Evidence of increased PTSD symptoms in autistics exposed to applied behavior analysis

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Abstract

Purpose – *The purpose of this paper is to examine the prevalence of posttraumatic stress symptoms (PTSS) in adults and children who were exposed to applied behavior analysis (ABA) autism early childhood intervention. Using an online questionnaire to survey autistic adults and caregivers of autistic children, the author collected data from 460 respondents on demographics, intervention types, and current pathological behaviors with symptom severity scales. This study noted PTSS in nearly half of ABA-exposed participants, while non-exposed controls had a 72 percent chance of being asymptomatic. ABA satisfaction ratings for caregivers averaged neutral or mild satisfaction. In contrast, adult satisfaction with ABA was lower on average and also tended to take on either extremely low or extremely high ratings. Exposure to ABA predicted a higher rate and more severe PTSS in participants, but the duration of exposure did not affect satisfaction with the intervention in caregivers.*

Design/methodology/approach – *Participants were recruited for an online survey through social media networks, adult gatherings, social skills groups, and autism support groups nationwide. Adult inclusion criteria consisted of autism – diagnosed or self-diagnosed – and an age of 18 or older. A total of 460 respondents, consisting of autistic adults and caregivers of autistic children, completed an online survey. The caregiver entries (n = 217) concerned 79 percent male children, 21 percent female children (male to female 3.80:1), and one MtF transgender child, ages 1-38, with an average age at diagnosis of 4.69 years. The adult entries (n = 243) concerned 30 percent males, 55 percent females (male to female 0.55:1), and 14 percent other gender, ages 18-73, with an average age at diagnosis of 25.38 years.*

Findings – *Nearly half (46 percent) of the ABA-exposed respondents met the diagnostic threshold for PTSD, and extreme levels of severity were recorded in 47 percent of the affected subgroup. Respondents of all ages who were exposed to ABA were 86 percent more likely to meet the PTSD criteria than respondents who were not exposed to ABA. Adults and children both had increased chances (41 and 130 percent, respectively) of meeting the PTSD criteria if they were exposed to ABA. Both adults and children without ABA exposure had a 72 percent chance of reporting no PTSS (see Figure 1). At the time of the study, 41 percent of the caregivers reported using ABA-based interventions.*

Originality/value – *The majority of adult respondents were female, raising questions about the population of online autistic survey respondents. Further, the high numbers of reported gender other than male or female in the adult respondents, as well as at least on MtF child from the caregiver respondents indicates that future studies should consider these intersections. These accompanied significant discrepancies in reporting bias between caregivers and ABA-exposed individuals, which highlight the need for the inclusion of the adult autistic voice in future intervention design. Based on the findings, the author predicts that nearly half of ABA-exposed autistic children will be expected to meet the PTSD criteria four weeks after commencing the intervention; if ABA intervention persists, there will tend to be an increase in parent satisfaction despite no decrease in PTSS severity.*

Keywords *Trauma, Autism, PTSD, Posttraumatic stress disorder, Autism spectrum disorder, ABA, Posttraumatic stress symptoms, PTSS, PTE, Applied behaviour analysis*

Paper type *Research paper*

Applied behavior analysis (ABA) is the most prevalent early childhood intervention recommended by clinicians after a child receives a diagnosis of autism (CDC, 2015). Behaviorists conceptualize autism as a disorder characterized by both behavioral deficits in communication and social skills, as well as excesses such as ritualistic behavior and tantrums (Green, 1996). ABA therapists

enforce behavior modification with a rewards-based model and systematically encourage social behaviors that have been deemed appropriate by the caregivers and the intervention team. ABA is behaviorally focused where the client is motivated by the reward to modify a behavior by completing a task without behavioral aberrations predetermined in the treatment goal (e.g. no eye contact, hand flapping, hitting therapist or self) or risk the delay of receiving a reward such as taking a break or computer time. An example of reinforcement during repeated exposure is with ongoing task-based sessions where, "the child then responds correctly, and the therapist responds by giving the child a reinforcer. If the child responds incorrectly, a reinforcer is not delivered and the therapist typically presents some kind of correction procedure, such as modeling the correct response and then initiating another discrete trial" (Granpeesheh et al., 2009, p. 164). Thus, the intervention quantifies the individual characteristics of the client and the therapist modifies the treatment in line with the client's response to the intervention.

Exposure to potentially traumatic events (PTEs) is often associated with significant psychological and emotional distress, causing posttraumatic stress symptoms (PTSS). Per the DSM-5, a specific cluster of PTSS can be diagnosed as a posttraumatic stress disorder (PTSD) and with moderate, severe, or extreme levels. Autistic people have a sensitivity to the way any situation is initially appraised, and a benign situation which was perceived as harmful or threatening to the individual can become a PTE which could trigger PTSS due to their underlying vulnerability (Ashley-Koch et al., 2006; Ma et al., 2005; Fatemi et al., 2009).

PTSD is based on neurochemical response patterns to acute stress and the neural mechanisms mediating reward, fear conditioning and extinction, and social behavior. Only a small percentage of individuals develop PTSD in the aftermath of a trauma, and highly specific genetic factors contribute to PTSD susceptibility and resilience "at both the behavioural and molecular level" (Dahlhoff et al., 2010, p. 1225). With autism, the epigenetic effects or gene-gene interactions may act as a predisposition for PTSD based on hyperreactivity to mild exposures. Autism influences trauma and traumatic stress, and the experience of the perceived trauma increases the presentation of their autism symptoms (Kerns et al., 2015, p. 3481). The impact of traumatic events on children adversely affects the child's development, and the child will suffer ongoing damage even when he or she has healed from the trauma. Because higher-intensity events have a greater risk to induce PTSD, we looked at autism early childhood interventions to measure impact of exposure as a potentially traumatic stressor.

