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ORIGINAL ARTICLE

Restricted, Repetitive Behaviors in Autism Spectrum Disorder and Obsessive–Compulsive Disorder: A Comparative Review

Marina Jiujias[1] · Elizabeth Kelley[1,2] · Layla Hall[1]

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Abstract This review paper critically examines literature regarding restricted and repetitive behaviors (RRBs) in Autism Spectrum Disorder (ASD) and Obsessive–Compulsive Disorder (OCD). The similar behavioral profiles of these disorders presents the potential for confusion regarding diagnoses and intervention efforts. As such, this review highlights the similarities and differences between RRBs in ASD and OCD. The developmental trajectories of RRBs are presented, followed by an exploration of three constructs implicated in RRB manifestation: anxiety, executive functioning, and sensory phenomena. While RRBs tend to develop with some similarity in both disorders, the differing role of anxiety highlights important distinctions between ASD and OCD. We urge researchers and clinicians to think critically about the dimensions that affect RRB presentation. Future research should use this review as a starting point to further elucidate the differences between RRBs in these two populations.

Keywords Repetitive behavior · Autism spectrum disorder · Obsessive–compulsive disorder · Compulsive behavior · Anxiety

Restricted and repetitive behaviors (RRBs) are broadly defined as frequent behaviors that occur in a manner that is both inappropriate to the situation and odd in context [1, 2]. These behaviors are diagnostically characteristic of both Autism Spectrum Disorder (ASD) and Obsessive–Compulsive Disorder (OCD) [3]. This review critically examines a large body of literature on RRBs in ASD and OCD. Developmental trajectories are discussed, followed by an analysis of three common factors implicated in the presentation of RRBs in both disorders: anxiety, executive functioning, and sensory phenomena. In this review, we will examine the parallels in RRB manifestation between ASD and OCD, we will discuss the limitations of the current research in this area, and we will suggest implications and directions for future research. The main aim of this paper is to clarify directions for future research regarding RRBs in both ASD and OCD, in order to inform concrete diagnostic and treatment decisions for these disorders.

RRBs in ASD

ASD is a neurodevelopmental disorder that is characterized by social/communicative impairments and the presence of RRBs [3]. Certain behavioral and cognitive deficits can be identified in children as young as 18–24 months that serve to predict a later diagnosis of ASD, with reliable diagnoses occurring most commonly at 3 years of age [4, 5]. A diagnosis of ASD occurs in approximately 1 in 68 children [6]. This diagnosis is more than four times as common among boys than girls, with one in 42 boys and one in 189 girls receiving an ASD diagnosis [6]. This disorder is classified as a spectrum due to the significant heterogeneity of symptoms that exist between individuals with an ASD diagnosis. For instance, toddlers later diagnosed with ASD demonstrate significant variability in their communicative acts and gestures [5]. Moreover, cognitive and language ability range from severe intellectual disability to genius level [7,

✉ Elizabeth Kelley
kelleyb@queensu.ca

[1] Psychology Department, Queen's University, Kingston, ON K7L 3N6, Canada

[2] Queen's University, Humphrey Hall Room 351, 62 Arch Street, Kingston, ON K7L 3N6, Canada

8]. This paper addresses how the heterogeneity of various constructs related to an ASD diagnosis affects the presentation and the severity of RRBs in ASD.

While most ASD literature has largely focused on the social impairments associated with a diagnosis, recent research reflects a growing trend toward gaining a better understanding of RRBs. Research conducting factor analyses of items on tools like the Repetitive Behavior Scale-Revised (RBS-R; [9]), the Autism Diagnostic Interview-Revised (ADI-R; [10]), and the Autism Diagnostic Observation Schedule (ADOS; [11]) reveal that RRBs in ASD are reliably grouped into two distinct categories: *repetitive sensory motor* behaviors and *insistence on sameness* behaviors [12]. These categories are also sometimes referred to as lower-level and higher-level repetitive behaviours, respectively [13–16]. Repetitive sensory motor behaviors encompass stereotyped movements (such as hand flapping) and the repetitive use of specific objects (such as spinning objects), while insistence on sameness behaviors characterize ritualistic habits and a strict adherence to well-established routines [12].

A specific insistence on sameness behavior that has been hypothesized as distinct from other RRBs is *restricted interests* [12, 13]. Restricted interests are defined as an interest or preoccupation with a particular object/topic or group of objects/topics, that is both abnormal in its specificity and the intensity with which it is expressed [17]. When items pertaining to restricted interests are included as separate constructs in factor analyses of various assessment tools, a three-factor model is often found to be a better fit than a two-factor model, suggesting that restricted interests may have a distinct pathology from other RRBs in individuals with ASD [1, 12, 18, 19]. Restricted interests in ASD have been likened to obsessions in OCD [17], a parallel that will be further explored later in this review.

Male and female experiences of RRBs in ASD are fairly similar. Gender does not appear to be related to the tendency for RRBs to decrease with age [20], nor do scores on RRB domains on tools like the ADI-R and the ADOS differ between male and female participants [21, 22]. A minor difference is the finding that some females between the ages of 2 and 9 years old experience milder repetitive sensory motor behaviours compared to males [23, 24].

RRBs in OCD

OCD is characterized by the presence of time-consuming obsessions and/or compulsions that cause functional impairment [3]. Unlike ASD, OCD is not characterized by marked language and cognitive impairments [3]. Obsessions are persistent thoughts that are often experienced as unpleasant, irrational, and unwanted. Some common examples include a fear of contamination, doubt regarding the completeness of certain actions, a preoccupation with organization, and sexual/taboo thoughts. Compulsions are behaviors that are performed excessively and usually with the purpose of relieving anxiety caused by obsessions [3, 25]. Some primary examples of compulsions include washing, checking, hoarding, and arranging [3].

Age of onset in OCD presents as distinct peaks in childhood and again in adulthood [26, 27]. The typical age of onset for a diagnosis of OCD is 19 years of age [28, 29]. Individuals who experience an early-age onset of OCD exhibit more frequent and more severe symptoms than those with a late-onset diagnosis [27], although adults whose age of onset is either prior to or after 18 years old appear not to differ in presentation of symptom severity [30]. While compulsions are generally less controlled in childhood and slightly more intense in adolescence and adulthood, obsessions are usually experienced as more severe and interfering as individuals get older [31, 32].

