analysis, 38, 373–383. doi:10.1901/jaba.2005.118-04 [PubMed: 16270846]

Smith T, Groen AD, & Wynn JW (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. American Journal on Mental Retardation, 105, 269–285. doi:10.1352/0895-8017(2000)105<0269:RTOIEI>2.0.CO;2 [PubMed: 10934569]

Soke GN, Rosenberg SA, Hamman RF, Fingerlin T, Robinson C, Carpenter L, … DiGuiseppi C (2016). Brief report: Prevalence of self-injurious behaviors among children with Autism spectrum disorder—A population-based study. Journal of Autism and Developmental Disorders, 46, 3607–3614. doi:10.1007/s10803-016-2879-1 [PubMed: 27565654]

Stocco CS, & Thompson RH (2015). Contingency analysis of caregiver behavior: Implications for parent training and future directions. Journal of Applied Behavior Analysis, 48, 417–435. doi:10.1002/jaba.206 [PubMed: 25916885]

Stokes TF, & Baer DM (1977). An implicit technology of generalization. Journal of Applied Behavior Analysis, 10, 349–367. doi:10.1901/jaba.1977.10-349 [PubMed: 16795561]

Storch EA, Zavrou S, Collier AB, Ung D, Arnold EB, Mutch PJ, … Murphy TK (2015). Preliminary study of family accommodation in youth with autism spectrum disorders and anxiety: Incidence, clinical correlates, and behavioral treatment response. Journal of Anxiety Disorders, 34, 94–99. doi:10.1016/j.janxdis.2015.06.007 [PubMed: 26188615]

Sturmey P, Lott JD, Laud R, & Matson JL (2005). Correlates of restraint use in an institutional population: A replication. Journal of Intellectual Disability Research, 49, 501–506. doi:10.1111/j.1365-2788.2005.00703.x [PubMed: 15966957]

Symons FJ, McDonald LM, & Wehby JH (1998). Functional assessment and teacher collected data. Education and Treatment of Children, 21, 135–159.

Thompson RH, & Iwata BA (2007). A comparison of outcomes from descriptive and functional analyses of problem behavior. Journal of Applied Behavior Analysis, 40, 333–338. doi:10.1901/jaba.2007.56-06 [PubMed: 17624074]

Thompson T, Egli M, Symons F, & Delaney D (1994). Neurobehavioral mechanisms of drug action in developmental disabilities. In Thompson T & Gray DB (Eds.), Destructive behavior in developmental disabilities: Diagnosis and treatment (pp. 133–188). Thousand Oaks, CA: Sage.

Van Camp CM, Lerman DC, Kelley ME, Contrucci SA, & Vorndran CM (2000). Variable-time reinforcement schedules in the treatment of socially mediated problem behavior. Journal of Applied Behavior Analysis, 33, 545–557. doi:10.1901/jaba.2000.33-545 [PubMed: 11214030]

Vollmer TR, Iwata BA, Zarcone JR, Smith RG, & Mazaleski JL (1993). The role of attention in the treatment of attention-maintained self-injurious behavior: Noncontingent reinforcement and differential reinforcement of other behavior. Journal of Applied Behavior Analysis, 26, 9–21. doi:10.1901/jaba.1993.26-9 [PubMed: 8473262]

Wachtel LE, & Hagopian LP (2006). Psychopharmacology and applied behavioral analysis: Tandem treatment of severe problem behaviors in intellectual disability and a case series. The Israel Journal of Psychiatry and Related Sciences, 43, 265–274. [PubMed: 17338446]

Wong C, Odom S, Hume K, Cox A, Fettig A, Kucharczyk S, … Schultz T (2013). Evidence- based practices for children, youth, and young adults with Autism spectrum disorder. Chapel Hill:

The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group.

Zaja RH, Moore L, Van Ingen DJ, & Rojahn J (2011). Psychometric comparison of the functional assessment instruments QABF, FACT and FAST for self-injurious, stereotypic and aggressive/destructive behaviour. Journalof Applied Research in Intellectual Disabilities, 24, 18–28. doi:10.1111/j.1468-3148.2010.00569.x