PTSD-like behaviors and persisting physiological abnormalities of the autonomic neural pathways result from disturbances in recovery from the initial stress response (Cohen et al., 2007, p. 476). Early trauma thus increases vulnerability to the development of long-term behavioral disruptions which persist into adulthood. Still, maladaptive behaviors may be a combination of nature and nurture, and have been linked to increased parental stress (Hall and Graff, 2012), family coping strategies (Kahana et al., 2015), and Reward Deficiency Syndrome marked by inhibited gamma-aminobutyric acid (GABA) neurotransmitters and a lack of D2 receptors (Blum et al., 2000).

Compelling evidence continues to support that the GABA system is impacted in autism, and alterations in the GABA receptor system "may contribute to the abnormal phenotype and the variable response to pharmacotherapy" (Oblak et al., 2009, p. 206). In one study, severity of autism symptoms, as reported on a questionnaire, were associated with differences in the level of GABA in the brain as measured by magnetic resonance spectroscopy, which supports the excitatory/inhibitory imbalance theory (Brix et al., 2015). With decreased GABA receptors, the autistic brain is naturally flooded with serotonin and remains in hyperarousal state. This suggests that an individual's predisposition to PTSD due to decreased GABA may be further endangered by exposure to stressors that modify the gene, producing a physiological marker, and psychological response. The psychological demands placed on the ABA recipient who has a predisposition for an exaggerated perceptual response leading to physiological alterations may be especially damaging.

Roberts et al. (2013) found that mothers who were exposed to childhood physical, emotional, and sexual abuse had a 1.8 percent elevated risk of giving birth to an autistic child. These findings raise the question if prima facie vulnerabilities for abuse stem from the inherent personality traits linked to parents of autistic children, such as parental psychiatric disorders (Jokiranta et al., 2013), paternal schizoid traits (Wolff et al., 1988), or maternal mood disorders (Vasa et al., 2012). PTSD in

autistic individuals is not an established comorbidity; just as in the general population, the risk of early onset of mental disorders among autistic people is dependent on "gene-environmental interactions, the timing of early developmental stressors (e.g. trauma), and history of learning experiences and in some cases, the presence of a specific behavioral phenotype" (Fletcher *et al.*, 2013, p. 8).

Mikics *et al.* (2008, p. 1207) found that even a single administration of electric footshock to rats caused lasting trauma-induced alterations in social and behavioral functioning. Thus, the behavioral deficits exacerbated activation of fear-related amygdala subdivisions, which can be associated with trauma-induced alterations in social and behavioral functioning (p. 1207). Other researchers also found that with readministration of electric footshock, the "hyperarousal does not depend on associative fear memory about the aversive encounter, but solely on sensitization induced by the inescapable footshock" (Siegmund and Wotjak, 2007, p. 103). Even from the early beginnings of exposure, the presence of an intense peritraumatic stress response may be a predictor of the subsequent development of a lasting negative emotional state in humans exposed to trauma (Chen *et al.*, 2012, p. 112).

In exposure therapy, a patient would not experience hyperarousal from the fear of the memory, but rather from the horror of the induced retraumatization. Even from the early beginnings of exposure, the presence of an intense peritraumatic stress response may be a predictor of the subsequent development of a lasting negative emotional state in humans exposed to trauma (Chen *et al.*, 2012, p. 112). If an initial ABA session is perceived as traumatic by a child, then the subsequent sessions would be a retraumatization of the memories. After neurobiological changes in the brain have occurred, the resulting normalized behavior changes can be measured by an ABA therapist using a functional behavioral assessment (FBA). Thus, positive behavioral outcomes of the intervention are a consequence of a rewired brain. Based on clinical observations, children exposed to ABA demonstrated fight/flight/freeze reactions to tasks that would otherwise be deemed pleasurable to a non-exposed peer, and those responses increased in severity based on length of exposure to ABA. Therefore, for the purpose of this study, we investigated whether autistic individuals exposed to ABA intervention would meet the PTSD criteria. We also tested for correlations between the severity of their PTSS and the length of time exposed to the intervention. We hypothesized that exposure to ABA as compared to other autism interventions would be highly correlated with reported PTSS severity, and that lack of exposure to ABA would predict fewer reports of trauma symptoms.

Methods

Participants

Participants were recruited for an online survey through social media networks, adult gatherings, social skills groups, and autism support groups nationwide. At least half of the participants were recruited via e-mail through the Interactive Autism Network (IAN) Research database and research registry; IAN probands must have received a professional diagnosis of ASD to join IAN Research. Adult inclusion criteria consisted of autism – diagnosed or self-diagnosed – and an age of 18 or older. Diagnostic reports were not collected nor stored to protect confidentiality of participants, and validity of self-report of diagnosis was presumed (Woodbury-Smith *et al.*, 2005; Erhardt *et al.*, 1999; Margolis *et al.*, 2008). A total of 460 respondents, consisting of autistic adults and caregivers of autistic children, completed an online survey. The caregiver entries ($n = 217$) concerned 79 percent male children, 21 percent female children (male to female 3.80:1), with one MtF transgender child, ages 1-38, with an average age at diagnosis of 4.69 years. The adult entries ($n = 243$) concerned 30 percent males, 55 percent females (male to female 0.55:1), and 14 percent other gender, ages 18-73, with an average age at diagnosis of 25.38 years.