In general, while males often experience an earlier age of onset than females [29], there are few significant gender differences between individuals with early and late ages of onset for a diagnosis of OCD [27]. Beyond this difference, few studies have examined gender differences in OCD. One finding in terms of symptom content is that women experience contamination and cleaning obsession/compulsions more often than males, and men more often experience religious and sexual RRBs than women [33].

Comparing ASD and OCD

At first glance, RRBs in ASD and OCD do not appear to differ greatly. Restricted interests/obsessions and repetitive sensory motor behaviors/compulsions are topographically quite similar. Moreover, the intrusive nature of RRBs are often found to be associated with social and functional impairments experienced both by individuals with ASD [17, 34, 35] and OCD [36, 37]. In addition to these similarities, comorbid diagnoses of ASD and OCD may further complicate efforts to distinguish between disorder-specific symptoms. Before 2013, diagnosticians basing their diagnoses on the *Diagnostic and Statistical Manual* (DSM) system of the American Psychiatric Association were unable to give individuals with ASD a diagnosis of OCD and vice versa [38]. However, some research indicates that this particular comorbid diagnosis has important clinical implications.

Generally, when symptoms/diagnoses of anxiety disorders in individuals with an ASD diagnosis are discussed in the literature, participants often meet the diagnostic criteria for OCD [39–42]. Comorbid cases present with unique symptom profiles as well. For example, children aged 7–13

with a comorbid diagnosis of ASD and OCD were found to be less likely to display the most common symptoms of OCD such as checking and washing [43]. Children between the ages of 9 and 17 diagnosed with comorbid ASD and OCD have also been found to be less likely to endorse magical thinking obsessions and more likely to engage in rigid obsessions [42].

When adult participants with a comorbid ASD/OCD diagnosis were compared to participants with ASD or participants with OCD using a self-report measure of obsessive–compulsive symptoms (OCI-R; [44]), the comorbid group did not exhibit significantly different scores on the RRB domains of the ADOS or the ADI-R when compared to the ASD-only group [45]. Conversely, the comorbid ASD/OCD group exhibited higher OCI-R scores compared to the OCD-only group. In terms of specific symptoms, the comorbid ASD/OCD group showed elevated levels of checking, ordering, and obsessing symptoms [45]. However, other studies report that non-significant differences exist in obsessive–compulsive symptoms between comorbid ASD/OCD and OCD-only participants, in both child [43] and adult samples [46].

These findings suggest that a comorbid ASD/OCD diagnosis may alter the expression of disorder-specific symptoms [43], making it difficult to discern whether certain RRBs stem from ASD or OCD. Overlap in comorbid cases may result in attributing symptoms to the wrong diagnosis [41, 47]. One study attempted to differentiate between OCD behaviours and repetitive sensory motor behaviours in two non-verbal adolescent boys with autism [48]. While one participant exhibited ASD-like repetitive sensory motor behavior, the other participant's actions were more similar to compulsions [48]. The authors categorized each participant's behaviours as such based on definitions from reviewed literature and the topographies of each participant's behaviour. They describe RRBs associated with an ASD diagnosis as stereotypical behaviours that are maintained by automatic reinforcement. This was evidenced through the first boy's lack of environmental context for his string-twirling behaviour, which occurred often and caused interference with doing other things. The second participant's behaviours included wiping tables and ordering/arranging objects. The authors described these behaviours as more "complex" than those exhibited by the first participant, and were in line with the DSM-IV definition of symptoms of OCD causing distress to whomever engages in these behaviours [48]. Measures of affect and heart rate during alternating phases of permitting and restricting engagement with RRBs revealed that the participant exhibiting OCD-like compulsions responded with increased heart rate after being restricted from his identified compulsive behavior (wiping a table scattered with salt). Given the fact that these physiological changes were not present in the participant exhibiting RRBs more similar to an ASD diagnosis, the authors posit that the combination of behaviour description and measurement of physiological change may assist clinician's in distinguishing between disorder-specific RRBs.

Results from cases of comorbid ASD/OCD studies or studies comparing the two disorders reflects the importance of carefully distinguishing between disorder-specific RRBs [39–48]. In light of this importance, our goal through reviewing and comparing literature examining the RRBs of ASD and OCD is to promote discussion regarding future research efforts that aim to clarify the complex distinction between ASD and OCD RRBs.

Developmental Trajectories of RRBs

Literature that examines the development of RRBs in ASD generally explores how symptom type and symptom severity are affected at different developmental phases. The presence of RRBs in ASD can be detected at an early age. For instance, sticky attention (a tendency to focus attention on stimuli for too long) has been observed in children as young as 12 months of age who are later diagnosed with ASD [4] and is thought to be a precursor to developing restricted interests [49]. Furthermore, infants who are at a high risk of developing an ASD diagnosis (based on familial trends in diagnosis) present with higher scores on the Repetitive and Stereotyped Movements Scale (RSMS; [50]), compared to high-risk infants who were not later diagnosed with ASD and low-risk infants [51]. The frequency of one specific behaviour (repetitive object manipulation) did not differ between the high-risk infants that were later diagnosed and the high-risk infants that were not later diagnosed. The authors posit that, while some commonalities in early atypical development may be attributed to genetic factors, the presentation of RRBs that ultimately lead to a diagnosis may be the product of different sources at a later time period. For instance, much of the literature regarding the development of RRBs in ASD looks at how these behaviours are affected by the interaction between intellectual capability and age. Generally, children obtaining low scores on measures of nonverbal IQ (NVIQ) have been found to display higher rates of repetitive sensory motor behaviors [13, 15, 52]. Conversely, higher scores of NVIQ are related to decreased rates of RRBs in 8-year-old children with ASD [15]. However, some researchers note that the relation between NVIQ and reported RRB severity (defined by frequency and degree of interference) is only significantly strong after 25 or 36 months of age [13, 15].

In addition to NVIQ, specific RRBs have different interactions with developmental factors that contribute to the heterogeneous topography of RRBs in ASD. For instance,

while measurements of RRBs in children aged 2–11 using the RBS-R [7] did not reveal significant changes across a 2-year time period [53], RRBs that were measured in children with ASD at four separate time points (ages 2, 3, 5, and 9) increased in severity as the participants aged [14]. Discrepancies such as these may occur when RRBs are measured and compared as a whole rather than separately, as important developmental differences exist between repetitive sensory motor behaviors and insistence on sameness behaviors. For example, restricted interests and rituals were shown to be more prevalent in children with higher scores of NVIQ than repetitive sensory motor behaviours [13]. Moreover, while higher cognitive abilities at 2 years of age are often associated with milder repetitive sensory motor behaviors and improvement over time, insistence on sameness behaviors are found to increase in severity over time regardless of IQ [14, 54]. The same pattern occurs in older samples as well. In a cross-sectional comparison of children and adults with ASD, although the frequency and the severity of RRBs in general had lessened in older individuals, restricted interests continued to be the most prevalent across all ages [34].

