

Restricted and Repetitive Behaviour in Persons with Autism (Ages 0-18): An Integrative Review of Treatment Related to Occupational Therapy

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Abstract: *Objective:* To identify evidence-based behavioural interventions used to decrease restricted and repetitive behaviour (RRB) in children with autism (ages 0-18); to understand the application of these strategies within the PEO (Person, Environment, Occupation) Model of Occupational Performance and the role of the occupational therapist in addressing this limitation.

Background: RRB is a core feature of autism that often impedes functional behaviour. Decreasing RRB to enable functional behaviours is central to the occupational therapist's role with this population. Many interventions identified as effective for this impairment are based on the principles of applied behaviour analysis (ABA).

Method: An integrative review of the literature was completed to identify interventions targeting RRBs. Those found to be effective are described within an ABA framework and within the PEO Model of Occupational Performance.

Results: This review identified twenty-eight effective interventions used to treat RRBs in autism relevant to the field of occupational therapy. Categorization of interventions using an ABA framework and the PEO Model allowed comparison between approaches and application to occupational therapy practice.

Conclusion: A functional behaviour approach (FBA) used in combination with the PEO model will enable greater understanding of RRBs and provide a more comprehensive approach to the treatment of RRBs in children with autism.

Keywords: Autism, repetitive behaviour, occupational therapy, PEO model, behavioural intervention.

INTRODUCTION

One of the primary criteria for the diagnosis of autism spectrum disorder (ASD) is the presence of restricted and repetitive patterns of behaviour (RRBs) [1]. Impairments included along the continuum of RRBs may include stereotypical or repetitive motor movements such as continuous jumping or spinning, repetitive use of objects (playing with only one toy for a prolonged length of time), speech or speech sounds (repeating the same word or sound over a prolonged length of time), insistence on sameness such as wanting to do things in the same way and having difficulty with changes in routine, highly restricted interests (only talking about or playing with items related to the same topic or theme with little variance), as well as hyper or -hypo reactivity to sensory input (an over-reaction or under-reaction to sensory stimuli) or an unusual interest in sensory aspects of the environment [1].

RRBs can potentially cause significant functional impairment in the daily lives of children with autism [2]. RRBs may cause an individual to stand out by making them look and or act differently, potentially affecting social interactions, personal relationships, and possibly

leading to social stigmatism and social isolation [3]. In addition, rather than participating in or choosing to perform tasks (occupations) that are typically expected of children their age, children with autism often participate in activities that may not be considered functional or purposeful such as RRBs. By repetitively performing the same seemingly non-purposeful behaviours these individuals often do not have the opportunity to learn more functional behaviours and acquire skills needed for expected or novel tasks or occupations.

Occupational therapy is concerned with promoting health and well-being through engagement in occupation [4]. Occupations include activities or tasks that are considered necessary for daily living [5]. Occupations also include those tasks or activities that are important or meaningful to the person them self [5]. For individuals between the ages of 0-18 typical, age appropriate, or expected occupations may include such activities as progressive independence in self-care tasks such as dressing, eating, and toileting [5]. Leisure occupations may include such things as play with toys, playing/interacting with friends, perhaps sports, crafts or other hobbies [5]. Progressive independence in productivity occupations could include school work, chores, and/or eventually paid employment [5]. There are sometimes barriers to functional performance in meaningful activities. An occupational therapist will aim

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to help their clients overcome occupational dysfunction by enhancing skills, modifying the environment, and/or altering the occupation.

The Person Environment Occupation (PEO) model of occupational performance [6] is a practice framework used by occupational therapists to understand the relationship and interactions between the person, the environment, and occupation. The PEO model proposes that the characteristics of the three constructs interact to determine an individual's occupational performance in everyday function. Dysfunctional occupational performance can result when there is not a good fit between these constructs. Occupational therapists aim to maximize occupational performance and decrease dysfunction in tasks by influencing change in any, some, or all of these components [6].

RRB's often act as barriers to functional performance. These barriers may occur secondary to limitations at the 'person' level within the PEO model. For example, perhaps children with autism engage in RRBs secondary to limited physical, cognitive, or perceptual skills required to perform more functional behaviors. The barrier to functional performance may also be 'occupation' based. For example, the child with autism may have a stronger preference or have developed a habit for the RRB. Participation in that RRB may then take the place of participation in a more meaningful task or occupation. Engagement in occupation may also be limited as a result of the environment in which the occupation is being performed in. Perhaps the physical or sensory aspects of the child's environment are acting as barriers to functional performance in that task or occupation.

Given the potential impact RRBs have on the functional ability and quality of life for children with autism (ages 0-18), occupational therapists have an important role to play with this population. All professionals working with this diagnostic group must be vigilant that the interventions implemented are evidence-based, efficient and effective. A clear understanding of effective interventions to address these concerns is therefore warranted.

Many evidence-based interventions used to address RRBs have been developed based on the field of Applied Behavioural Analysis (ABA). An ABA approach considers the relationship between behaviour and the environment: what happens before the behaviour occurs, that may trigger the behaviour (antecedent) and what happens after the behaviour occurs (the

consequences) potentially reinforces the behaviour. Specifically, the use of Functional Behavioural Assessment (FBA) has allowed a greater understanding of why individuals perform the behaviours they do, including RRB.

