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Effects of an Interactive Web Training to Support Parents in Reducing Challenging Behaviors  
in Children with Autism

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### **Abstract**

Many children with autism spectrum disorder (ASD) engage in challenging behaviors, which may interfere with their daily functioning, development, and well-being. To address this issue, we conducted a four-week randomized waitlist control trial to examine the effects of a fully self-guided interactive web training (IWT) on (a) child engagement in challenging behaviors and (b) parental intervention. After four weeks, parents in the treatment group reported lower levels of challenging behaviors in their children and more frequent use of behavioral interventions than those in the waitlist groups. Furthermore, within-group analyses suggest that these changes persisted up to 12 weeks following completion of the IWT. Our results highlight the potential utility of web training, but our high attrition rate and potential side effects prevent us from recommending the training as a standalone treatment.

*Keywords:* autism, behavioral interventions, challenging behavior, parent training, web training.

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Children with autism spectrum disorder (ASD) frequently display challenging behaviors such as aggression, destruction, self-injury, tantrums, and stereotypy (Medeiros, Rojahn, Moore, & van Ingen, 2014; Ritter, Barnard-Brak, Richman, & Grubb, 2018). Specifically, researchers have found that 50% to 90% of children with ASD display at least one of these topographies of challenging behavior (J. F. Lee et al., 2015; McTiernan, Leader, Healy, & Mannion, 2011; Soke, Maenner, Christensen, Kurzius-Spencer, & Schieve, 2018; Stevens et al., 2017). Challenging behaviors may interfere with the development, well-being, and health of children with ASD and others around them (Minshawi, Hurwitz, Morriss, & McDougle, 2015; Stevens et al., 2017; Walsh, Mulder, & Tudor, 2013). If left untreated, challenging behaviors tend to persist, or even increase in severity, continuously exposing the child to potentially detrimental developmental and functional consequences (G. T. Lee, Williams, Simmons, & Johnson-Patagoc, 2018; McTiernan et al., 2011).

Interventions based on behavior analytic principles have the most evidence for decreasing challenging behaviors and teaching adaptive behaviors to children with ASD (Roth, Gillis, & DiGennaro Reed, 2014; Wong et al., 2015). In brief, these interventions involve operationally defining the challenging behavior, identifying its function, and selecting a function-based intervention to reduce its occurrence and intensity (Hanley, Iwata, & McCord, 2003; Iwata & Dozier, 2008; Shayne & Miltenberger, 2013). Researchers also consider parental involvement as an important component for short- and long-term effectiveness of behavioral interventions (Postorino et al., 2017; Rogers & Vismara, 2008; Williams, Lee, & Grossett, 2016). As parents are often the primary caretakers of their child, training them to manage challenging behaviors is

essential. Training parents may increase the intensity of intervention a child receives, enhance opportunities for generalization by intervening in a broad array of contexts (e.g., at home, in the community), and prevent challenging behaviors from worsening over time (Postorino et al., 2017; Prata, Lawson, & Coelho, 2018).

Practitioners traditionally offer training to parents of children with ASD in the form of an in-person intervention (Postorino et al., 2017; Prata et al., 2018), which involves group or one-on-one sessions. Researchers have associated in-person training with positive parent and child outcomes (e.g., Argumedes, Lanovaz, & Larivée, 2018; Bearss, Johnson, Handen, Smith, & Scahill, 2013; Bearss, Johnson, Smith, & et al., 2015; Shayne & Miltenberger, 2013). Recent reviews have highlighted that in-person training for the management of challenging behaviors can increase parental knowledge of empirically-supported assessment and intervention procedures for reducing challenging behaviors (Postorino et al., 2017; Prata et al., 2018). For example, Shayne and Miltenberger (2013) found that, after completing a 3-hr training, parents of children with ASD could effectively identify the function of challenging behavior and select function-based treatments. Moreover, further studies have found that gains in knowledge may translate to significant reductions in the frequency and severity of challenging behaviors (e.g., Bearss et al., 2013; Bearss et al., 2015; Ginn, Clionsky, Eyberg, Warner-Metzger, & Abner, 2017; Ilg et al., 2017).

Although traditional parent training has been consistently associated with positive parent and child outcomes, in-person interventions comprise many barriers that limit their accessibility. On one hand, public services are not meeting the intervention demands as parents can be placed on waiting lists for several years (Csanady, 2015; Kogan et al., 2008; Rivard et al., 2017). On the other hand, private sector services can be unaffordable for some families, especially those with

lower socioeconomic status or without insurance coverage (Kogan, Newacheck, Honberg, & Strickland, 2005; Kogan et al., 2008; Young, Ruble, & McGrew, 2009). Other barriers to in-person parent training can include a lack of transportation, geographical isolation, and conflicting schedules (e.g., public services are often offered during standard business hours; Meadan, Meyer, Snodgrass, & Halle, 2013; Murphy & Ruble, 2012). Finally, some parents may be reluctant to seek professional help regarding parenting practices due to cultural, socioeconomic and psychological barriers (e.g., feeling of incompetence; Keller & McDade, 2000; Morawska & Sultan, 2016). Thus, improving accessibility to parent trainings that teach empirically-supported interventions appears important.