Thus, in general, repetitive sensory motor/lower-level RRBs like self-injurious behavior and the repetitive manipulation of objects are generally more common in younger and lower-functioning individuals with ASD [13–15]. Comparatively, insistence on sameness/higher-level RRBs like attachment to specific objects and the manifestation of restricted interests present more frequently in older, higher-functioning individuals [13, 14, 16]. The distinction between lower-level and higher-level RRBs is evident across all age groups [16].

Evidence for developmental differences is also supported when past and current RRBs in adults with ASD are compared using the ADI-R and the RBS-R as retrospective and present-day measures. Current and lifetime impairment scores were compared in both measurement tools in a sample of adults (aged 19–28) with ASD to garner an improvement rating, defined as lesser intensity or frequency of an RRB [55]. The results for both the ADI-R and the RBS-R were fairly consistent. Overall, the highest prevalence of specific RRB subtypes was the Restricted Behaviour and Sameness Behaviour domain of the RBS-R, consistent with other research demonstrating that higher-level RRBs are more commonly present in older individuals [13–15, 20, 54]. Similarly, consistent with other research, the highest proportion of participants showed improvement in a lower-level RRB; both the "repetitive use of objects" subscale as measured by the ADI-R and the "compulsive behaviour" subscale of the RBS-R (which included repetitive use of objects) revealed the best positive change scores in this sample [55]. Unusual preoccupations measured by the ADI-R persisted into adulthood with a small degree of participants becoming asymptomatic in present-day ratings [55]. Accordingly, the "restricted behaviour" domain of the RBS-R, including items like restricted interests or focuses, showed the least improvement between lifetime and current scores [55]. This study demonstrates how differences between higher-level RRBs and lower-level RRBS (in that lower-level RRBs tend to abate as individuals get older and higher-level RRBs persist) continue to be present in adult populations, as well as child samples.

Conclusions drawn between child and adult ASD literature may be affected by the variable levels of insight documented in self-reports of symptoms. For instance, self- and parent-reports of autism traits and behaviors were compared in a sample of children and adolescents with ASD (ages 9–18) [37]. The children reported fewer autism symptoms and more empathic traits for themselves compared to the degree of symptoms and traits that their parents reported [56]. However, some adults with ASD are in close agreement with their parents on ratings of their personalities, indicating that some adults with ASD exhibit relatively sound self-insight [57]. While differences between parent and child reports of RRBs may differ due to other reasons, one potential factor may be that some adults with ASD exhibit more insight into their symptoms than some children and adolescents with ASD. This information will be an important source of comparison in our discussion of the developmental trajectories of RRBs in OCD.

Generally, the development of obsessions and compulsions in OCD varies according to age and ability. The frequently used Yale-Brown Obsessive Compulsive Scale (Y-BOCS; [58]) consistently reflects increased symptom severity in adults with regards to obsessive, but not compulsive, behaviors [32, 59]. Across analyses of the symptom characteristics measured by the Y-BOCS, children and adults were found to be almost always significantly different from each other, with adolescents sharing different commonalities with both children and adults [31]. One specific difference that may be affected by age is the thematic content of obsessions and compulsions. Adolescents and adults with OCD typically experience higher levels of contamination and religious/sexual obsessions than children with OCD [30–32, 60, 61]. The presence of sexual obsessions in older individuals is hypothesized to be due to typical pubertal changes and an increased understanding of sexuality [61].

While adults with OCD experience more difficulties with obsessions [32, 59], younger individuals with OCD exhibit poorer resistance against compulsions. These differences in symptom management may reflect an important developmental distinction between the cognitive (obsessions) and the behavioral (compulsions) components of an OCD diagnosis. For example, children and adolescents diagnosed with OCD are less likely to feel personally

responsible for their thoughts and behaviors than adults; conversely, adults internalize their symptoms [59]. Perhaps due to fewer feelings of responsibility, younger populations demonstrate less of a tendency to suppress their obsessive thoughts [59]. Poor compulsion resistance in childhood, then, may reflect a lessened importance placed on obsessions at younger ages. If the inferred threat of obsessions exists in varying degrees across age groups, this construct may contribute to differences in obsession severity and subsequent control over compulsions between children and adults [59].

Different degrees of insight may also contribute to different RRB presentations. For example, when groups of children, adolescents, and adults seeking treatment for OCD are compared, children and adolescents are found to exhibit less insight into their symptoms than adults [31]. If adults exhibit more insight, an elevated recognition of the irrationality of obsessions may contribute to the increased presence of internalizing symptoms and feelings of personal responsibility in adults with OCD. This, in turn, may be related to the anxiety implicated in an OCD diagnosis. As such, cognitive-behavioural therapies for OCD often focus on educating individuals about their symptoms and providing strategies like exposure and response/ritual prevention to better manage symptoms [47, 62, 63]. However, several studies have documented low insight in some adults with OCD [63–67]. Low or poor insight measured by the Y-BOCS or the Brown Assessment of Beliefs Scale (BABS; [68]) was sometimes related to issues of control and resistance of obsessions and compulsions [65, 67]. These findings highlight the potential contribution that insight lends to RRB management in OCD. Although adults with OCD mostly have good insight and experience obsessions more severely, when adults have poor insight, they are similar to children with OCD in that they exhibit poor control over RRB management.

Summary

The developmental trajectories of RRBs in both disorders follow a relatively predictable course: as individuals get older, the presentation of their behaviors becomes more sophisticated and complex [16, 31]. In ASD, the relation between age and RRBs is shown to be somewhat mediated by IQ [13–15], although the exact nature of this association is still unknown. Age and cognitive abilities distinguish between low-level and high-level RRBs in ASD [13, 14]. Conversely, in OCD, obsessions remain problematic in adulthood and compulsions become more manageable [32, 59]. Different cognitive constructs like internalization and insight contribute to differences in RRB presentation and management between age groups in OCD [32, 59, 65, 67].