Boyd, Mcdonough, & Bodfish [7] gathered information regarding a variety of approaches used to treat RRB and classified them using an ABA framework. Understanding these behavioural interventions through the lens of the PEO model [6] will relate these treatments to occupational therapy practice. The purpose of this paper is to identify effective interventions used by clinicians to manage RRB in children diagnosed with autism and gain an understanding of how these interventions relate to the role of the occupational therapist using the PEO model.

MATERIALS AND METHODS

This integrative review based on Whittemore & Knaf'l's [8] approach, aimed to collect and critically examine relevant information regarding effective interventions used to decrease the occurrence of RRBs within an ABA /FBA framework and then apply this understanding to occupational therapy using the PEO model [6]. This method allowed direct comparison between both frames of reference. An integrative review includes applicable empirical and theoretical literature that provided a comprehensive understanding of the related concepts [8].

Search Strategy

Six electronic databases were searched (Cinahl, ERIC, Proquest Nursing and Allied Health, PubMed, OTSeeker, and PsycINFO) for English language articles published between 2005 and 2015 to ensure the most recent information was examined. Search terms used for this review included autism, treatment/intervention, and repetitive behaviour/stereotypical behaviour. Inclusion criteria specified only studies that used human subjects ranging in age from 0-18. The search source types included scholarly articles, journal articles, and books. Qualitative, quantitative, and mixed methodology studies were considered as well as systematic and scoping reviews.

Studies were excluded upon review of the abstracts if the treatment was not relevant to the scope of practice of occupational therapy (i.e. treatment such as use of medication to decrease repetitive behaviour), if

treatment was not clearly defined, and if restricted or repetitive behaviour was not a dependent variable. Additional exclusion criteria included articles in which study participants were not diagnosed with autism and if all study subjects were older than eighteen. The search and selection process is illustrated in Figure 1.

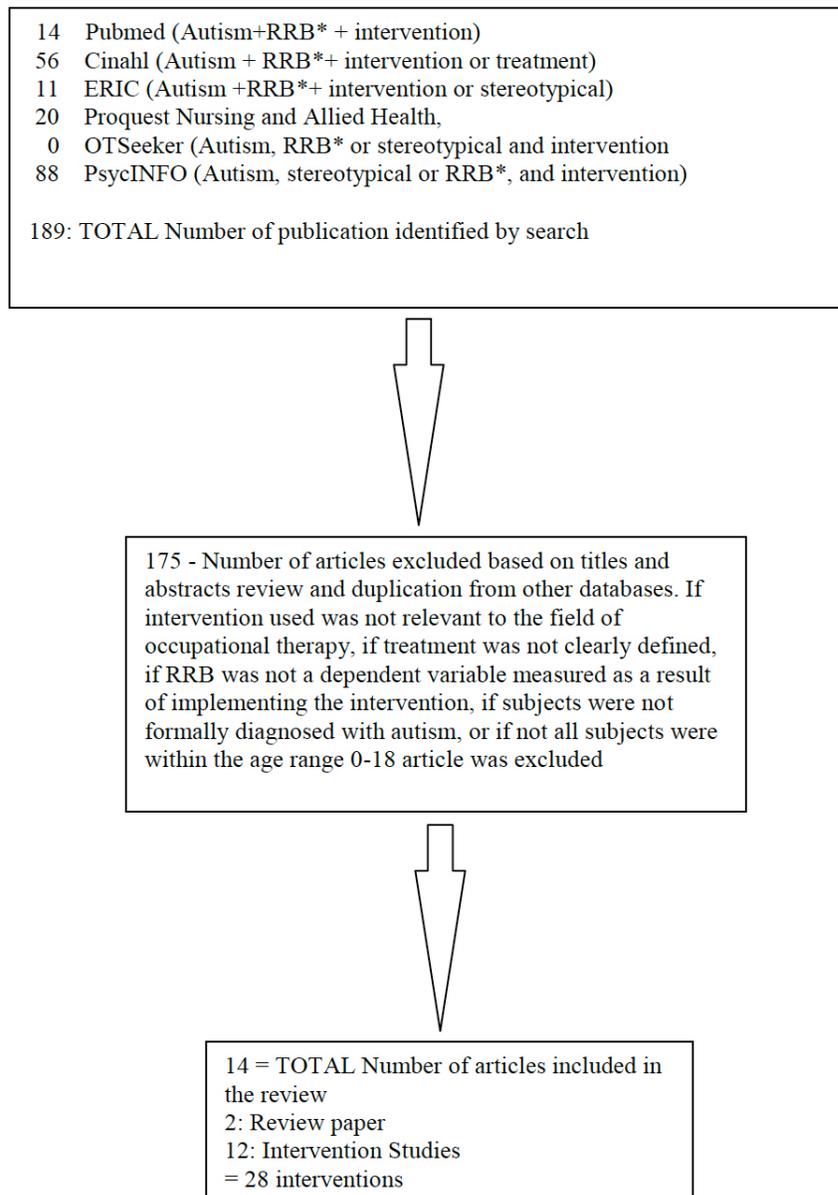
RESULTS

Article Selection and Quality Appraisal

After initial searches and review of article abstracts to ensure all inclusion and exclusion criteria were met, fourteen publications, two review papers and twelve

individual intervention studies, were included in this review. Search results are presented in Table 1 and organized into two categories for clarity: 1) reviews and 2) intervention studies. All were initially appraised under the following headings: study information; (author/year of publication); type of study (design); sample (size, diagnosis, and ages); the type of intervention; and results of the intervention (e.g., effective or not at decreasing RRB).