Survey

To synthesize the complex challenges of comorbidities in this unique population, we created a 26-question survey that is an amalgam of both autism-specific and intervention-related questions. We modeled these questions on the PCL-5 Psychopathy Checklist self-report measure, which assesses the 20 symptoms of PTSD (Weathers *et al.*, 2013) per the DSM-5

(American Psychiatric Association, 2013, pp. 271-74), and modified those questions to also assess whether the intervention itself was the stressor in this context. The Clinician Administered PTSD Scale (CAPS-5) age-adjusted severity conventions were used to score survey responses on symptom clusters, with reference to thresholds of moderate, severe, or extreme, by summing each criterion individually without averaging the total criterion scores. The self-designed measures were informed by validated industry standard tools used in previous autism and PTSD studies (Stewart, 2016; Kosatka and Ona, 2014). The survey instrument was designed for standalone use in this study only and not intended for clinical assessments. With 26 survey questions for 5 criteria, each criterion had from two to four times the chance to be met by way of the survey questions.

The survey opened with a consent form which informed participants of their rights to withdraw at any time, that participation was entirely voluntary, and that strict confidentiality would be maintained. In the next two sections, information was obtained about basic demographics, the type of autism childhood intervention received, if any, and the length of time the intervention was applied. The fourth and final section consisted of 26 survey questions, and the participant was instructed to answer "as it pertains to the present, in the last four weeks." Any of the 26 questions were allowed to be omitted, and an omission was denoted as a null value in the database. The 1-5 Likert scale was used for responses concerning symptom frequency, with 1 denoting never, 2 denoting rarely (1×/month), 3 denoting sometimes (2×/month), 4 denoting quite a lot (2×/week), and 5 denoting always. At the conclusion of the survey questions, participants had the option of entering textual comments into a free-response box before submitting the survey. Collecting binary data by depersonalizing sensitive information in an online survey may decontextualize the meaning of responses, which naturally occurs in contextually grounded conversation, and therefore necessitated a comments box at the conclusion of the survey (Mishler, 1991, p. 27). All data were entered directly by each respondent via an internet-based software system (online at wufoo.com) and stored at a secure central server. Questions and scoring considerations for each individual criterion, which were developed by the research team for the purpose of this study, are discussed below.

Measures and scoring

An exposure subscale for Criterion A was computed by type of intervention, and length of time the intervention was received. This was converted into "percentage of lifetime exposure," which is the percentage of total lifetime during which an intervention was received (total hours of intervention divided total hours of lifetime, multiplied by 100). Opinions of the intervention as influenced by the exposure were collected to further confirm repeated exposure. For example, question 1 for adults was, "Has the intervention been effective for improving your overall functioning?" and question 2 was, "Do you believe you have met the therapist's goals yet?" By including an additional criterion set for symptoms in children aged six years and younger, the DSM-5 diagnosis is more "developmentally sensitive and call[s] attention to differences in presentation among young children vs adults (e.g., the reexperiencing of traumatic events through play or storytelling)" (Kupfer et al., 2013, p. 1692). In the DSM-5, one of four exposure types are needed to fulfill Criterion A for adults and older children, and three exposure types are needed for children aged 6 and younger. The survey provided two opportunities to meet the moderate threshold for both groups.

Respondents were required to experience one or more intrusion symptoms such as dissociative flashbacks and nightmares of the trauma in order to meet Criterion B, and seven opportunities were provided to meet the moderate threshold for both adults and children. For example, questions for adults included, "Do you react to other people's instructions in the way that you would react to the therapist's instructions (e.g. 'how many minutes do I have to do this?' and 'what am I working for?' or reach for your token/schedule board)?" and "When you were receiving therapy, did you have more meltdowns than at the time of your diagnosis?"

Persistent avoidance of stimuli related to the trauma (Criterion C) in adults entailed one or both of the avoidance of thoughts or feelings associated with distressing memories, and the avoidance of external reminders of the event, such as people, places, objects, activities, or situations that arouse distressing memories. The survey provided six opportunities to meet the moderate threshold. In the DSM-5, Criterion C assesses children not only for persistent avoidance but also for negative alterations in cognition and mood with six subtypes, the latter of which is otherwise

assessed in the adult Criterion D. One or more avoidance or alteration in cognition is required for children to meet the threshold, and the survey provided 13 opportunities for it to be met.