One similarity between ASD and OCD is the similar developmental progression of obsessions in OCD and restricted interests in ASD. Compared to repetitive sensory motor behaviors and compulsions, which lessen in frequency or become more manageable as an individual gets older, restricted interests and obsessions typically continue to be interfering in older populations [20, 32, 55, 59]. However, the ability to understand and manage obsessions and restricted interests appears to function differently in ASD and OCD. While the ability to understand and manage behavior tends to lessen the severity of RRBs in ASD, increased insight into obsessions in OCD leads to increased severity [65, 67]. In OCD, adults usually experience more severe and frequent obsessive but not compulsive symptoms [32, 59]. However, insight influences the perception of OCD symptoms, and therefore alters how obsessions and compulsions may be experienced across the lifespan [31, 59, 67]. Although there is little research exploring insight in ASD, it appears as though children and adolescents have less insight into their symptoms than adults [56, 57]. Investigations into the role that insight plays in the severity of RRB experiences may be a potential avenue for future research, an idea that will be further explored in the discussion section of this review.

Anxiety and RRBs

Anxiety is estimated to exist in 30–81% of individuals diagnosed with ASD [69], with approximately 40% of children with ASD meeting the DSM-IV criteria for an anxiety disorder [70, 71]. Frequently cited causes of anxiety in ASD include social impairment, changes in routine, and sensory overload [17]. Individuals with ASD who exhibit clinical levels of anxiety report experiencing more severe and/or frequent instances of RRBs on the Repetitive Behavior Questionnaire when compared to individuals with non-clinical levels of anxiety [69, 70]. Moreover, specific subtypes of RRBs in ASD are affected differently by the presence of anxiety; for example, insistence on sameness behaviors as measured by the ADI-R are shown to be significantly associated with the Anxiety Problems sub-scale of the Child Behavior Checklist (CBCL; [72]) [73]. Repetitive sensory motor behaviors, however, are not significantly related to anxiety [74].

One study that assessed insistence on sameness behaviors in individuals with Down's syndrome, Asperger's syndrome, or autism, found that cancelled and/or interrupted activities were one of the most common situations to precede insistence on sameness behaviors across all three diagnostic groups [75]. This finding was further supported by an observational case study looking at insistence on sameness behaviors in an 11-year old boy with Asperger's

syndrome [76]. The observations took place in naturalistic play settings that reflected situations reported to cause the boy distress. During a simulated play session where an interruption condition was introduced, the participant exhibited rigid insistence on sameness behaviors in an apparent attempt to repair the environment to his preferred state [76]. These studies suggest that individuals with high-functioning ASD may engage in insistence on sameness behaviors to relieve stress in anxiety-provoking situations, such that providing a predictable degree of structure to one's world can reduce anxiety [75, 76].

Anxiety may also contribute to the presence of restricted interests [16, 69, 70, 74]. This relationship is especially evident when individually defined interests are explored. Symbolic enactment, a unique type of restricted interest, is defined as the emulation of a person's interest during symbolic play, such as the imitation of a character from a favorite movie/TV show [17]. This type of restricted interest is highly correlated with the presence of obsessions, compulsions, anxiety symptoms, and increasingly severe anxiety diagnoses in children with ASD [17]. Interestingly, although restricted interests are frequently associated with anxiety in ASD, they are also associated with positive emotions [77]. When individuals with autism or Asperger's syndrome were interviewed about their restricted interests, all respondents felt that their interests contributed to a sense of validation, happiness, and pride [78]. While the participants acknowledged how engagement with their interests interfered with daily activities and functioning, they also reported having developed strategies to productively integrate their interests into their daily lives [78]. Thus, although anxiety and engagement with restricted interests are highly correlated, this correlation may be due to an increased engagement with restricted interests to circumvent feelings of anxiety.

Although anxiety is often present in an ASD diagnosis, anxiety is significantly more prominent in OCD. Indeed, until the DSM-5, OCD was considered to be an Anxiety Disorder [3, 38]. In OCD, cortisol concentrations are higher than those in healthy controls, reflecting a predisposition for anxiety in individuals with this disorder [79]. Perceived stress is significantly correlated with intensity of obsessions, but not compulsions [79]. Both self- and parent-reports support evidence that anxiety plays a significant role in the core symptoms in OCD. In self-reports, anxiety is often expressed as a primary precursor to compulsions in OCD [25]. Additionally, parent-reported anxiety in children with OCD is rated significantly higher than parent-reported anxiety in typically-developing children in the contexts of social and separation anxiety fears [32].

Anxiety plays a dual role in OCD, in that obsessions cause anxiety and compulsions alleviate anxiety. One way in which this relation presents itself is when obsessions are aversive or taboo and do not correspond with an individual's identity, such as extreme sexual or aggressive obsessions [61]. For instance, the results of a priming study demonstrated that subtle threats to one's self-perception aggravated the perceived importance of these thoughts, which lead to compulsive behaviors [80].

The traditional cognitive model of OCD states that for individuals who experience obsessions, naturally occurring invasive thoughts are erroneously interpreted as threatening [81]. One maladaptive construct, distress tolerance, may be implicated in OCD-related symptoms. Distress tolerance is defined as the degree to which an individual can handle various aspects of distress, pain, and negative feelings [82]. In a non-clinical sample of undergraduate students, poor distress tolerance was associated with high rates of reported obsessions and with acts of neutralization (ways of coping with stress) during anxiety-inducing tasks [83]. Due to the use of a non-clinical sample, distress tolerance cannot conclusively be linked to clinical anxiety or OCD; however, the researchers suggest that the improper management of negative emotions could lead to the use of maladaptive techniques to deal with stress, such as compulsions [83]. This suggestion was tested in a recent study that assessed a sample of treatment-seeking adults diagnosed with either an anxiety disorder or OCD using anxiety-related cognitive measures such as the Distress Tolerance Scale (DTS; [82]). Scores on these measures collectively predicted symptoms of OCD as measured by the Y-BOCS, with low levels of distress tolerance predicting symptom severity [84].

The RRBs called compulsions are used to alleviate stress caused by obsessions. When treatment-seeking patients with OCD were interviewed about their reasons for engaging in their most frequent and interfering compulsions, three quarters of the sample quoted "anxiety and distress" as the primary cause of their compulsive behaviors [25]. Specific reasons related to anxiety in general—such as decreasing distress, avoiding catastrophic outcomes, or neutralizing obsessions—co-occurred in more than half the sample. A different way in which compulsions can occur is when individuals cannot grasp the origins of their obsessions, and are therefore unable to modify their unwanted thoughts and feelings. As a result, these obsessions are frequently expelled via indirect avoidance compulsions that often are unrelated to the content of the obsessions themselves [85].