From the fourteen publications, only the original study or review paper that reported results of effective



***RRB (Restricted and Repetitive Behaviour)**

Figure 1: Search and Selection Process.

Table 1: Summary of Articles Included in the Integrative Review

Study Information	Type of study	Sample	Intervention	Results: Effectively or ineffectively decrease RRBs	
				Effective	Ineffective
I Reviews					
Boyd BA, McDonough SG, Bodfish JW 2012. [7]	Review 1974- 2010	27 studies Dx: ASD * with RRBs** Age: Does not specify	Response Interruption and Redirection /response blocking (Physically or verbally blocking from engaging in behaviour)	Ahearn <i>et al.</i> 2007. [9] Koegal <i>et al.</i> 1974 [10] Liu-Gitz L, Banda DR 2010. [11]	
			Response cost procedures (Removal of a positive consequence when a repetitive behaviour occurs)	Athens <i>et al.</i> 2008. [12] Sidener <i>et al.</i> 2005. [13]	
			Differential reinforcement (Reinforce other behaviour the individual displays)	Azrin <i>et al.</i> 1988. [14]	
			Consequence based uses Circumscribed Interests (CI) (CI used as a contingent reinforcer delivered on the occurrence of appropriate behaviours)	Charlop-Christy M, Haymes L. 1996[15] 1998) [16]	
			Differential reinforcement of variability (Reinforcing the individual for varying behavioural responses with the reinforcement being linked to how novel the behaviour is)	Boyd <i>et al.</i> 2010 [17] Miller, Neuringer 2000 [18]	
			Visual or verbal cues (Cues used to forewarn the child or allow engagement in calming or highly preferred task prior to difficult task)	Conroy <i>et al.</i> 2005 [19] Horner <i>et al.</i> 1997 [20]	
			Environmental enrichment (Strategies: noncontingent access to appropriate competing sources of reinforcement)	Piazza <i>et al.</i> 2000 [21] Rapp, Vollmer (2005) [22] Vollmer <i>et al.</i> 1994. [23]	
			Antecedent Based uses of Circumscribed interests (CI) (CI is embedded in the task the person will engage in to increase desired behaviour during the activity)	Baker, 2000. [24] Baker <i>et al.</i> 1998. [25] Boyd <i>et al.</i> 2007. [26]	
			Visual schedules or video based technologies (used to tolerate change or expand repetitive behaviour)	Hine, Wolery 2006 [27] Odom <i>et al.</i> 2003. [28]	
			Cognitive Behaviour Therapy/Exposure Response Prevention (Cognitive reframing and exposure response prevention exercises)	Lehmkuhl <i>et al.</i> 2008**** [29] Reaven, Hepburn 2003. [30]	
			Functional Communications training (teaching appropriate communication responses that can be used to obtain the same reinforcer)	Kennedy <i>et al.</i> 2000. [31]	
Physical Exercise (participates prior to subsequent activity associated with repetitive behaviour)	Kern <i>et al.</i> 1984. [32]				

(Table 1). Continued.

Study Information	Type of study	Sample	Intervention	Results: Effectively or ineffectively decrease RRBs	
				Effective	Ineffective
Patterson SY, Smith V, Jelen M. 2010. [33]	Systematic Review 10 single case studies Studies up until June 2008	Size: 17 participants Dx: ASD* Age 2y 11mo-26years	Response interruption and redirection (RIRD)	Ahearn <i>et al.</i> 2007[9]	
			Differential reinforcement and extinction (reinforcement in the event of a correct response, and no reinforcement when there is not a correct response)	Rehfeldt, Chambers, 2003. [34]	
			Scheduled thinning of response blocking		Tarbox <i>et al.</i> 2002. [35]
			Noncontingent Reinforcement and response blocking (the delivery of reinforcers according to a schedule that is not response contingent and blocking the response before it starts)		Carr <i>et al.</i> 2002 [36]
			Noncontingent Reinforcement and response interruption (RI) (the delivery of reinforcers according to a schedule that is not response contingent and interrupting the behaviour as it is occurring)		Cicero 2007 [37] (No more difference than RI alone)
			Noncontingent access (Continuous access, access to items not dependent on behaviour)	Roane <i>et al.</i> 2003. [38]	
			Matched stimulation and noncontingent reinforcement (Access to items that produced similar sounds to the problematic behaviour, Access not contingent on behaviour)	Rapp 2007. [39]	
			Noncontingent reinforcement and prompting procedures (the delivery of reinforcers according to a schedule that is not response contingent and the adult prompting the child to perform an appropriate behaviour)		Britton <i>et al.</i> 2002 [40]
			Functional communication training (teaching appropriate communication responses that can be used to obtain the same reinforcer)		Kennedy <i>et al.</i> 2000. [31]
Antecedent based visual cue card strategy (Visual prompts provided before the behaviour occurs)		Conroy <i>et al.</i> 2005 [19]			
II Intervention Studies					
Boyd BA, McDonough SG, Rupp B, Khan F, Bodfish JW. 2011. [41]	Multiple Single case design	Size: 5 Dx: ASD* Age: 48 months	Family-Implemented Treatment for Behavioural Inflexibility 12 week direct instruction to teach parents to identify environmental cues that elicited RRBs**, how to inhibit repetitive behaviours in the presence of these cues and replace them with alternative, adaptive behaviours	Decrease in repetitive behaviours	

(Table 1). Continued.