Criterion D for adults assesses negative alterations in cognition and mood associated with the trauma, which must be evidenced by two or more of seven possible alterations. Seven subscales were assessed in separate questions; the last subscale of "inability to experience positive emotion" was eliminated to prevent double scoring with autism symptomatology and was replaced with the DSM-5 addition of a persistent negative emotional state such as fear, horror, guilt, or shame. For example, adults were asked, "When you were receiving therapy, were you embarrassed of the therapy you were receiving?"
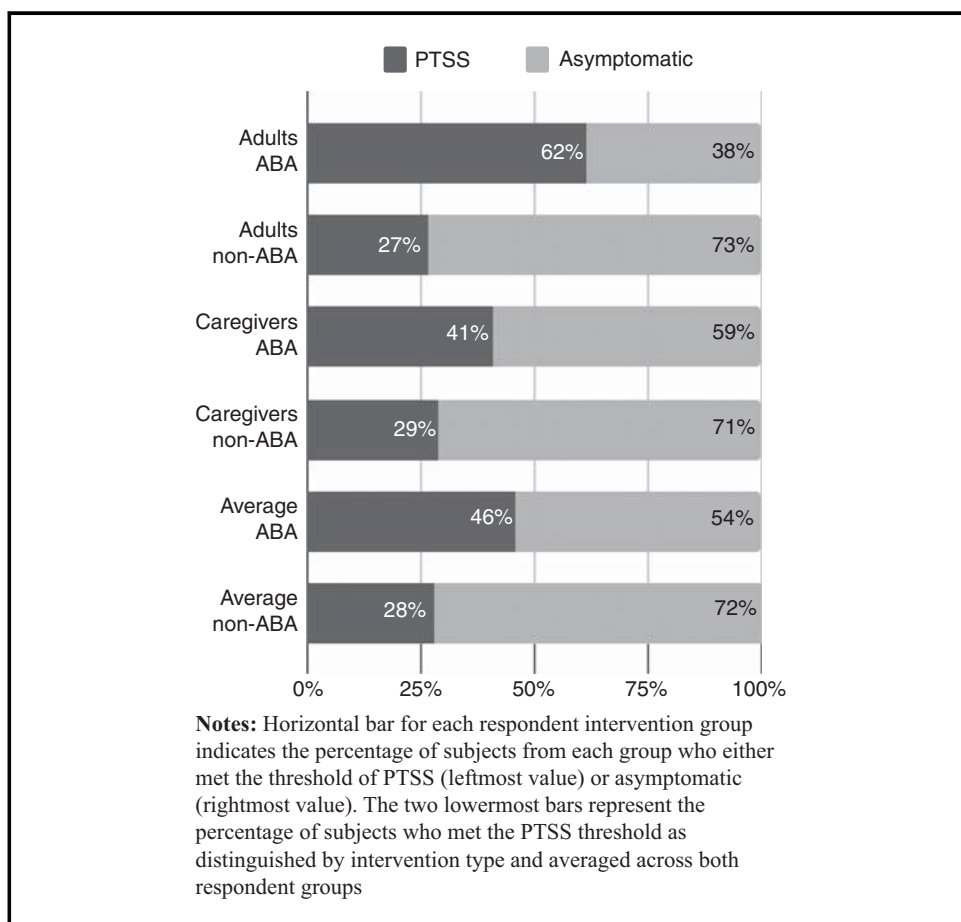
For adults, marked alterations in arousal and reactivity associated with the trauma (Criterion E) required two of six possible hyperarousal types to meet the moderate threshold, and four of six arousal types were represented in a total of six questions. Hyperarousal for children (Criterion D) required two or more hyperarousal symptoms to meet this criterion, and four opportunities were provided for it to be met. The arousal subtypes of "hypervigilance" and "exaggerated startle response" were omitted for adults and children, due to the risk of double scoring of neurodevelopmental and psychiatric comorbidities. Instead, since sleep disturbance is classified as a significant alteration in arousal, cognition and mood in the DSM-5, we asked caregivers, "Has your child had difficulty with falling or staying asleep the night before therapy, or winding down after the therapy session?" to measure how significantly arousal states impacted mood, functioning, and sleep. This classification is supported by studies on fear-based trauma; alteration of sleep architecture in animals is a fundamental indicator of fear training, and laboratory rats displayed an expected REMS-selective decrease in sleep when studied in the presence of situational reminders in a PTSD simulation study (Pawlyk et al., 2005, p. 276).

For adult respondents and children ages seven and older, severity scores for Criteria B through E were obtained by summing the scores for the individual subscales within each criterion's cluster, where $0 =$ absent, $1 =$ mild, $2 =$ moderate, $3 =$ severe, and $4 =$ extreme. For children ages six and under, severity scores for Criteria B through D were obtained by summing the scores for the individual subscales within each criterion's cluster, where severity $0 =$ absent, $1 =$ mild, $2 =$ moderate, $3 =$ severe, and $4 =$ extreme. Individual Likert selections of "sometimes, 2×/month" selection of Likert 3 and 4 was marked as severe, where 5 remained as extreme and were converted into numerical values for scoring. Initial diagnostic determination was made by a cumulative sum of individual subscales within each criterion's cluster. Binary classification of PTSS was determined by the cumulative scores exceeding a PTSD diagnostic threshold of 2, where severity $0 =$ absent, $1 =$ mild, $2 =$ moderate, $3 =$ severe, and $4 =$ extreme.

Results

Nearly half (46 percent) of the ABA-exposed respondents met the diagnostic threshold for PTSD, and extreme levels of severity were recorded in 47 percent of the affected subgroup. Respondents of all ages who were exposed to ABA were 86 percent more likely to meet the PTSD criteria than respondents who were not exposed to ABA. Adults and children both had increased chances (41 and 130 percent, respectively) of meeting the PTSD criteria if they were exposed to ABA. Both adults and children without ABA exposure had a 72 percent chance of reporting no PTSS (see Figure 1). At the time of the study, 41 percent of the caregivers reported using ABA-based interventions as compared to 11 percent adults. Autism early intervention types were entered by participants from a pre-formatted list or a text-entry box for "other." Non-exposed controls concerning interventions other than ABA are listed by caregiver and adult percentages, respectively, and values are based on 96 percent of quantifiable entries: DIR Floortime: 2 percent, 0 percent; RDI Gutstein: 1 percent, 0 percent; Son-Rise: 1 percent, 1 percent; AACs: 5 percent, 0 percent; RPM: 2 percent, 1 percent; FC: 1 percent, 2 percent; Speech: 6 percent, 3 percent; OT: 6 percent, 7 percent; PT: 3 percent, 2 percent; CBT: 1 percent, 3 percent; Medication: 2 percent, 7 percent; none: 20 percent, 57 percent; other: 3 percent, 4 percent (see Figure 2). Financial eligibility for ABA services terminates at the age of 18 and similar autism interventions do not persist into adulthood; findings across both groups were generalized to be equally stratified and representative of a diagnosis received at an age younger than the adult group average.