Summary

Anxiety plays substantially different roles in the manifestation of RRBs in ASD and OCD. Obsessions cause anxiety in OCD, as these pervasive thoughts oftentimes do not correspond to the identity of the persons experiencing them and subsequently cause substantial distress. For instance,

obsessions can sometimes have sexual or aggressive themes, creating additional anxiety for the person experiencing intrusive thoughts [61]. Other themes, such as a poor reaction to disorganization or a fear of contamination, are also unpleasant because there is usually some degree of recognition regarding the irrationality of these thoughts, contributing to an increased level of anxiety [85]. Moreover, it is relatively well established that anxiety in this disorder is bidirectional, in that obsessions produce anxiety that is subsequently relieved through engagement with compulsions [25, 79, 81].

The role that anxiety plays in the presentation of RRBs in ASD, however, is less clear. While the literature reviewed here talks about the constant presence of anxiety implicated in the presence of RRBs, a question of directionality exists. Do RRBs perpetuate the presence of anxiety, or does anxiety encourage the execution of RRBs as a form of relief? Although some researchers speculate whether the time-consuming and intense nature of RRBs in ASD contributes to social ostracizing [86], it appears as though insistence on sameness routines and restricted interests are more apt to calm anxiety rather than cause it. In fact, insistence on sameness behaviors and restricted interests may help to *reduce* anxiety in ASD [16, 17, 74–76, 86].

Executive Functioning and RRBs

Executive functioning deficits have traditionally been thought of as the primary explanation for RRBs in ASD [2, 87]. Executive functioning is an umbrella term used to describe a wide range of behaviors involved in planning, controlling, and regulating higher-order mental processes [88]. Children and adolescents with ASD demonstrate persistent difficulties with a variety of executive functioning skills, even after controlling for IQ and autistic symptomatology [89]. A primary deficit of executive functioning in ASD is cognitive flexibility, which is defined as the ability to accurately and appropriately switch between different concepts or behaviors. Research has consistently reported evidence of cognitive flexibility deficits on executive functioning tasks performed by individuals with ASD that require switching behaviors and the generation of new ideas [90, 91], such as nonverbal fluency tasks [92] and sorting tasks [93].

When compared to typically-developing controls, children with ASD also experience difficulties on tasks that require self-monitoring. Specifically, children with ASD perseverate on previously generated or rewarded responses regardless of feedback or the possibility that a new response will garner a larger reward [94–96]. This deficit is illustrated in research that utilizes computerized set shifting tasks to measure cognitive flexibility [94, 97]. While cognitive flexibility is a well-established deficit in ASD, evidence for impairment in other aspects of executive functioning is mixed. For example, while some researchers have detected impaired performance on tests measuring inhibition in ASD [95, 98], other studies reveal relatively intact performances [92].

Although executive functioning in ASD has been extensively researched, and although executive functioning has been theorized as a primary explanation for RRBs in ASD, there have been fewer studies that have directly examined how executive functioning deficits affect RRBs. Across various studies, cognitive flexibility deficits are found to be associated with an increased presence and a higher severity of RRBs, as measured by the ADI-R and the ADOS [91, 92, 94, 96, 97, 99]. Cognitive flexibility has specifically been shown to uniquely predict RRBs in ASD in comparison to other deficits in executive functioning [92]. In an observational study that analyzed instances of repetitive sensory motor behaviour against tasks of inhibition, planning, and mental flexibility, low performances on all three tasks predicted higher frequencies and longer instances of lower-level RRBs [98]. Moreover, impaired inhibitory control has been found to be associated with higher-level RRBs, but not with lower-level RRBs [100].

Investigations of executive functioning in individuals with OCD reveal some similarities with ASD. For example, individuals with OCD exhibit significant impairments on tasks of cognitive flexibility and set shifting [101–106]. Unlike the variability present amongst individuals with ASD, impaired inhibition in individuals with OCD is well documented and fairly consistent across various studies [101, 107–109]. Specifically, these individuals tend to perseverate on previously rewarded stimuli in attention-shifting tasks, a deficit that resembles the difficulties that individuals with ASD experience with generating novel responses in laboratory settings [96, 110].

In relation to RRBs, measures of cognitive flexibility positively correlate with symptoms of OCD [106]. In particular, cognitive flexibility appears to be specifically related to obsessions [102]. For example, individuals with OCD demonstrated a strong attentional bias towards anxiety-inducing images versus neutral images during attention allocation tasks [111]. Biased attention towards specific images corresponded to both parent- and self-reported obsessions in this study. For example, restricted attention towards an image of disorganized shoes was strongly correlated to an increased severity of ordering symptoms as measured by the Obsessive–Compulsive Inventory [111]. This attentional bias may reflect an inability to draw attention away from stimuli that correspond to obsession-specific themes, perpetuating the presence of obsessions themselves. Similar themes emerge in the ASD literature, whereby children with ASD consistently demonstrate

circumscribed attention towards objects pertaining to restricted interests [112, 113]. Restricted attention related to restricted interests is correlated with clinical measures of increased RRB severity [114].

Parent reports of deficits of executive functioning in children with OCD indicate that inhibition is specifically related to total severity scores on the Y-BOCS [108]. Interestingly, this association is highly related to compulsion scores and only weakly related to obsession scores [108]. Some authors have used tasks of decision-making to evaluate inhibition in individuals with OCD. Although some researchers detect intact performance in regards to decision-making [105, 110], one study detected impaired decision-making in individuals with OCD on the Iowa Gambling Task (IGT; [115]), a tool that measures how people make decisions towards maximizing a potential reward [109]. Although participants were able to identify which decks would cause greater loss, the researchers reported that the participants also had a tendency to select those same decks deemed disadvantageous to the goal of the task [109]. The perseverative tendency towards loss-bearing decks resembles how individuals with OCD may be unable to inhibit engagement with RRBs to achieve the long-term satisfaction of restricting compulsive behavior, instead of achieving short-term relief from obsessions. Several other researchers have also observed this deficit in decision-making using the IGT [116–118].

When ASD and OCD are directly compared, conflicting results are found. First and foremost, individuals with ASD and individuals with OCD (aged 6–17 years) both demonstrate behavioral impairment on parent-reports of inhibition, shifting, planning, and organization compared to IQ-matched, typically-developing controls [87]. In general, executive functioning skills are associated with more frequent rates of RRBs in ASD compared to OCD [87]. In this same study, participants with ASD demonstrated a more severe impairment on tasks requiring the generation of novel responses and participants with OCD demonstrated a more severe impairment on tasks measuring inhibition [87]. These results are consistent with studies illustrating impairments in novel response generation in ASD [93, 95, 96] and inhibition in OCD [101, 104, 109].