Study Information	Type of study	Sample	Intervention	Results: Effectively or ineffectively decrease RRBs	
				Effective	Ineffective
Boyd BA, Woodard CR, Bodfish JW. 2013. [42]	Multiple single case design	Size: 5 Dx: ASD* and co-morbid intellectual disabilities Lived in a residential facility Age: School age (5-11)	Exposure response prevention (Exposure: repeated gradual exposure to environmental stimuli that are associated with anxiety and subsequent compulsive behaviour) AND Response prevention (active avoidance of the compulsive act) 10 sessions	Decreased lower order RRBs *** Most effective when there are tangible antecedent stimuli. that reliably predict the onset of RB***	
Grahame V, Brett D, Dixon L, McConachie H, Lowry J, Rodgers J, Couteur A. 2015. [43]	RCT Intervention vs delayed intervention	45 families Parents of children with ASD* Aged 3-7 years	Managing Repetitive Behaviours Program (Parent-group intervention: Psycho-educational intervention incorporates knowledge of ASD, the principles of a Functional analysis approach Combined with the mutual support of group peer learning)	Parent-reported changes in RRBs* vs delayed group	
Kang S, O'Reilly M, Rojas L, Blenden K, Xu Z, Davis T, Lancioni G. 2013. [44]	Multiple single case design ABA design	Size: 3 Dx: ASD* Age: 3-8 years	Tangible reinforcer Compared to Social Reinforcement by others	When social praise used as the reinforcer	
Kuhn DE, Hardesty SL, Sweeney NM. 2009. [45]	Single Case study ABAB Design	Size: 1 Dx: ASD* and moderate mental retardation Age: 16 years	Functional communication training with extinction of destructive behaviour and response blocking of repetitive straightening (physically or mechanically disrupting the response before its completion).	Effective when all three approaches were used together	
Lehmkuhl HD, Storch EA, Bodfish JW, Geffken GR. 2008. [29]	Single case study	Size; 1 Dx ASD* and Obsessive Compulsive Disorder (OCD) Age: 12-year-old male	Cognitive behavioural therapy with exposure and response prevention.	Cognitive behavioural therapy is effective in reducing OCD symptoms in a child with Autism	
Loftin RL, Odom SL, Lantz JF 2008. [46]	Multiple single case multiple baseline design	Size: 3 Dx: ASD* Age: 9,10,10	Multi-component social skills intervention (including peer training, social initiation instruction, and self-monitoring)	Participants' repetitive motor behaviour was reduced. Changes in social behaviour and in repetitive motor behaviour maintained more than one month after the intervention ended	

(Table 1). Continued.

Study Information	Type of study	Sample	Intervention	Results: Effectively or ineffectively decrease RRBs	
				Effective	Ineffective
Love JJ, Miguel CF, Fernand J K, LaBrie JK. 2012. [3]	Case study Quantitative And qualitative	Size: 2 Dx: ASD* Age: 9,10	Response interruption and redirection (RIRD) Noncontingent access to matched stimulus (MS) Response interruption and redirection AND Noncontingent access to matched stimulus	Client 1: Similar suppressive effects on vocal stereotypy across treatment conditions. Client 2: Slightly greater suppression of stereotypy was associated with MS and RIRD together.	
Murdock LC, Dantzer J A, Walker AN, Wood L B 2014. [47]	Randomized pretest–posttest control group design	Size:30 Dx: ASD* Median age was 52 months with a range of 30 to 77 months	Platform swing (used after and before participation in tasks) Vs. watching a movie (non-sensory task)		No differences were evidenced between the treatment and control groups on engagement, on-task behaviour, stereotyped/repetitive behaviour, or out-of-seat behaviour.
Rodriguez NM, Thompson RH, Stocco CS, Schlichenmeyer K. 2013. [48]	Multiple single case ABA design?	Size: 3 Dx: ASD* and demonstrating ordering and arranging that was problematic Age: 9-14 yrs.	Matched Item plus blocking Matched Item plus prompts plus blocking	Depending on the function of the behaviour RB*** decreased when the function of the behaviour was determined and treatment was chosen based on the FBA	
Storch EA, Arnold EB, Lewin AB, Nadeau J, Jones AM, De Nadai AS, Murphy TK. 2012. [49]	2 group Treatment vs Treatment as Usual) RCT Pre-post design	Size: 45 Dx: ASD* High functioning And clinically significant anxiety Age 7-11 years	Cognitive Behavioural Therapy x 16 weeks Behavioural Interventions for Anxiety in children with Autism (Biaca) Family based approach Child and Parents	Autism symptoms (stereotypic mannerisms) decreased as a secondary effect (not directly targeted) I.e. As anxiety symptoms decreased so did Stereotypic mannerisms (RRB**)	
Watling RL, Dietz J. 2007. [50]	Single-subject study used an ABAB design	Size: 4 Dx: ASD* Age: 3-4.4 years	Ayres Sensory Integration Vs. play scenario		No difference between 2 groups on RB***

Notes:

Dx = Diagnosis.