Recent studies have found that parents of children with ASD (a) primarily use the internet to seek information on ASD and interventions to utilize, (b) do not consider evidence of effectiveness when selecting an intervention, and (c) usually use a “trial and error” approach for intervention selection and implementation with their children (Grant, Rodger, & Hoffmann 2016; Hall, Culler, & Frank-Webb, 2016). To support parents acquire knowledge on validated intervention principles, several researchers have developed and tested technology-based parent training programs for the management of challenging behaviors in children with ASD (Dai et al., 2018; Marleau, Lanovaz, Gendron, Higbee, & Morin, 2019; Pannefather, Hieneman, Raulston, & Caraway; Sourander et al., 2016; Suess, Wacker, Schwartz, Lustig, & Detrick, 2016). These technology-based trainings typically involve either a telehealth intervention or a web-based training.

According to the World Health Organization (2019), telehealth intervention “involves the use of telecommunications and virtual technology to deliver health care outside of traditional health-care facilities”. This type of parent training requires real-time interaction with a

practitioner or research professional (J. F. Lee et al., 2015). Recent studies have found positive parent and child outcomes following telehealth interventions (Heitzman-Powell, Buzhardt, Rusinko, & Miller, 2014; Pannefather et al., 2018; Suess et al., 2016; Wacker et al., 2013a; 2013b). Altogether, telehealth interventions can support parents of children with ASD to correctly identify the function of a targeted challenging behavior, select an appropriate functionally-based intervention, and reduce challenging behaviors. Telehealth interventions have advantages such as not requiring the parent or practitioner to travel and giving parents access to real-time feedback regarding parenting practices. However, telehealth interventions comprise some barriers such as requiring specialized equipment (i.e., a webcam and a microphone) and high-speed internet (J. F. Lee et al., 2015). The most important barrier, however, is the requirement of real-time access to a trained professional, which may be limited due to increasing demand for services and the shortage of trained professionals (Csanady, 2015; Kogan et al., 2008; Rivard et al., 2017).

Technology-based parent training can also take the form of a web-based training. Web-based training has benefits such as being low cost, easily disseminated, and highly accessible (Dai et al., 2018; Nieuwboer, Fukkink, & Hermanns, 2013). Most importantly, the presence of a trained professional is not required for its implementation once the web-based training has been developed (Dai et al., 2018; Nieuwboer et al., 2013). Given the above-mentioned features, this form of parent training is especially interesting to increase program reach to parents who do not have access to support of a trained professional (Piotrowska et al., 2019). In a meta-analysis comprising 12 studies, researchers found that web-based parent training of children with variable profiles (e.g., health issues, developmental disability, attention-deficit/hyperactivity disorder) produced improvements in knowledge, attitudinal and behavioral outcomes for parents as well as

in behavioral and attitudinal outcomes for children (Nieuwboer et al., 2013). Specifically, Nieuwboer et al. (2013) found small-to-medium effect sizes for parent (e.g., positive parenting) and child (e.g., adherence to family rules, social competency) behavioral outcomes. That said, few web-based parent training programs specifically targeted challenging behavior in children with ASD.

To our knowledge, only four studies have specifically evaluated the effects of a web-based training to teach parents of children with ASD theoretical or practical concepts to manage challenging behaviors (Heitzman-Powell et al., 2014; Kolb, 2007; Marleau et al., 2019; Sourander et al., 2016). These studies suggest that web-based training is a promising tool to increase parental knowledge and implementation of behavioral principles, and possibly decrease challenging behaviors. Of these four studies, Marleau et al. (2019) is the only one that did not include a feedback component from a practitioner or a researcher. In a pre-experimental pre-test/post-test design, Marleau et al. (2019) found that 26 parents of children with a diagnosis of ASD or intellectual disability performed significantly better on a behavior function identification task as well as on a function-based intervention selection task following the completion of an interactive web training (IWT). This study suggests that IWT as a standalone intervention can lead to positive knowledge development outcomes in the absence of a trained professional. The main limitation of Marleau et al. was that the researchers did not examine whether the knowledge acquired through a fully self-guided IWT translated to changes in child and parent behavior (i.e., knowledge acquisition was measured using written case examples only).