Figure 1 The prevalence of posttraumatic stress symptoms (PTSS) by intervention type (ABA or non-ABA), and respondent group

Notes: Horizontal bar for each respondent intervention group indicates the percentage of subjects from each group who either met the threshold of PTSS (leftmost value) or asymptomatic (rightmost value). The two lowermost bars represent the percentage of subjects who met the PTSS threshold as distinguished by intervention type and averaged across both respondent groups

Trauma

Based on our findings, the highest rates and severity of PTSS were reported by caregivers upon initial exposure to the intervention. Adults and children showed similar levels of severity score at the initial exposure to ABA (see Figure 3). While adults and children met the threshold of PTSD during the initial exposure to the ABA intervention, the reported symptoms did not significantly change with increasing exposure for children, $B = 8.84$, $F(1,215) = 0.89$, $p = 0.35$. By contrast, adults reported significantly greater symptom severity with increasing exposure, $B = 44.12$, $F(1,240) = 4.52$, $p = 0.03$.

In adults, the severity of symptoms was positively correlated with the duration of exposure to the intervention, such that severity scores tended to increase by half of a severity threshold with every additional increment of 5 percent in lifetime exposure. This translates to a prediction that for every increment of 5 percent in their lifetime exposure to ABA, the individual's severity score will increase by half of a severity threshold. The average 18-month-old autistic child who is exposed to 40 hours of ABA per week will be expected to surpass the severe threshold of the PTSD criteria within six weeks, given 1.5 percent lifetime exposure. The average three-year-old autistic child who is exposed to 20 hours of ABA per week will be expected to surpass the severe threshold of the PTSD criteria within five months of ABA exposure. The average five-year-old autistic child who is exposed to ten hours of ABA per week will be expected to surpass the severe threshold of the PTSD criteria before their seventh birthday.

Figure 2 Non-exposed controls by intervention for both groups
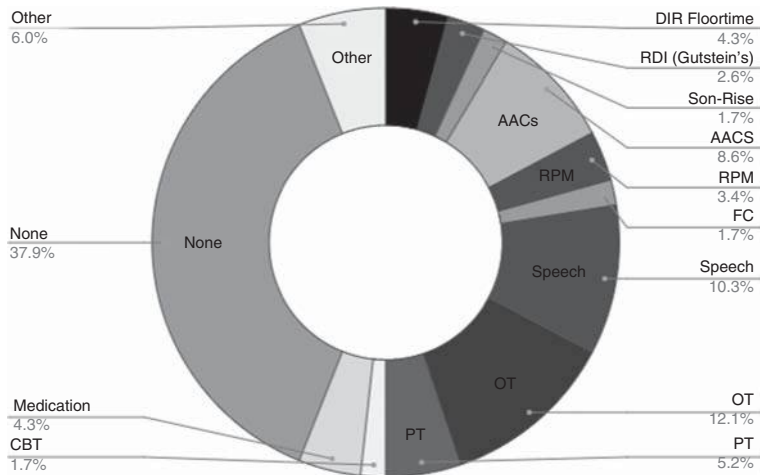
Notes: Pie chart of autism early childhood intervention values indicate selections made by for caregiver and adult participants combined. From the top-center moving counterclockwise, selections include other: 6 percent; none: 37.9 percent; medication (psychiatry): 4.3 percent; cognitive behavioral therapy (CBT): 1.7 percent; DIR Floortime: 4.3 percent; RDI Gutstein: 2.6 percent; Son-Rise: 1.7 percent; augmentative and alternative communication (AACs): 8.6 percent; rapid prompting method (RPM): 3.4 percent; facilitated communication (FC): 1.7 percent; speech (speech and language pathology): 10.3 percent; occupational therapy (OT): 12.1 percent; physical therapy (PT): 5.2 percent

Figure 3 Regression analysis of PTSD severity on ABA exposure duration
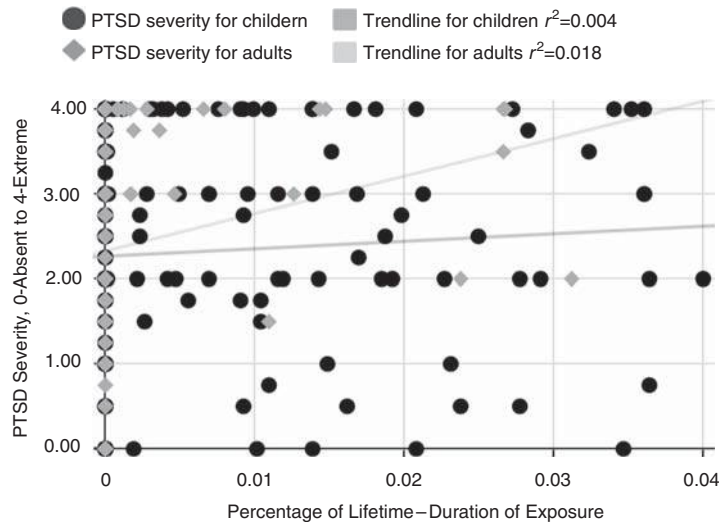
Notes: The vertical axis represents PTSD severity thresholds, where 0=absent, 1=mild, 2=moderate, 3=severe and 4=extreme. The horizontal axis represents the duration of ABA exposure as a percentage of the individual's lifetime. Adult respondents with PTSD are represented as diamonds, and children meeting the PTSD criteria are represented as circlesDuration of Exposure