*(ASD) Autism Spectrum Disorder.

** (RRB) Restricted and Repetitive Behaviours.

*** (RB) Restricted Behaviours.

**** Studies are also listed in intervention studies.

interventions to decrease RRBs is included in Table 2. Those interventions found to be ineffective or inconclusive (i.e., had no effect on RRB or had no more effect compared to treatment as usual) by the

respective authors or by the authors of the reviews were not included. All of the interventions noted in the review by Boyd *et al.* [7] were identified as effective in the reduction of RRBs. Only some of the interventions

Table 2: Classification and Analysis of Effective RRB Interventions that Target Person, Environment or Occupation

Study Information: Author (year of publication)	Intervention	Intervention Category (Boyd et al. 2012)	PEO*Level of Treatment (Law et al. 1996)
<i>Treatment Approaches that Target the Environment</i>			
Boyd BA, McDounough SG, Ruppy B, Khan F, Bodfish JW. 2011. [41]	Family-Implemented Treatment for Behavioural Inflexibility (FITBI)	Antecedent: skills (parents)	Environment
Hine, Wolery. 2006. [27] Odom et al. 2003[28] <i>In: Boyd BA, Mcdonough SG., Bodfish JW. 2012. [7]</i>	Use of visual schedules or video based technologies (used to help prepare child to tolerate change or expand RB**)	Antecedent: modifying environment	Environment
Conroy et al. 2005 [19] & Horner et al. 1997 [20] <i>In: Boyd, BA, Mcdonough, SG, Bodfish JW. 2012. [7]</i>	Visual or verbal cues (to forewarn the child or allow engagement in calming or highly preferred task prior to difficult task)	Antecedent: modifying environment	Environment
Boyd et al. 2010 [17] Miller, Neuringer. 2000. [18] <i>In: Boyd BA, Mcdonough, SG, Bodfish, JW. 2012. [7]</i>	Differential reinforcement of variability (reinforcing the individual for varying behavioural responses with the reinforcement being linked to how novel the behaviour is)	Consequence	Environment
Azrin et al. 1988. [14] <i>In: Boyd BA, Mcdonough SG, Bodfish JW. 2012. [7]</i>	Differential reinforcement (Reinforce other behaviour the individual displays)	Consequence	Environment
Athens et al. 2008[12] Sidener et al. 2005[13] <i>In: Boyd BA, Mcdonough SG, Bodfish JW. 2012. [7]</i>	Response cost procedures: removal of a positive consequence when a repetitive behaviour occurs	Consequence	Environment
Boyd BA, Woodard CR, Bodfish JW. 2013. [42]	Exposure response prevention: ERP (Exposure: repeated gradual exposure to environmental stimuli that are associated with anxiety and subsequent compulsive behaviour) (Response prevention: active avoidance of the compulsive act)	Antecedent: modify environment and consequence	Environment
Grahame V, Brett D, Dixon L, McConachie H, Lowry J, Rodgers J, Couteur A. 2015. [43]	Managing repetitive behaviours program with parent-group intervention	Antecedent: Skills (parents)	Environment
Kang S, O'Reilly M, Rojeski L, Blenden K, Xu Z, Davis T, Lancioni G. 2013. [44]	Tangible reinforcer Compared to social reinforcement by others	Consequence	Environment
Rehfeldt RA, Chambers MR. 2003. [34] <i>In: Patterson SY, Smith V, Jelen M. 2010. [33]</i>	Differential reinforcement and extinction (Reinforcement in the event of a correct response, and no reinforcement when there is not a correct response)	Consequence	Environment
<i>Treatment Approaches that Target the Person</i>			
	None	None	None
<i>Treatment Approaches that Target Occupation</i>			
Kern et al. 1984 [32] <i>In: Boyd BA, Mcdonough SG, Bodfish JW. 2012. [7]</i>	Physical exercise (child participates prior to subsequent activity associated with RB**)	Antecedent modify environment (routine)	Occupation

(Table 2). Continued.