Thus, the purpose of our study was to extend Marleau et al.'s (2019) findings by evaluating the effects of a modified version of the fully self-guided IWT on child behavioral outcomes and parental intervention. The primary objectives of our study were to examine the

effects of the IWT alone on the frequency and severity of challenging behaviors, reported use of behavioral interventions by parents, and parenting practices. We hypothesized that following the completion of the IWT, parents would report lower frequency, lower severity of challenging behavior, more frequent use of behavioral interventions, and improved parental practices. We also measured social validity and quantified intervention usage (i.e., completion time, numbers of attempts until successful completion of each module, and score on quizzes) as secondary outcomes.

## **Method**

### **Participants**

To recruit participants, we posted a message in 7 Facebook® groups for parents of children with ASD as well as on our research lab's public Facebook® page. The message included a brief description of the purpose of the project, the target population, and the first author's contact information. We encouraged parents, professionals, and groups who contacted us to share the post. Our post resulted in 32,401 views and 292 shares over the span of 11 months. Individuals were eligible to participate in the study if (a) they were the parent or primary caretaker of a child 12 years of age or younger with a formal diagnosis of ASD<sup>1</sup>, (b) their child presented challenging behaviors as confirmed by a frequency score of at least three and a severity score of at least two on one or more items of the Behavior Problems Inventory-01 (BPI-01; Rojahn, Matson, Lott, Esbensen, & Smalls, 2001), (c) they lived in the province of Québec, Canada, and (d) they understood French. We excluded parents from the study if they had formal training in psychosocial interventions (e.g., behavior analysis, education, psychology, social work).

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<sup>1</sup> Parents were asked to provide information found on their diagnostic report (i.e., diagnosis, date of the report, and name and profession of the specialist that signed the report)



In total, 50 parents contacted the first author to participate in the study. Forty-seven parent/child dyads met all the inclusion and exclusion criteria with the parent providing informed consent to participate. Parents were predominantly female ( $n = 39$ ; 83%) and children were mostly male ( $n = 42$ ; 89%). On average, children were 7 years old ( $SD = 2.40$ ) and their mean general adaptive composite score ranged between 40 and 108 on the Adaptive Behavior Assessment System – Second Edition (ABAS-II; Harrison & Oakland, 2011a;  $M = 66.30$ ;  $SD = 15.52$ ). Our sample did not include households with more than one dyad. Parent and child demographic characteristics are presented in Table 1 (see initial sample column). Of the 47 parent/child dyads, only 26 completed their participation in the study. We ran our analyses with this sample of 26 parents (see non-attrition column in Table 1 for sample characteristics).

## Measures

**Characteristics of the participants.** The parents completed a sociodemographic questionnaire to collect information on their gender, education, language spoken at home and household income as well as on the age, gender and any comorbid diagnosis of their child. The interviewer also administered the ABAS-II (Harrison & Oakland, 2011a) to document adaptive functioning. Each item of the ABAS-II measures the frequency of a behavior with a four-point Likert scale (0 = unable to 3 = always when necessary). The psychometric properties of the questionnaire include high internal consistency values (e.g., alpha coefficients for each of the domains of competence of .91 to .98) and an inter-rater fidelity score between .60 and .79. The ABAS-II has a good concurrent validity as supported by correlations obtained with other adaptive behaviors scales (Harrison & Oakland, 2011b).

**Challenging behavior.** The parents reported the frequency and severity of their child's challenging behaviors using the French translation of the BPI-01 (Rojahn et al., 2001). The BPI-

01 comprises 52 items that are divided into three subscales: stereotyped behaviors, self-injurious behaviors, and aggressive/destructive behaviors. The BPI-01 has a good test-retest reliability of .76 and a Cronbach alpha of .83. Parents assessed the frequency (0 = never to 4 = every hour) and the severity (1 = low to 3 = severe) of their child's challenging behaviors during the last four weeks, rather than during the last two months, as indicated by Rojahn et al. (2001). We selected a four-week data collection interval as our study aimed to monitor behavior every four weeks.

**Use of behavioral intervention.** We created an eight-item ad hoc questionnaire to measure the use of behavioral interventions by parents (see Appendix for the detailed questionnaire). The items represented strategies that parents were taught to use as part of the IWT. Parents scored each item using a four-point Likert scale (0 = never to 3 = always). A higher overall score corresponded to a more frequent use of appropriate behavioral interventions by parents.