Satisfaction

Both ABA-exposed groups showed a nonsignificant increase in success ratings for increased exposure duration. For caregiver respondents, a positive relationship was observed between relative duration of exposure to ABA and perceived intervention effectiveness, although this increase was not statistically significant, $B = 5.39$, $F(1,85) = 0.23$, $p = 0.63$. Adults tended to rate the intervention as only mildly successful from initial exposure and did not increase satisfaction with length of exposure, $B = 16.27$, $F(1,23) = 0.27$, $p = 0.60$. For adults with ABA exposure longer than 0.20 percent of lifetime, or an adult in their late thirties accruing more than one month of exposure, nobody reported neutral or mild satisfaction; rather, opinion and satisfaction was reported with Likert extremes of 1 or 5. Caregivers tended to rate the intervention as more successful than did adults, even for very low durations of exposure, and increased success ratings with exposure time. Of the caregivers who voluntarily commented that they had discontinued ABA, 9 percent indicated that it was due to insufficient progress or negative alterations in their child's function.

Response bias and disparities in reporting

Only 50 percent of the adult respondents answered all of the survey questions compared to 61 percent of caregivers. We found a significant disparity in survey abandonment between ABA-exposed respondents and non-exposed controls. An analysis of abandoned surveys revealed that 92 percent of those abandonments concerned non-exposed adults, as compared to 8 percent of ABA-exposed adults who submitted the survey. In the caregiver group, 23 percent of caregivers of ABA-exposed children and 77 percent of caregivers of non-exposed children abandoned the survey. Survey abandonment for non-exposed respondents tended to occur around questions relating to Criterion D and E pertaining to self-esteem, negative perceptions of self, aggression, self-harm, and shame. We found that ABA-exposed adult respondents scored themselves with an average 68 percent higher severity rating when compared to non-exposed adults for questions within Criterion D and E.

Discussion

The aims of this research were to identify the correlations between PTSS and autism childhood interventions, and to investigate whether severity of symptoms increase with length of exposure time. Of all autism early childhood interventions surveyed, ABA correlated with the highest ratings of PTSS in both children and adults. By comparison, individuals who did not receive ABA remained without PTSS and reported excellent daily functioning. While the ABA administration may not be traumatic in application, the encounter lingers with lasting fear-related associative memories to the autistic client.

In an initial ABA session, a therapist might enforce the suppression of an autistic client's self-stimulatory behaviors, which is merely a visceral reaction to seek meaningful change in one's environment in an effort to prevent sensory overload. The continued exposure to such an intervention would activate the fear-association of the memory of the initial suppression rather than a fear of the upcoming session, indicating the etiology of a PTE. Based on our findings, the highest rates and severity of PTSS were reported upon initial exposure to the intervention, however, there was no significant correlation between PTSS and length of exposure to ABA as reported by caregivers. There was a significant correlation between PTSS and length of exposure to ABA as self-reported by adults.

We investigated survey responses of adults who answered questions to Criterion D and E pertaining to self-esteem, negative perceptions of self, aggression, self-harm, and shame. We found that ABA-exposed adult respondents scored themselves with an average 68 percent higher severity rating when compared to non-exposed adults, perhaps arising from negative self-image and familiarity with the grading and scrutiny by behaviorists. Specifically, the FBA in use by behaviorists is the gold standard for identifying environmental variables related to problem behavior (e.g. aggression, self-injury) and the events that occur immediately before and after the behavior (Oliver *et al.*, 2015, p. 817). Individuals exposed to ABA and FBA assessments are accustomed to rating their behavior as it pertains to aggression and self-harm. We conjecture

that the FBAs may be why ABA-exposed respondents completed the self-harm/aggression survey questions without much hesitation, when compared to the high survey abandonment rate of their non-exposed peers around the same questions. The perception of self becomes significantly altered after extended exposure to ABA, and exposed individuals may become emotionally distant as they objectively measure themselves or their loved ones.

Behaviorist theorists believe that changing the parents' perception of their children is key to changing the child's behavior. However, other researchers found that instead of the child's behavior modifying, the parents became conditioned to report the child's observed behavior with a more positive view (Loop *et al.*, 2017). Consistent with our findings, caregivers of ABA-exposed children reported higher satisfaction ratings with longer intervention exposure, even though their PTSS severity scores did not change significantly. ABA interventions require caregiver involvement and for the parent to set boundaries with the child when the therapist is not in the home. Such programs "focus on helping parents to model more effective behaviour" and produce a statistically significant reduction in child conduct problems (Furlong *et al.*, 2010, p. 3). A large proportion of parenting interventions directly derived from the social learning theory contribute to reduce preschoolers' externalizing behavior, "but their multimodal format prevents us to know what causes change in children's behavioral adjustment" (Loop *et al.*, 2017). While researchers are interested in parent involvement in minimizing negative childhood behavior, few studies investigate the extent to which the manipulation of parenting variables influences the caregiver. The reported PTSS declines in children with long-term ABA exposure may reflect how the intervention might manipulate the way in which a caregiver perceives their child's behavior after an extended period of time.

Conclusion

Autistic respondents exposed to ABA were 1.86 times more likely to meet the PTSD diagnostic criteria. Overall, individuals exposed to ABA had a 46 percent likelihood of indicating PTSS. In contrast, 72 percent of non-exposed individuals did not report PTSS. Symptom severity was more harshly graded by respondents concerning ABA exposure. Severity of PTSS in ABA-exposed individuals was heightened upon initial exposure to the intervention, but decreased over time. Opinions pertaining to ABA intervention satisfaction were more positively indicated by caregivers than by adults, however, the caregiver satisfaction was generally reported within the neutral range. The longer a child was exposed to ABA, the more likely a caregiver was to rate the intervention as effective for improving overall functioning.