Study Information: Author (year of publication)	Intervention	Intervention Category (Boyd et al. 2012)	PEO*Level of Treatment (Law et al. 1996)
Treatment Approaches that Target the Environment and Person			
Lehmkuhl et al. 2008. [29]*** Reaven, Hepburn 2003. [30] <i>In: Boyd BA, Mcdonough SG, Bodfish JW. 2012. [7]</i>	Cognitive Behaviour Therapy /Exposure Response Prevention (Cognitive reframing and exposure response prevention exercises)	Antecedent: skill Antecedent: modifying environment and consequence	Person Environment
Lehmkuhl HD, Storch EA, Bodfish JW, Geffken GR. 2008. [29]	Cognitive behavioural therapy with exposure and response prevention.	Antecedent: skill Antecedent: modify environment and consequence	Person Environment
Storch EA, Arnold EB, Lewin AB, Nadeau J, Jones AM, De Nadai AS, Murphy TK. (2012). [49]	Cognitive Behaviour Therapy x 16 weeks	Antecedent: skill	Environment (parent skills) Person (child skills)
Treatment Approaches that Target the Environment and the Occupation			
Baker MJ. 2000 [24], Baker et al. 1998. [25] <i>In: Boyd BA, Mcdonough, SG, Bodfish JW. 2012. [7]</i>	Antecedent Based uses of circumscribed interests (CI) (CI is embedded in the task the person will engage in to increase desired behaviour during the activity)	Antecedents: modifying environment	Environment and occupation
Piazza et al. 2000. [21] Rapp, Vollmer. 2005. [22] Vollmer et al. 1994. [23] <i>In: Boyd B A, Mcdonough SG, Bodfish JW. 2012. [7]</i>	Environmental enrichment strategies (noncontingent access to appropriate competing sources of reinforcement)	Antecedent: modifying environment	Environment and occupation
Charlop-Christy M, Haymes L. 1996. [15], 1998[16] <i>In: Boyd BA, Mcdonough, SG, Bodfish JW. 2012. [7]</i>	Consequence based uses Circumscribed Interests (CI) (CI used as a contingent reinforcer delivered on the occurrence of appropriate behaviours)	Consequence	Environment and occupation
Ahearn et al. 2007 [9] Koegel et al. 1974. [10] Liu-Gitz L, Banda DR. 2010. [11] <i>In: Boyd BA, Mcdonough S.G. Bodfish JW. 2012. [7]</i>	Response Interruption and Redirection/response blocking (Physically or verbally blocking from engaging in behaviour)	Consequence	Environment and occupation
Love JJ, Miguel C F, Fernand JK, LaBrie JK. 2012. [3]	Response interruption and redirection (RIRD) Noncontingent access to matched stimulation (MS) RIRD and MS	Consequence Antecedent: modify environment Consequence and Antecedent: modify environment	Environment and occupation Environment and occupation Environment and occupation
Roane H S, Kelly ML, Fisher WW. 2003. [38] <i>In Patterson SY, Smith V, Jelen M. 2010. [33]</i>	Noncontingent access	Antecedent: modify environment	Environment and occupation
Ahearn WH, Clark KM, Macdonald RPF, Chung BI. 2007. [9] <i>In: Patterson SY, Smith V, Jelen M. 2010. [33]</i>	Response interruption and redirection	Consequence	Environment and occupation
Rapp JT. 2007.[39] <i>In Patterson SY, Smith V, Jelen M. 2010. [33]</i>	Matched stimulation and Noncontingent Reinforcement	Antecedent: modify environment and consequence	Occupation and environment

(Table 2). Continued.

Study Information: Author (year of publication)	Intervention	Intervention Category (Boyd <i>et al.</i> 2012)	PEO*Level of Treatment (Law <i>et al.</i> 1996)
Rodriquez NM, Thompson RH, Schlichenmeyer K.2013. [48]	Matched Item plus blocking Matched Item plus prompts plus blocking	Antecedent: modify environment and consequence Antecedent: modify environment and consequence	Occupation and environment Occupation and environment
Treatment Approaches that Target the Environment, Occupation and Person			
Kennedy <i>et al.</i> 2000. [31] Boyd BA, Mcdonough SG, Bodfish JW. 2012. [7]	Functional communications training (teaching appropriate communication responses that can be used to obtain the same reinforcer)	Antecedent: skill and consequence	Person (speech) Environment Occupation (social interaction)
Kuhn DE, Hardesty SL, Sweeney NM. 2009. [45]	Incorporated functional communication, with extinction of destructive behaviour and response blocking of repetitive straightening	Antecedent: skill and consequence Antecedent: modifying environment	Occupation (alternative replacement activity: social interaction) Environment (Mod) Person (skills: speech)
Loftin RL, Odom SL, Lantz J F. 2008. [46]	Multi-component social skills intervention (including peer training, social initiation instruction, and self-monitoring)	Antecedent: skill and consequence	Occupation (social interaction) Environment (social) Person (social initiation and self-monitoring)

Notes:

*PEO (Person Environment Occupation) Model of Occupational Performance.

**RB (Restricted Behaviour).

in the systematic review by Patterson, Smith & Jelen [9] and some of the interventions in the individual intervention studies were found to be effective. In total twenty-eight different effective interventions were identified from eleven of the studies. Table 2 describes those studies in terms of intervention, intervention category, and PEO [6]. The Intervention category uses a classification system [7] with terms that are common within the field of ABA and FBA.

Data Analysis

Intervention Classification by ABA Framework

Analysis of the total twenty-eight effective interventions named using the FBA framework proposed by Boyd *et al.* [7] led to nine interventions being considered within the Consequence-based intervention category, ten fell within the Antecedent-based intervention category (modifying the environment or routine to reduce the likelihood of the RRB occurring or enriching the skills of the individuals in the environment). The remaining nine interventions were found to fall under a combination of the Consequence and Antecedent categories.

Intervention Classification by PEO Model

PEO classification was determined by answering the question: Is the treatment aiming to impact the

person, the environment or the occupation? Of the twenty eight effective interventions identified none were found to exclusively target the person, eleven targeted the environment only (enhancing the physical or social environment of the child), and one targeted only occupation. Many interventions targeted strategies at two or more aspects of the PEO model: two concurrently targeted the person and the environment, eleven targeted the environment and occupation and the remaining three interventions targeted all aspects of the PEO: person, environment and occupation.