**Parenting practices.** The Alabama Parenting Questionnaire-Short Form (APQ-SF) is a brief assessment tool for self-reported parenting practices (Elgar, Waschbusch, Dadds, & Sigvaldason, 2007; Shelton, Frick & Wootton, 1996). The APQ-SF includes nine items that are divided into three subdomains: positive parenting, inconsistent discipline, and poor supervision (Elgar et al., 2007). The parents scored all items using a five-point Likert scale (1 = almost never to 5 = always). The APQ-SF has internal consistency values ranging from .59 to .84. A three-factor confirmatory factor analysis with a sample of 1,296 mothers and a sample of 745 fathers suggested a good fit (see Elgar et al., 2007 for the model fit indices).

**Social validity.** The parents assessed the social validity of the IWT using the Treatment Acceptability Rating Form – Revised (TARF-R; Carter, 2007). This 20-item questionnaire measures parental perception of acceptability, effectiveness, and ease of use of the IWT. Parents

scored all items using a five-point Likert scale, where a value of one represented a lower social validity score for an item and a value of five presented a higher social validity score. The TARF-R has a good internal consistency with a Cronbach's alpha value of .92 and is considered as a suitable measurement for clinical subpopulations (Carter, 2007). We translated the TARF-R to French (TARF-R-VF) using a similar procedure to the one proposed by Sousa and Rojjanasrirat (2011).

**Web training usage.** The server automatically recorded parental use of the IWT. For each participant, the server saved completion time, number of attempts to pass each module, and scores obtained for all end-of-module quizzes.

### **Interactive Web Training**

As part of the current study, parents completed a modified version of the IWT described in Marleau et al. (2019), which was designed as a fully self-guided training to reduce challenging behavior in children with developmental disabilities. The teaching procedures included a written user guide, slide-supported video-based presentations, video models of the correct implementation of the behavioral interventions, and questions to promote active participation (Gerencser, Higbee, Akers, & Contreras, 2017; Pollard, Higbee, Akers, & Brodhead, 2014). The original IWT involved four modules. Module 1 taught parents how to define a challenging behavior and identify its function, while emphasizing the importance of excluding potential medical and physiological causes (e.g., change in medication, tiredness). Modules 2 and 3 demonstrated how to change the antecedents and consequences of a challenging behavior. Finally, module 4 explained how to implement strategies to teach appropriate alternative behaviors. Each module ended with a quiz containing 10 multiple-choice questions. The parent

had to obtain a score of 80% or more on the end-of-module quiz to move on to the next module. If not, the training prompted the parent to restart the current module.

To improve the training based on the results of Marleau et al. (2019), we added and changed some video examples, and inserted a fifth module. Thus, the new version of the IWT included five modules: the first four teaching the same content as the original IWT, and the fifth module discussing practical and ethical considerations for the management of challenging behaviors. We also updated the user guide to ensure consistency with the content of the new IWT (see Table 2 for summary of the content).

### **Procedures**

Upon approval by the research ethics board of our university, we assessed the effects of the IWT using a four-week randomized waitlist control trial. This type of design has a good internal validity and allows all participants to receive the tested intervention (Marchand, Stice, Rohde, & Becker, 2011; Ronaldson, Adamson, Dyson, & Torgerson, 2014). Moreover, within-group post-test measures were collected for all participants at four-week intervals for 12 weeks after completing the IWT. Using block randomization, a spreadsheet automatically assigned the participants to the experimental group or waitlist group (Beller, Gebiski, & Keech, 2002). We remained blind to group assignment until the first data collection was completed. Parents assigned to the experimental group completed interviews to respond to the questionnaires at baseline (T1), four (T2), eight (T3), and twelve (T4) weeks after the IWT. Parents assigned to the waitlist group completed interviews at five time points: two baseline measures (i.e., T1 and T2) administered four weeks apart and then three post-test measures at four (T3), eight (T4), and twelve (T5) weeks after the IWT (see Figure 1 for the study procedure by group). We administered the questionnaires to assess the characteristics of the participants at T1 only and the

social validity measure at the 4-week post-test (T2 for experimental group and T3 for waitlist group). The parents responded to all other questionnaires (i.e., challenging behaviors, behavioral intervention use, and parenting practices) at all time points.

We administered all questionnaires over the phone. During these calls, the first author or a research assistant read each item to the parents while recording their responses on the questionnaires. Upon request, the parents received an electronic version of each questionnaire via email for visual support. At the end of the first interview, we informed parents whether they would have access to the IWT immediately or had to complete a second interview in four weeks before getting access. Immediately following the first baseline measure (experimental group) or second baseline measure (waitlist group), the parents received a link, a unique username, and a password by email to access the training. We informed the parents that the IWT lasted approximately 3 hr that they could complete it intermittently, that she would not respond to any of their questions involving the content of the training, and that the training should be completed within the next two weeks.