The majority of adult respondents were female, raising questions about the population of online autistic survey respondents. Further, the high numbers of reported gender other than male or female in the adult respondents, as well as at least one MtF transgender child from the caregiver respondents indicates that future studies should consider these intersections. These accompanying significant discrepancies in reporting bias between caregivers and ABA-exposed individuals, highlights the need for the inclusion of the adult autistic voice in future intervention design. Based on our findings, we predict that nearly half of ABA-exposed autistic children will be expected to meet the PTSD criteria four weeks after commencing the intervention; if ABA intervention persists, there will tend to be an increase in parent satisfaction despite no decrease in PTSS severity.

References

American Psychiatric Association (2013), *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*, American Psychiatric Association, Washington, DC.

Ashley-Koch, A.E., Mei, H., Jaworski, J., Ma, D.Q., Ritchie, M.D., Menold, M.M., Delong, G.R., Abramson, R.K., Wright, H.H., Hussman, J.P., Cuccaro, M.L., Gilbert, J.R., Martin, E.R. and Pericak-Vance, M.A. (2006), "An analysis paradigm for investigating multi-locus effects in complex disease: examination of three GABAA receptor subunit genes on 15q11-q13 as risk factors for autistic disorder", *Annals of Human Genetics*, Vol. 70 No. 3, pp. 281-92.

Blum, K., Braverman, E.R., Holder, J.M., Lubar, J.F., Monastra, V.J., Miller, D., Lubar, J.O., Chen, T.J. and Comings, D.E. (2000), "The reward deficiency syndrome: a biogenetic model for the diagnosis and treatment of impulsive, addictive and compulsive behaviors", *Journal of Psychoactive Drugs*, Vol. 32, Supplement, pp. 1-112.

Brix, M.K., Ersland, L., Hugdahl, K., Grüner, R., Posserud, M.B., Hammar, Å., Craven, A.R., Noeske, R., Evans, C.J., Walker, H.B., Midtvedt, T. and Beyer, M.K. (2015), "Brain MR spectroscopy in autism spectrum disorder – the GABA excitatory/inhibitory imbalance theory revisited", *Frontiers in Human Neuroscience*, Vol. 9 No. 365, pp. 1-12.

CDC (2015), "Autism spectrum disorder (ASD): treatment", Center for Disease Control and Prevention, Atlanta, GA, March 10, 2017, available at: www.cdc.gov/ncbddd/autism/treatment.html (accessed May 13, 2017).

Chen, X., Li, Y., Li, S. and Kirouac, G.J. (2012), "Early fear as a predictor of avoidance in a rat model of post-traumatic stress disorder", *Behavioural Brain Research*, Vol. 226 No. 1, pp. 112-7.

Cohen, H., Kaplan, Z., Matar, M.A., Loewenthal, U., Zohar, J. and Richter-Levin, G. (2007), "Long-lasting behavioral effects of juvenile trauma in an animal model of PTSD associated with a failure of the autonomic nervous system to recover", *European Neuropsychopharmacology*, Vol. 17 No. 6, pp. 464-77.

Dahlhoff, M., Siegmund, A., Golub, Y., Wolf, E., Holsboer, F. and Wotjak, C.T. (2010), "AKT/GSK-3β/β-catenin signalling within hippocampus and amygdala reflects genetically determined differences in posttraumatic stress disorder like symptoms", *Neuroscience*, Vol. 169 No. 3, pp. 1216-26.

Erhardt, D., Epstein, J.N., Conners, C.K., Parker, J.D.A. and Sitarenios, G. (1999), "Self-ratings of ADHD symptomas in auts II: reliability, validity, and diagnostic sensitivity", *Journal of Attention Disorders*, Vol. 3 No. 3, pp. 153-8.

Fatemi, S.H., Reutiman, T.J., Folsom, T.D. and Thuras, P.D. (2009), "GABAA receptor down regulation in brains of subjects with autism", *Journal of Autism and Developmental Disorders*, Vol. 39 No. 2, pp. 223-30.

Fletcher, R.J., Barnhill, J. and Cooper, S. (Eds) (2013), *Diagnostic Manual – Intellectual Disability (DM-ID-2): A Textbook of Diagnosis of Mental Disorders in Persons with Intellectual Disability*, National Assn for the Dually Diagnosed, Kingston, NY.

Furlong, M., McGilloway, S., Bywater, T., Hutchings, J., Donnelly, M., Smith, S.M. and O'Neill, C. (2010), "Behavioural/cognitive-behavioural group-based parenting interventions for children age 3-12 with early onset conduct problems", *Cochrane Database of Systematic Reviews*, Vol. 1, John Wiley & Sons, Oxford.

Granpeesheh, D., Tarbox, J. and Dixon, D.R. (2009), "Applied behavior analytic interventions for children with autism: a description and review of treatment research", *Annals of Clinical Psychiatry*, Vol. 21 No. 3, pp. 162-73.

Green, G. (1996), "Early behavioral intervention for autism: what does research tell us", in Maurice, C., Green, G. and Luce, S.C. (Eds), *Behavioral Intervention for Young Children with Autism: A Manual for Parents and Professionals*, PRO-ED, Austin, TX, pp. 29-44.

Hall, H.R. and Graff, J.C. (2012), "Maladaptive behaviors of children with autism: parent support, stress, and coping", *Issues in Comprehensive Pediatric Nursing*, Vol. 35 Nos 3-4, pp. 194-214.