A comparison of the identified effective behavioural interventions using both the ABA approach suggested by Boyd *et al.* [7] and the PEO model [6] can be seen in Table 3.

DISCUSSION

This integrative review explored how occupational therapists can address RRBs by incorporating known evidence-based behavioural interventions into an occupational therapy frame of reference. Analysis of the twenty-eight effective interventions identified for the treatment of RRBs in autism included in this review outlined similarities between the FBA approach suggested by Boyd *et al.* [7] and the PEO model [6]. The simultaneous application of these two models

demonstrate how the interventions relate to occupational therapy theory and practice and will help guide occupational therapists in choosing the best treatment approach to use with their clients. In addition this analysis highlights for all members of interdisciplinary teams working with children with autism, the unique perspective that occupational therapists have in understanding RRBs in relation to the person, the environment, and also the occupation and how these limitations can be addressed.

Interventions Targeting the Environment

Occupational therapists often aim to impact occupational performance by changing the environment in which the occupation is performed. The Functional Behaviour Assessment when used in combination with the PEO concepts allows the therapist to consider events in the environment in terms of antecedents and consequences of behaviours and the timing of these environmental adjustments or controls. Many of the interventions (eleven) were found by the authors of this review, to be primarily targeting the environment aspect of the PEO model. Interventions that were classified under environment included consequence based interventions, antecedent based (modifying the environment or routine) interventions, as well as some antecedent based (enriching skills) interventions.

An example of an intervention that targeted change to the environment by changing or improving the skills of others in the child's world is the Family-Implemented Treatment for Behavioural Inflexibility (FITBI) [41]. A parent-group intervention in which the parents were trained and offered new skills in order to address their child's RRBs. This approach would be seen as changing the antecedent or what happens before the behaviour occurs by enriching the skills of individuals in the child's environment and by doing so affecting the RRB.

Some interventions targeted the environment by modifying the physical surroundings in which the behaviour was performed. Examples of such interventions include the use of visual schedules or video based technologies [27, 28]. Using the FBA framework, these strategies are examples of modifying the environment as an antecedent approach. Other interventions used the environment as a consequence strategy by changing the environment after the RRB occurred to either reinforce or deter the performance of the RRB. Finally, a few interventions utilized the

environment as both an antecedent and a consequence strategy by differential reinforcement with and without extinction [14, 18, 34].

Interventions Targeting the Person

In practice the occupational therapist may address the individual's skills and determine if they fit with the occupation possibly having an impact on occupational performance. If the person's skills do not match the demands of the occupation and the environment where the task is being performed, intervention at the skill level of the person will need to be addressed. Of all the effective interventions identified in this study, none were found to target solely the person level of the PEO model exclusively.

Interventions Targeting Occupation

Occupational therapists also influence changes at the level of the occupation as a way to impact occupational performance or behaviour. "Occupations refer to the everyday activities that people do as individuals, in families and with communities to occupy time and bring meaning and purpose to life. Occupations include things people need to, want to and are expected to do" [5]. When considering the number of effective treatment options discovered in the literature, the occupational therapist must consider how "occupation" fits.

Occupation may be incorporated into intervention for RRBs as an antecedent event that will decrease the likelihood of a problematic behaviour such as RRB occurring. Kern, Koegel, & Dunlap [32] identified one intervention that used the occupation of physical exercise in this way. By exercising, the person is engaging in a functional occupation that may fulfill the same sensory needs as the RRB. Exercise therefore eliminates the need for engagement in the RRB and serves as a replacement behaviour for the nonfunctional RRB. The type of antecedent occupation that is facilitated however will be dependent on the person and therefore must be chosen and/or adapted based on the needs and abilities of the person.

Interventions Targeting Person and Environment

A few interventions identified addressed both the person and the environment aspects of the PEO model. These interventions included antecedent (enrichment of skills) approaches, antecedent (modifying the environment) approaches, as well as consequence based approaches.

Table 3: RRB Intervention Classification and Comparison between the ABA approach and the PEO Model of Occupational Performance

	<i>Functional Behaviour Analysis Concepts</i>			
	Antecedent based Interventions (Modifying environment or routine)	Antecedent Based Interventions (Enriching Skills)	Consequence Based Interventions	Consequence and Antecedent Based interventions
PEO Components				
Person	NA	NA	NA	NA
Environment	Visual schedules or video based technologies [27,28]	Family-implemented treatment for behavioural inflexibility [41]	Differential reinforcement of variability [17,18]	Exposure response Prevention [42]
			Response cost procedures [12,13]	*
	Visual or verbal Cues[19,20]	Managing Repetitive Behavior Program[43]	Tangible reinforce [44]	
			Social praise [44]	
			Differential reinforcement plus extinction [34]	
			Differential Reinforcement [14]	
Occupation	Physical exercise [32]			
PEO Component Interactions				
Person and Environment		Cognitive Behavioural Therapy (parents and child) [49]		Cognitive behavioural therapy plus exposure response prevention [29,30]
Occupation and Environment.	Antecedent based uses of circumscribed interests [24,25]		Consequence based use of circumscribed interests [15,16]	Response interruption redirection plus matched stimulus [3]
	Environmental enrichment strategies [21,22,23]		Response interruption and redirection/response blocking [9,10,11]	Matched stimulation and noncontingent reinforcement [39]
	Noncontingent access to matched stimuli [3]		Response interruption and redirection [3,9]	Matched item plus blocking [48]
	Noncontingent access [38]			Matched item plus prompts plus blocking [48]
Occupation, Environment, and Person				Multi-component social skills intervention [46]
				Functional communication training (FCT) with reinforcement [31]
				Functional communication plus extinction of destructive behaviour plus response blocking [45]

Cognitive behaviour therapy (CBT) [29] targets the cognitive skills of the individual while also targeting change in the environment by using exposure and response prevention at the same time. Not only were cognitive reframing skills taught to the client, they were physically applied using strategies that involved access or denial of items in the environment that were related to the RRBs.