### **Analysis**

Given the high attrition rate observed, we first conducted preliminary analyses to test whether the participants that withdrew from the study differed significantly from those that did not. Second, analyses of covariance (ANCOVA) examined between-group differences for each dependent variable (i.e., challenging behavior, use of behavioral interventions, and parenting practices). In these analyses, group assignment (experimental or waitlist) was the fixed factor, the four-week post-test score was the dependent variable, and the pre-test score of the variable of interest was the covariate (to control for baseline levels of challenging behavior). We also calculated an effect size based on the pooled pretest standard deviation ( $d_{ppc2}$ ; see Morris, 2008).

Third, our within-group analyses involved assessing changes four, eight and twelve weeks after completing the IWT for each dependent variable using a repeated measures analysis of variance (ANOVA). For these analyses, we combined the data (i.e., pre-test<sup>2</sup> and three post-tests) of the participants for both groups and applied a Bonferroni correction for our post hoc pairwise comparisons. Finally, we calculated descriptive statistics for our social validity and web training usage data.

## Results

### Preliminary Analyses

Of the initial 47 participants, 20 (43%) did not complete the IWT and 1 completed a single post-test measure (see Figure 1 for the CONSORT flow diagram). Of the 20 participants who did not complete the training, eight never started the modules, two did not complete module 1, six did not complete module 2, and five did not complete module 4. Table 1 shows the differences between the initial sample and the dyads who completed their participation in the study. Participants who completed their participation in the study differed significantly from participants who withdrew on family income,  $t(41) = 2.70, p = .01$ , as well as on child adaptive functioning based on the ABAS-II,  $t(45) = 2.68, p = .01$ . That is, parents in the attrition group had a lower mean revenue and children with lower adaptive functioning scores. Because the attrition rate was high (> 5%) and that 20 participants did not complete any post-test measures, we could not use imputation techniques (Schlomer, Bauman, & Card, 2010). Hence, we conducted our analyses using the data of the 26 participants who completed their participation in the study. For these 26 participants, the sociodemographic variables and pre-test measures did

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<sup>2</sup> Pre-test 2 scores were used as the pre-test score of participants in the waitlist group for the within-group analyses to ensure that the time between pre-test and post-test data was four weeks for all participants.

not significantly differ between those in the experimental group ( $n = 14$ ) versus those in the waitlist group ( $n = 12$ ).

### **Between-Group Effects**

For child outcomes measured using the BPI-01, we found a significant main effect of group on the frequency of challenging behaviors after controlling for pre-test scores,  $F(1,23)=5.501, p = .028, d_{ppc2} = .555 [0.088, 1.705]$ . Descriptive statistics suggest that parents in the experimental group reported lower frequency scores during the four weeks following the pre-test. A significant difference was also observed for the severity of challenging behaviors after controlling for pre-test scores,  $F(1,23)=4.720, p = .040, d_{ppc2} = .553, 95\% \text{ CI } [.031, 1.641]$ . Parents reported lower severity of challenging behaviors four weeks after completing the IWT.

For parent outcomes, the IWT produced a significant main effect on behavioral intervention use (measured by the ad hoc questionnaire), after controlling for pre-test scores,  $F(1,23) = 5.478, p = .025, d_{ppc2} = .892, 95\% \text{ CI } [.160, 1.791]$ . Mean comparisons suggest that the parents in the experimental group reported using more appropriate behavioral interventions to manage challenging behaviors during four weeks after completing the IWT than the parents still on the waiting list. Finally, parenting practices as measured by the APQ-SF did not differ significantly across groups,  $F(1,23) = .126, p > .05, d_{ppc2} = .08, 95\% \text{ CI } [-.847, .696]$ .

### **Within-Group Effects**

Figure 2 presents mean changes in the frequency and severity of challenging behaviors over time (data of both groups combined). We found a significant main within-group effect of time for the frequency of challenging behaviors,  $F(3, 72) = 12.413, p < .001, \eta^2 = .341$ . Post-hoc pairwise comparisons reveal significant differences in frequency means between the pre-test score and the four- ( $M = -9.429, p = .017$ ), eight- ( $M = -11.619, p = .002$ ) and twelve-week ( $M =$

-14.006,  $p < .001$ ) post-test scores, but no differences between the post-test scores themselves. For severity, the main within-group effect for time was also statistically significant,  $F(3, 72) = 15.344$ ,  $p < .001$ ,  $\eta^2 = .390$ . Post-hoc pairwise comparisons identified significant differences between the pre-test score and the four- ( $M = -6.732$ ,  $p = .021$ ), eight- ( $M = -8.935$ ,  $p = .002$ ) and twelve-week ( $M = -12.077$ ,  $p < .001$ ) post-tests, and between the four- and twelve-week post-tests scores ( $M = -5.345$ ,  $p < .022$ ).