Summary

Although research on executive functioning in general is mixed, research on the relationship between executive functioning and RRBs in both disorders is relatively consistent. Individuals with ASD and OCD both experience marked deficits with cognitive flexibility and self-monitoring [93, 95, 103, 110]. Furthermore, strong attentional biases towards symptom- and disorder-specific RRBs are present in both disorders [111–114]. While problems with inhibition are more concretely present in OCD [87, 104], issues of cognitive flexibility and set-shifting are more prevalent in ASD [92, 96, 97]. These differences reflect an important distinction in understanding the RRBs that are present in ASD and OCD. Poor inhibition, for example, does not indicate an *inability* to switch between tasks or topics. Rather, poor inhibition seems to reflect a function of lowered control, which corresponds to the automaticity that accompanies performance of compulsions in OCD [25]. The cognitive flexibility deficit that contributes to RRBs in ASD, however, appears to be more indicative of a specific deficit.

Sensory Phenomena and RRBs

Sensory phenomena in ASD refer to behaviors that are produced in response to an abnormal reaction to sensory stimuli [119]. Early theories regarding the presentation of RRBs in ASD hypothesized that repetitive behaviors functioned to mediate states of sensory under- or over-arousal [120]. There is a significant association between certain abnormal sensory responses and the presence of RRBs in ASD [121–124]. RRBs in ASD are correlated with both *sensory-seeking* and *sensory-avoidance* behaviors [74]. Repetitive sensory motor behaviors are often specifically associated with both sensory-seeking and sensory-avoidance behaviors. When compared to typically-developing and developmentally-delayed individuals, participants with ASD appeared hyper-responsive to sensory stimuli in social situations and hypo-responsive to sensory stimuli in non-social situations [125]. In a subset of this sample, these behaviors occurred simultaneously [125].

The severity and the frequency of RRBs in ASD in general may also be related to increased sensory seeking behaviors. When children and adolescents were divided into groups based on similar intensities and frequencies of RRBs, the high-frequency RRB group showed significantly more abnormal sensory processes than the other groups [119]. Research suggests that the fluctuation between sensory-seeking and sensory-avoidance behaviors reflects an inability to properly modulate sensory reactions [74, 122]. As a result, RRBs may reflect attempts to modulate such an imbalance. For example, repetitive sensory motor behaviors have been found to be correlated with sensation seeking and avoiding, but not with anxiety [74]. The researchers speculate that behaviors such as repetitive hand/finger movements and spinning provide a source of stimulation to individuals, without creating anxiety, to help restore some sort of sensory balance.

Alternatively, sensory phenomena and anxiety may differentially contribute to the presentation of RRBs in ASD. For example, one study evaluated the motivations behind

RRBs in ASD using a revised version of the Motivation Assessment Scale (MAS; [126]). The MAS is used to evaluate the motivations for certain behaviors in an observational setting. The researchers in this study added ASD-related anxiety items to this tool, such as resistance to change, to evaluate ASD-specific motivations for RRBs [123]. While anxiety was a stronger motivator for RRBs in this study compared to sensory-related motivations, a follow-up study was conducted to specify the contexts in which different motivations were recorded for RRBs [124]. Raters in this study observed children with a dual diagnosis (an ASD diagnosis in addition to an intellectual disability) in three settings where the children had been reported to engage in lower-level RRBs: during a task, during a transition, and during free-play time. In addition to these three settings, raters recorded data that was hypothesized to correspond to either internal or external motivations related to engagement with lower-level RRBs. Sensory-related motivations for RRBs were rated more frequently than anxiety-related motivations when the setting did not contain immediate external factors (e.g., during free time vs. task completion/transitions) [124]. Conversely, external motivations related to transition contexts revealed a higher degree of anxiety motivations. The authors discuss how differences regarding sensory and anxiety motivations were more prominently contrasted than predicted, suggesting that the inclusion of contextual factors are important pieces of information to consider when studying RRBs in ASD.

Sensory phenomena have been less studied in OCD; however, there is some evidence that sensory issues are associated with RRBs in OCD. In the OCD literature, the term "sensory phenomena" does not refer to the sensory seeking and/or avoiding behaviors present in ASD. Instead, it refers to uncomfortable feelings and/or experiences, such as feelings of incompleteness or sensory tics [127]. While the traditional view of OCD states that obsessions precede compulsory behaviors, some individuals report that distressing and/or uncomfortable feelings are the precursor to their compulsive behaviors [127].

When compared to typically-developing controls, individuals with OCD report significantly more frequent and severe sensory phenomena [128]. Individuals with OCD who report having unusual and distressing sensory experiences report experiencing more severe ordering/washing/hoarding symptoms and lower levels of insight into their behaviors [127]. Out of 1001 interviewed patients, 65% reported at least one subtype of sensory phenomena preceding or accompanying compulsive RRBs, such as uncomfortable physical sensations, "just right" feelings in response to tactile and visual contact, and feelings of incompleteness [127].

These "just right" feelings are called *Not Just Right experiences*. These feelings of incompleteness are thought to reflect the motivation behind some compulsions [129]. A non-clinical sample of undergraduate students was used to demonstrate the relation between Not Just Right experiences and compulsions through exposure to stimuli related to OCD symptom dimensions [130]. For instance, one condition instructed participants to focus attention on a desk cluttered with unorganized items. Self-report measures indicated that the participants experienced discomfort towards the messy stimulus, in addition to an urge to organize the table. These responses were associated with participant reported obsessive–compulsive symptoms. As per the example provided, distress and an urge to organize the table were both related to the OCD-specific ordering/arranging symptom domain [130]. A recent study demonstrated how Not Just Right experiences are correlated with measures of obsessions [62]. This association was taken into consideration in later use of cognitive behavioural therapy (CBT) treatment for OCD symptoms, which resulted in a subsequent decrease of OCD symptom severity in addition to less Not Just Right experiences reported by the NJRE Questionnaire (NJRE-Q; [131]) [62]. The authors discuss how these results indicate that Not Just Right experiences are an important part of the discussion in regards to OCD symptomatology and treatment.