Jokiranta, E., Brown, A.S., Heinimaa, M., Cheslack-Postava, K., Suominen, A. and Sourander, A. (2013), "Parental psychiatric disorders and autism spectrum disorders", *Psychiatry Research*, Vol. 207 No. 3, pp. 203-11.

Kahana, E., Lee, J.E., Kahana, J., Goler, T., Kahana, B., Shick, S., Burk, E. and Barnes, K. (2015), "Childhood autism and proactive family coping: intergenerational perspectives", *Journal of Intergenerational Relationships*, Vol. 13 No. 2, pp. 150-66.

Kerns, C.M., Newschaffer, C.J. and Berkowitz, S.J. (2015), "Traumatic childhood events and autism spectrum disorder", *Journal of Autism and Developmental Disorders*, Vol. 45 No. 11, pp. 3475-86.

Kosatka, D. and Ona, C. (2014), "Eye movement desensitization and reprocessing in a patient with Asperger's disorder: case report", *Journal of EMDR Practice and Research*, Vol. 8 No. 1, pp. 13-8.

Kupfer, D.J., Kuhl, E.A. and Regier, D.A. (2013), "DSM-5 – the future arrived", *Journal of the American Medical Association*, Vol. 309 No. 16, pp. 1691-2.

Loop, L., Mouton, B., Stievenart, M. and Roskam, I. (2017), "One or many? Which and how many parenting variables should be targeted in interventions to reduce children's externalizing behavior?", *Behaviour Research and Therapy*, Vol. 92, pp. 11-23.

Ma, D.Q., Whitehead, P.L., Menold, M.M., Martin, E.R., Ashley-Koch, A.E., Mei, H., Ritchie, M.D., DeLong, G.R., Abramson, R.K., Wright, H.H., Cuccaro, M.L., Hussman, J.P., Gilbert, J.R. and Pericak-Vance, M.A. (2005), "Identification of significant association and gene-gene interaction of GABA receptor subunit genes in autism", *The American Journal of Human Genetics*, Vol. 77 No. 3, pp. 377-88.

Margolis, K.L., Qi, L., Brzyski, R., Bonds, D.E., Howard, B.V., Kempainen, S., Liu, S., Robinson, J.G., Safford, M.M., Tinker, L.T. and Phillips, L.S. (2008), "Validity of diabetes self-reports in the women's health Initiative: comparison with medication inventories and fasting glucose measurements", *Clinical Trials*, Vol. 5 No. 3, pp. 240-7.

Mikics, É., Tóth, M., Varjú, P., Gereben, B., Liposits, Z., Ashaber, M., Halász, J., Barna, I., Farkas, I. and Haller, J. (2008), "Lasting changes in social behavior and amygdala function following traumatic experience induced by a single series of foot-shocks", *Psychoneuroendocrinology*, Vol. 33 No. 9, pp. 1198-210.

Mishler, E.G. (1991), *Research Interviewing*, Harvard University Press, Cambridge, MA.

Oblak, A., Gibbs, T.T. and Blatt, G.J. (2009), "Decreased GABAA receptors and benzodiazepine binding sites in the anterior cingulate cortex in autism", *Autism Research*, Vol. 2 No. 4, pp. 205-19.

Oliver, A.C., Pratt, L.A. and Normand, M.P. (2015), "A survey of functional behavior assessment methods used by behavior analysts in practice", *Journal of Applied Behavior Analysis*, Vol. 48 No. 4, pp. 817-29.

Pawlyk, A.C., Jha, S.K., Brennan, F.X., Morrison, A.R. and Ross, R.J. (2005), "A rodent model of sleep disturbances in posttraumatic stress disorder: the role of context after fear conditioning", *Biological Psychiatry*, Vol. 57 No. 3, pp. 268-77.

Roberts, A.L., Lyall, K., Rich-Edwards, J.W., Aschorio, A. and Weisskopf, M. (2013), "Association of maternal exposure to childhood abuse with elevated risk for autism in offspring", *JAMA Psychiatry*, Vol. 70 No. 5, pp. 508-15.

Siegmund, A. and Wotjak, C.T. (2007), "Hyperarousal does not depend on trauma-related contextual memory in an animal model of posttraumatic stress disorder", *Physiology & Behavior*, Vol. 90 No. 1, pp. 103-7.

Stewart, M. (2016), "Traumatic stress in parents of children with autism spectrum disorder", No. DPsych (Clin), Deakin University, Victoria.

Vasa, R.A., Anderson, C., Marvin, A.R., Rosenberg, R.E., Law, J.K., Thorn, J., Sarphare, G. and Law, P.A. (2012), "Mood disorders in mothers of children on the autism spectrum are associated with higher functioning autism", *Autism Research and Treatment*, Vol. 2012 No. 435646, pp. 1-8, available at: http://dx.doi.org/10.1155/2012/435646

Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P. and Schnurr, P.P. (2013), "The PTSD checklist for DSM-5 (PCL-5)", Scale available from the National Center for PTSD, available at: www. Ptsd.va.gov (accessed April 20, 2017).

Wolff, S., Narayan, S. and Moyes, B. (1988), "Personality characteristics of parents of autistic children: a controlled study", *Journal of Child Psychology and Psychiatry*, Vol. 29 No. 2, pp. 143-53.

Woodbury-Smith, M.R., Robinson, J., Wheelwright, S. and Baron-Cohen, S. (2005), "Screening adults for Asperger syndrome using the AQ: a preliminary study of its diagnostic validity in clinical practice", *Journal of Autism and Developmental Disorders*, Vol. 35 No. 3, pp. 331-5.

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