For parent outcomes, the within-group analysis on the use of behavioral interventions indicated a significant difference across time,  $F(3, 72) = 15.344$ ,  $p < .001$ ,  $\eta^2 = .390$ . Post-hoc pairwise comparisons revealed significant differences in means for reported use of behavioral interventions between the pre-test score and the four- ( $M = 2.077$ ,  $p = .011$ ), eight- ( $M = 1.935$ ,  $p = .003$ ) and twelve-week ( $M = 2.244$ ,  $p < .001$ ) post-test scores while no differences were observed across post-test scores. Finally, we found no significant within-group effect of time on parenting practices,  $F(3, 72) = .835$ ,  $p > .05$ ,  $\eta^2 = .034$ .

### **IWT usage measure and social validity**

Table 3 shows the descriptive statistics of the IWT. The median time for parents to complete the IWT was 3.9 hr. In general, parents completed each module once. However, 9 of the 26 parents had to restart one or more modules before obtaining a passing score of 80% or more to move on to a subsequent module. Table 4 presents the item-level descriptive statistics of the social validity measure. On average, parents scored the TARF-R-VF items 4.0 out of a possible score of 5.0. The highest-rated items were related to the affordability of the IWT, the cost to carry out the intervention, and the comprehension of the interventions taught through the IWT. Parents rated the following items as lowest on the TARF-R-VF: "How much discomfort is your child likely to experience during the course of this treatment?", "To what extent are



undesirable side-effects likely to result from this treatment?”, “How much time will be needed each day for you to carry out this treatment?”, and “How disruptive will it be to the family (in general) to carry out this treatment”. Mean scores on these items were 3.00, 2.92, 2.65, and 2.46, respectively. These results suggest that parents concerns regarding these items were generally neutral to mild.

### **Discussion**

The purpose of our study was to extend a study conducted by Marleau et al. (2019) by assessing the effects of a modified version of the IWT on child and parent outcomes within a randomized waitlist control trial. Our results indicate that parents in the experimental group reported using more behavioral interventions and observed lower frequency and severity of challenging behaviors in their child than parents on the waiting list for four weeks after completing the IWT. These changes persisted up to 12 weeks after the training. Surprisingly, the medium-to-large effect sizes observed for our fully self-administered short-duration IWT were comparable to previous research evaluating in-person, personalized parent trainings (Postorino et al., 2017). On the other hand, we did not find the IWT to significantly improve parenting practices as measured by the APQ-SF. Parents rated the social acceptability of the training highly.

Consistent with Marleau et al. (2019), one of the main concerns reported by parents related to their child experiencing discomfort or side-effects during the implementation of the behavioral interventions. Through the IWT, parents learned about the possible short-term side-effects of some interventions such as extinction, which probably explains these results. As we did not measure the side-effects or discomfort directly, we do not know whether these concerns materialized when the parents implemented some of the interventions. The results indicate that it

would be essential to implement a side-effect monitoring system in the future and to provide on demand support from a practitioner when the intervention produces undesirable consequences. Parents also reported that implementing the treatment may be time consuming and effortful, underlying the need to integrate strategies to support and encourage parents during implementation.

Despite the low response effort associated with completing the IWT, the observed attrition rate remained high (i.e., 45%;  $n = 21$ ), but comparable to the 51% dropout rate found by Chacko et al. (2016) in their review of engagement in behavioral parent training comprising 262 studies with parents of children with disruptive behavior disorders (e.g., attention-deficit/hyperactivity disorder, conduct disorder). This issue significantly reduced our statistical power by forcing us to rely on only a subsample (i.e., parents who completed the study) to conduct our analyses. When parents informed the first author that they wanted to withdraw their participation, the predominant reason they provided was the lack of time ( $n = 19$ ), which is consistent with prior research (Dadds et al., 2019). These results suggest that a standalone web training may be insufficient to maintain parental participation. Having active support and encouragements from a trained professional may potentially increase completion rate. Alternatively, implementing a reinforcement contingency for the parents may decrease attrition while potentially also addressing issues related to the high response effort associated with carrying out the interventions.

Consistent with our results, other researchers have found that a lower socioeconomic status is related to higher attrition rates in parent trainings (Chen & Fortson, 2015; Gross, Belcher, Budhathoki, Ofonedu, & Uveges, 2018; Lavigne et al., 2010). Furthermore, we also observed that attrition was skewed towards parents with children with lower adaptive functioning

scores, possibly highlighting the challenges of finding time when caring for a child with more substantial needs. Despite this difference, readers should note that mean and median adaptive behavior functioning score remained extremely low for children in both groups. Further, attrition was not related to pre-test frequency or severity of challenging behaviors. Because attrition results in parents not receiving the intervention, researchers should investigate components that may increase parent training completion rates, such as the presence of a parent support component and the type of teaching modality used. Researchers should also conduct interviews with participants who withdraw from studies to better understand the reasons of non-completion of the online training.