These unique sensory experiences appear to have a course of development that may begin in childhood. A preliminary study found that oral and tactile sensitivity is not only related to rituals in childhood, but is associated with symptoms of OCD later in life [132]. One hypothesis states that imparting a sense of control via rituals and OCD symptoms helps to overcome sensory-related issues [132] which may also account for the employment of various RRBs in ASD to mediate sensory dysfunction [74].

Summary

The contribution of sensory phenomena to RRBs in ASD and OCD, while less researched than other constructs like anxiety, is an important dimension to account for in a discussion of these behaviors. While sensory over- and under-responsivity contributes to ASD symptomatology [74, 119, 122], sensory phenomena may represent a different dimension of the OCD profile [127]. Preliminary research investigating the role of sensory phenomena on the production of RRBs in OCD is promising; for example, researchers are beginning to track how deficits in sensory integration contribute to obsessions in OCD and a subsequent need for control [132]. This issue of control is also present in ASD populations, as evidenced by research investigating deficits in arousal modulation [74].

General Discussion

The purpose of this paper was to summarize and to evaluate the many research articles that have examined various dimensions of RRB presentation in ASD and OCD. A continued emphasis on research comparing ASD and OCD in the context of RRBs will substantially contribute to an increased understanding of the phenomenology of these behaviors. By conducting an in-depth analysis of various RRB constructs in these two disorders, new connections or questions about RRBs in ASD or OCD have developed that may not have been apparent in a self-contained review of one of the disorders alone. Based on the content that was reviewed here, it is important to elaborate on some insights that came from this comparison, in addition to some limitations and suggestions for future research.

One comparison that was highlighted in this review was between restricted interests in ASD and obsessions in OCD. Restricted interests and obsessions are continually experienced as frequent and severe in adult populations, compared to the decreased frequency/severity of repetitive sensory motor behaviours and compulsions [13, 14, 20, 32, 54, 59]. The idea that these two RRBs continue to be interfering in adult populations may be related to the difference more generally between restricted interests/obsessions and repetitive sensory motor behaviours/compulsions. The former group of behaviours are cognitive constructs that create behavioural products, comprising the latter group of behaviours that are tangible, observable behaviours that can be concretely defined and treated. Although some psychoeducation regarding obsession experiences are included in cognitive-behavioural therapies for OCD [133], the frequently employed exposure and response/ritual prevention technique specifically targets compulsion management [47, 62, 63, 134, 135]. Moreover, treatment of RRBs in ASD tends to target lower-order/repetitive sensory motor RRBs [136]. Thus, in addition to restricted interests and obsessions being similar, a lack of research directly addressing the treatment of these higher-order categories of RRBs does not contribute to any clear distinctions between the two. Based on their observable similarities and the way in which both behaviors contradict each disorder's typical developmental progression, this parallel represents an important research area worth exploring.

Anxiety is a central construct to include in discussions of the similar mechanisms of RRBs in ASD and OCD. Future research can utilize the parallels between restricted interests and obsessions in the context of anxiety in order to learn more about each experience separately. For instance, if semi-structured interviews about restricted interests/obsessions that could apply to both RRBs were conducted with individuals with ASD and individuals with OCD, having this subjective data to compare would allow researchers to analyze how the experiences of individuals with these disorders differ. These comparisons would not only help to clarify the role that anxiety plays in both disorders, but would assist in teasing apart the differences between two very similar behaviors to help clinicians better distinguish between them.

Although insistence on sameness behaviours and restricted interests may help to reduce existing anxiety in individuals with ASD, these behaviours may also be a source of anxiety if individuals are prohibited from engaging in these behaviours. In this context, these behaviours produce a similar effect as the RRBs in OCD, wherein individuals cannot relieve the stress from obsessions by engaging in compulsions. The ambiguity regarding causal direction leaves room for diagnostic confusion, because the "restricted" rigidity of these behaviours and the potentially negative consequences for being unable to engage in the behaviours are quite similar. Thus, one way to distinguish between the two disorders would be to examine the contextual factors which precipitate RRBs. The importance of contextual information being used to discern motivations behind RRBs was demonstrated in an ASD sample [124], but the same principle could be used to distinguish between ASD-specific and OCD-specific RRBs. Furthermore, in consideration of the importance of modified cognitive-behavioural therapy for individuals with a comorbid ASD/OCD diagnosis [47, 63, 135], targeting ASD-specific RRBs may be better served by providing individuals with coping strategies regarding insistence on sameness behaviors [135]. These strategies may include working towards accepting changes in schedule, and by extension beginning to decrease the need to engage in such behaviors in order to decrease anxiety that stems from other sources.

Distress tolerance was discussed as possibly being implicated in the presentation of RRBs in OCD [83, 84]. Distress tolerance bears a resemblance to insistence on sameness behaviors, whereby individuals with ASD engage in sameness routines and rituals when they cannot appropriately respond to change [75, 76]. Thus, due to the heavy presence of anxiety in both disorders, an examination of distress tolerance in ASD populations may also be a useful tool in understanding the anxiety experienced in ASD. An ideal starting point would be to implement both the Distress Tolerance Scale [82] and the ADOS or the ADI-R in an ASD sample. Having both assessments administered to the same sample group would help to determine whether this cognitive construct also relates to RRBs in ASD.

The similar process of alleviating distress that stems from sensory phenomena in both disorders also warrants further discussion. In ASD, the term "sensory phenomena" refers to behaviors, whereas in OCD, the term refers to an internal experience or feeling. In keeping with the sensory imbalance hypothesis of RRBs and sensory experiences in

ASD [74, 120, 122] we can reasonably assume that individuals with ASD may experience similarly uncomfortable, internal feelings that are described by certain individuals within the OCD population [127]. This assumption is supported by the finding that sensory-related motivations for RRBs occur most often in demand-free environments [124]. Future research should investigate whether individuals with ASD also experience these feelings prior to engaging in RRBs that resemble sensory seeking or avoiding behaviors, especially considering the possible interaction between anxiety and sensory-seeking/sensory-avoiding RRBs in ASD [74, 123, 124]. Future research also may consider elements of control regarding sensory dysfunction in both ASD and OCD in order to develop more concrete theories regarding sensory phenomena and how they affect RRBs in general. In order to tease the differences between these two disorders apart, research should focus in particular on what aspects of their experience individuals with ASD and OCD are trying to control via sensory seeking/avoiding behaviors and compulsions.

This review proposes two specific recommendations for accurately assessing RRBs in ASD and OCD. First, the *contextual variables* that affect which RRBs are occurring and why are an important part of this process. This is especially important in consideration of treatment for RRBs in ASD, whereby antecedents and consequences are utilized to scaffold treatment plans [136]. Using information regarding the context in which RRBs occur has proven successful to aid clinicians in better differentiating between ASD-specific and OCD-specific RRBs [41].