Interventions Targeting Occupation and Environment

Some interventions targeted occupation while also targeting the environment. An example includes matched Item, plus blocks and prompting approach [48]. In this approach the performance of RRB is blocked and participation in use of the matched item is prompted. This intervention is both antecedent type (modifying the environment) and consequence type.

Interventions Targeting Occupation, Environment, and Person

Functional communication training (FCT) [45] addresses person, occupation and environment. The person component is addressed as improving skills (speaking) and the occupation of social interaction is done through modification of the task by providing prompts. The environment (modifying) is involved through the availability of items dependent upon whether RRB are occurring or not. Treatments are considered to be antecedent (enhancing skills of client or others in the child's environment) and consequence based (access or denial of reinforcers).

Occupational Therapy and Occupation as Part of Intervention for RRB

Since occupational therapists aim to make change in occupational performance or behaviour by influencing change in any or all aspects of the PEO Model, interventions that target change under any of these categories are within the occupational therapy scope of practice.

Occupation has been incorporated into RRB interventions through the use of the alternative replacement behaviour - typically recommended as part of a FBA. The alternative replacement behaviour is considered the functional equivalent to the identified problematic behaviour [51]. The alternative replacement behaviour is a new behaviour, chosen by the therapist that is more appropriate or more functional than the problematic behaviour. To

occupational therapists, this alternative replacement behaviour may be seen as the modified occupation; the occupation is changed in such a way that it will enable successful occupational performance. The alternative replacement behaviour is maintained by the same consequence that maintained the problematic behaviour or RRB. In other words it provides the same reinforcement that the problematic behaviour provided. The function of RRBs for individuals with autism has frequently been determined to be a need for unique sensory input [52]. Boyd *et al.*, [7] discuss how this can sometimes complicate the development of interventions that target repetitive behaviour since understanding what the child actually gains or escapes by engaging in the sensory behaviour can be difficult. In relation to treatment for RRBs, Patterson with Smith & Jelen (2010) [33] suggest "The clinical expertise of occupational therapists who work with individuals with ASD may prove to be a valuable resource in the decision making process" (p. 325) for this reason.

Occupational therapists are skilled in the assessment of occupational performance by understanding occupation or task requirements, the influences of the environment (physical, social, sensory as antecedents and consequences) and the skills of the person (cognitive, perceptual, physical, sensory) and then determining how those components match or fit together. If there is not a good fit resulting in occupational dysfunction, the occupational therapist may modify the environment, the occupation, or enhance the individual's skills as part of treatment in order to achieve optimal occupational performance. Occupational Therapists may therefore be uniquely qualified in determining the maintaining consequences of a problematic behaviour and also in recommending appropriate alternative replacement behaviours/occupations that would result in the same consequences as the RRB, particularly those that seem to be related to a sensory need.

LIMITATIONS

It is possible that all known evidenced based interventions identified to effectively address RRBs were not identified as a result of the search completed for this review based upon the search terms utilized.

The classification of the evidenced based interventions identified according to the PEO Model was based on the opinion and analysis of the author group. Other therapists or professionals may view the intervention categorization differently. The same is true

for the classification of identified interventions according to the FBA framework. Many were classified previously by the author Boyd *et al.* [7] however the remaining interventions that were not part of that study were classified based on the opinion of the author of the present study as well. Nonetheless, the similarities between how the two frameworks align could be useful to the occupational therapist in determining the intervention approach for their respective client needs.

The current analysis is not specific in terms of RRBs type and the corresponding effective evidenced based intervention(s) (e.g., effective interventions for the RRB of spinning repetitively). In addition effective interventions for RRBs for individuals with and without intellectual disabilities were not addressed separately. Further delineation of interventions for specific RRB, together with addressing the potential for the interaction with the level of intellectual ability is warranted.

CONCLUSION

Occupational Therapists have an important role to play in the treatment of RRBs seen in individuals diagnosed with autism. As members of interdisciplinary teams working with this population, occupational therapists can enable improved engagement and performance in meaningful occupations in part by decreasing RRBs and teaching new skills. This can be achieved in many ways by targeting various or multiple aspects of the PEO model which map well onto the list of interventions identified in this review. This review provides a framework for occupational therapists to understand and utilize behavioural interventions in the context of occupational performance. This new information will also inform other professionals of the potential role the occupational therapists may have with this population.

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Received on 28-06-2017

Accepted on 03-08-2017

Published on 17-10-2017

DOI: <https://doi.org/10.6000/2292-2598.2017.05.03.1>

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