The initial purpose of our study was to develop and test a fully self-guided web training to reduce engagement in challenging behavior. Unfortunately, our high attrition rate and the concerns reported by the parents in the social validity questionnaire prevent us from recommending the web training as a standalone treatment at this point. The IWT does not include a direct feedback component for treatment implementation fidelity, which may also raise some ethical issues. More specifically, parents may implement the learned intervention inadequately without realizing it (Meade, Dozier, & Bernard, 2014; Neely, Rispoli, Gerow, Hong, & Hagan-Burke, 2017). As shown by prior research, these errors in integrity may unknowingly increase engagement in challenging behavior (St. Peter, Byrd, Pence, & Foreman, 2016; St. Peter Pipkin, Vollmer, & Sloman, 2010; Wilder, Atwell, & Wine, 2006). Therefore, we recommend that a practitioner be available to provide encouragement and support on an as-needed basis to complete training and to monitor the side-effects of implementation. Professionals may provide this support by phone or by email. In doing so, the web training may still have potential benefits over other forms of training (e.g., reducing costs and wait times, providing services to

those in remote areas) as the practitioner would not need to provide the actual training in person or live online.

Nevertheless, many parents primarily rely on the internet to identify potential interventions to use (Grant et al., 2016; Hall et al., 2016). Consequently, some parents have reported using unvalidated interventions that have been associated with negative health-related consequences (e.g., Arnold, Hyman, Mooney, & Kirby, 2003; Heiger et al., 2008) and even death (Brown, Willis, Omalu, & Leiker, 2006). When parents do not have access to services, we would argue that teaching parents basic empirically-supported interventions outweighs the risks of parents accessing other unvalidated interventions found on the internet (Green et al., 2006; Smith, Oakes, & Selver, 2014). We thus need more research on the benefits and drawbacks of fully self-guided approaches.

Our study is the first to test the effects of a fully self-administered IWT on child challenging behavior within a randomized waitlist control trial. Another contribution of our study is the diversity of our sample. Most research on parent training of children with ASD has emphasized younger children (e.g., < 8 years of age) with higher levels of functioning (i.e., Ilg et al., 2017; Postorino et al., 2017; Suess et al., 2016; Wacker et al., 2013a, 2013b). In our study, adaptive scores for the ABAS-II varied from the 1<sup>st</sup> percentile (extremely low) to the 70<sup>th</sup> percentile (average) and the age of children ranged from 3.5 to 12.0 years. Parents followed the IWT and carried out the interventions in a real-life setting, which is also a strength of the study. From a practical standpoint, the training only lasted a median of 4 hr and parents rated its social acceptability and validity highly, which are two further benefits of using the IWT.

Although the IWT is promising, our study has limitations that should be noted. First, the parents reported all the measures collected as part of the current study. By relying solely on the

parent, we can only conclude that parents perceived improvements in challenging behaviors following the IWT. Second, our measure of behavioral intervention use was an ad hoc questionnaire created by the second author, which focused on only one dimension of parent implementation. In the future, researchers should also measure other dimensions such as quality of implementation (Sanetti & Kratochwill, 2009). Third, our four-week randomized waitlist control trial does not allow us to experimentally assess the effect of the IWT at the eight- and twelve-week post-tests (Marchand et al., 2011; Ronaldson et al., 2014). Our within-group analyses only indicate that outcomes changed or persisted favorably over time.

Future research should replicate our study with a larger sample and should include other sources of data such as direct observation measurements or data collected from a third party (e.g., the other parent). Researchers should also study the effects of the IWT on specific behavior topographies. For example, Bearss et al. (2015) found that their parent training had an almost null effect size on stereotypic and social withdrawal behaviors, but a medium-to-large effect size for other disruptive behaviors. Since our effect sizes were comparable to other practitioner-supported parent trainings, comparing the effects of IWT with and without the support of a practitioner to identify the most effective training package seems important. Finally, researchers should assess the long-term effects of the IWT on parent and child outcomes as well as distal outcomes such as changes in adaptive behaviors of children, parental stress, and family quality of life. Despite the need for additional research, our results underline the potential utility of using web-based training as a short, low cost, and easily accessible option to supplement services provided to parents of children with ASD.