Second, the *language* used to define behaviours is a large contributor to whether a classification is correct or not. In one study, ASD-specific behaviours were described primarily as "repetitive behaviours", providing little to no detail regarding the specific nature of the behaviours [47]. Moreover, in a different study, RRBs were differentiated between ASD and OCD based on "complexity", indicating that repetitive sensory motor RRBs were related with an ASD diagnosis and more complex behaviours such as arranging and cleaning were related with an OCD diagnosis [48]. While repetitive sensory motor RRBs may be easily distinguishable from common obsessions and compulsions, this type of loose differentiation does not aid in distinguishing between OCD symptoms and higher-order ASD RRBs. The language used in the DSM-5 appropriately improves on the language previously used to describe diagnostic criteria of RRBs from the DSM-IV by specifically using terms and categories informed by research (such as repetitive motor movements, insistence on sameness, and restricted interests) [3]. As such, consistency and specificity in topographical descriptions of behavior may only serve to enhance precision in determining the nature and the source of RRBs.

Although the potential for new research is large, there are some limitations that should be addressed. First and foremost, a clear disadvantage to comparing these disorders is that they are distinct in fundamental ways (e.g., developmental disorder vs. psychiatric disorder). A major limitation in compiling developmental patterns of RRBs in both disorders is that individual age groups do not have enough research necessary to draw substantial conclusions. There is a large amount of research in children with ASD and little research in children with OCD. Moreover, differences in age of onset make it difficult to develop comparisons while controlling for these discrepancies. Save for several longitudinal designs, much of the literature reviewed in this paper used cross-sectional research designs [15, 30, 59]. In order to further examine development of RRBs in these populations, more longitudinal studies are needed. This is especially important for OCD, given the unique differences between children and adults across various symptom dimensions [59]. Moreover, although useful, the frequent use of parent reports may not be the most accurate reflection of symptomatology. While older individuals with OCD can comment on personal feelings towards their behavior and provide insight, self-reports of children with OCD differ from parent-reports of the same behaviors [37]. Similarly, the unique behavioral profile of ASD can interfere with the accuracy of a self-report [2, 137, 138].

Summary

This paper reviewed the extant literature addressing RRBs in ASD and OCD, with the purpose of contributing to an increased understanding of the phenomenology of these behaviours and the differences between these behaviors in the two populations. Several conclusions may be drawn from this review.

Cognitive ability and age in individuals with ASD tend to differentiate between high- and low-level RRBs, in that younger/lower-functioning individuals more often experience low-level RRBs like repetitive sensory motor behaviours and older/higher-functioning individuals more often experience high-level RRBs like insistence on sameness behaviors [13–15]. RRBs in OCD follow a similar course, with younger individuals experiencing more frequent/severe compulsions and older individuals experiencing more frequent/severe obsessions [32, 59]. An important point of comparison that was discussed in this review is the role of insight in the management of RRBs in both disorders. While some adults with ASD experience less frequent and/or severe RRBs and exhibit more insight into their symptoms than children and adolescents [57], the RRBs that occur across the lifespan in individuals with OCD are more likely impacted by the degree of insight an individual may have [13, 14, 59, 67]. Specifically, when adults with

OCD have a better understanding of their symptomatology, this actually contributes to an increase in more severely experienced RRBs.

While anxiety is heavily implicated in the presentation of RRBs in both disorders, the cause of and the relief from anxiety is more clearly defined in OCD than in ASD. The assertion that obsessions cause anxiety in individuals with OCD, while compulsions relieve that anxiety, is well supported by the literature reviewed in this paper. Specifically, while anxiety is not related to compulsions, various authors suggest that compulsions are preceded by obsessions and the anxiety that accompanies them [79, 80, 83]. The exact way in which anxiety is related to RRBs in ASD, however, is not yet clear. One promising finding is that events that cause anxiety (such as cancelled or interrupted schedules) are commonly followed by engagement with insistence on sameness behaviors, lending support to the hypothesis that insistence on sameness behaviors may function as an anxiety-reduction technique in individuals with ASD [16, 17, 75, 76].

The literature describing the relation between performance on executive functioning tasks and RRB presentation indicates that both disorders show similar impairments in constructs like cognitive flexibility, planning, inhibition, and shifting, among others [87, 93, 95, 103, 110–114]. Deficits in cognitive flexibility, or the ability to switch behaviours or concepts, is consistently associated with the presence of RRBs in ASD [91, 92, 94, 97–99]. While this inability to switch fluently contributes to RRBs in ASD, inhibition is more frequently associated with RRBs in OCD [101, 107–109]. The way in which inhibition is impaired in individuals with OCD is illustrated in decision-making literature, where the ability to acknowledge the outcome of a decision and to subsequently follow through with corresponding actions is impaired [109, 116–118].

Finally, although less literature was available on sensory phenomena for both disorders in comparison to anxiety and executive functioning, the conclusions drawn from the available literature are nonetheless important to summarize here. In both ASD and OCD, RRBs that occur in response to distressing sensory experiences reflect a way to restore some form of sensory balance [74, 121–124, 127]. An important takeaway point from this comparison is the different definitions of sensory phenomena that are presented for both disorders (defined as behaviors that follow sensory stimuli in ASD and internal, uncomfortable feelings in OCD), and whether future investigations are able to learn more about sensory phenomena overall to create a more cohesive definition.

Repetitive behaviours, although present in a wide variety of individuals with varying diagnoses and abilities, are variable based on diagnosis and must be examined carefully both within and across disorders. This is important for two reasons: first, in-depth comparisons lead to insights that specify certain features or functions to a specific diagnostic group, further informing steps that need to be taken towards treating these behaviours. Second, the common comorbidity of these two specific disorders further complicates research and treatment efforts. Therefore, a more comprehensive understanding of these behaviours separated diagnostically helps to lead both researchers and treatment providers in the right direction towards targeting these behaviours appropriately and minimizing fruitless treatment efforts.

RRBs play a prominent role in the social and functional impairments that individuals with ASD and OCD experience [29, 34, 37]. It is our hope that this review encourages future research designed to answer the questions raised by the comparison of these behaviours in these two populations. Ultimately, continued research in this area will help researchers and clinicians develop empirically-based strategies to assist individuals with ASD and OCD manage these behaviors in the hopes of improving their quality of life.

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