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Table 1  
*Parent and Child Characteristics*

Variable	Initial sample ( <i>N</i> = 47)		Non-attrition sample ( <i>N</i> = 26)	
	Frequency	%	Frequency	%
<b>Child characteristics</b>				
<b>Sex</b>				
Male	42	89.4	23	88.5
Female	5	10.6	3	11.5
<b>ABAS-II GAC score</b>				
>130 (very superior)	0	0	0	0
120-129 (superior)	0	0	0	0
110-119 (above average)	1	2.1	1	3.8
90-109 (average)	3	6.4	3	11.5
80-89 (below average)	2	4.3	2	7.7
71-79 (borderline)	12	25.5	7	26.9
<70 (extremely low)	29	61.7	13	50.0
<b>Comorbid diagnostic</b>				
Yes	22	46.8	10	38.5
No	25	53.2	16	61.5
<b>Parent characteristics</b>				
<b>Family income (\$)</b>				
Less than 10 000	1	2.1	0	0
10,000-29,999	7	14.9	2	7.7
30,000-49,999	4	8.5	1	3.8
50,000-69,999	9	19.1	6	23.1
70,000-89,999	7	14.9	5	19.2
90,000 or more	15	31.9	11	42.3
Prefer not to answer	4	8.5	1	3.8
<b>Sex</b>				
Female	39	83	22	15.4
Male	8	17	4	84.6
<b>Spoken language at home</b>				
French	43	91.5	25	96.2
English	0	0	0	0
Other	4	8.5	1	3.8
<b>Education</b>				
Uncompleted high school	1	2.1	0	0
High school	9	19.2	3	11.5
College	15	31.9	8	30.8
Undergraduate	16	34.0	10	38.5
Graduate	6	12.8	5	19.2

*Notes:* ABAS-II = Adaptive Behavior Assessment System – Second Edition; GAC = General adaptive composite

Table 2

*Content of the Interactive Web Training*

Module	Content
1: Understanding challenging behaviors	Part 1: What is a challenging behavior? Part 2: Why does my child engage in challenging behaviors (antecedents-behavior-consequence)? Part 3: What is the function of the behavior and how do I identify it?
2: Modify the antecedents	Part 1: Why modify the antecedents? Part 2: Modify the antecedents, regardless of behavioral function Part 3: Modify the antecedents based on the function of the behavior
3: Changing the consequences	Part 1: Why is my child engaging in challenging behavior? (review) Part 2: What are the consequence-based interventions? Part 3: Extinction Part 4: How to succeed with implementing extinction? Part 5: Response interruption and redirection
4: Teaching an appropriate behavior	Part 1: What is an appropriate behavior? Part 2: How can I teach an appropriate behavior? Part 3: Alternative intervention for self-stimulatory behavior
5: Practical considerations	Part 1: Combining interventions Part 2: Important considerations: (a) prioritizing safety, (b) choosing the number of behaviors to target, and (c) possible short-term effects of extinction. Part 3: What to do if the intervention is ineffective?

Table 3

*Duration of Modules, End-of-Module Scores, and Number of Times Each Module Was Attempted*

Module	Mean duration (min)	Median duration (min)	Mean score on end-of-module quiz (%)	Number of Attempts	
				Median	Maximum
1	77	55	90	1	3
2	104	45	96	1	1
3	59	48	83	1	7
4	69	48	97	1	10
5	18	16	95	1	4

Table 4

*TARF-R-VF Mean Scores per Item from Highest to Lowest*

Item	Mean	SD
How affordable is this treatment for your family?	4.65	0.75
How costly will it be to carry out this treatment?	4.62	0.85
How clear is your understanding of this treatment?	4.58	0.50
How willing are you to carry out this treatment?	4.42	0.95
How confident are you that the treatment will be effective?	4.42	0.76
How willing would you be to change your family routine to carry out this treatment?	4.38	0.70
How acceptable do you find the treatment to be regarding your concerns about your child?	4.35	0.80
How likely is this treatment to make permanent improvements in your child's behavior?	4.35	0.80
Given your child's behavioral problems, how reasonable do you find the treatment to be?	4.31	0.79
How much do you like the procedures used in the proposed treatment?	4.31	0.79
To what extent do you think there might be disadvantages in following this treatment?	4.15	0.92
How effective is this treatment likely to be for your child?	4.15	0.78
How well will carrying out this treatment fit into the family routine?	4.04	0.82
How willing will other family members be to help carry out this treatment?	3.46	1.24
How disruptive will it be to the family (in general) to carry out this treatment?	3.00	1.20
To what extent are undesirable side-effects likely to result from this treatment?	2.92	1.60
How much time will be needed each day for you to carry out this treatment?	2.65	1.47
How much discomfort is your child likely to experience during the course of this treatment?	2.46	1.48

Note. TARF-R-VF = Treatment Acceptability Rating Form-Version Française

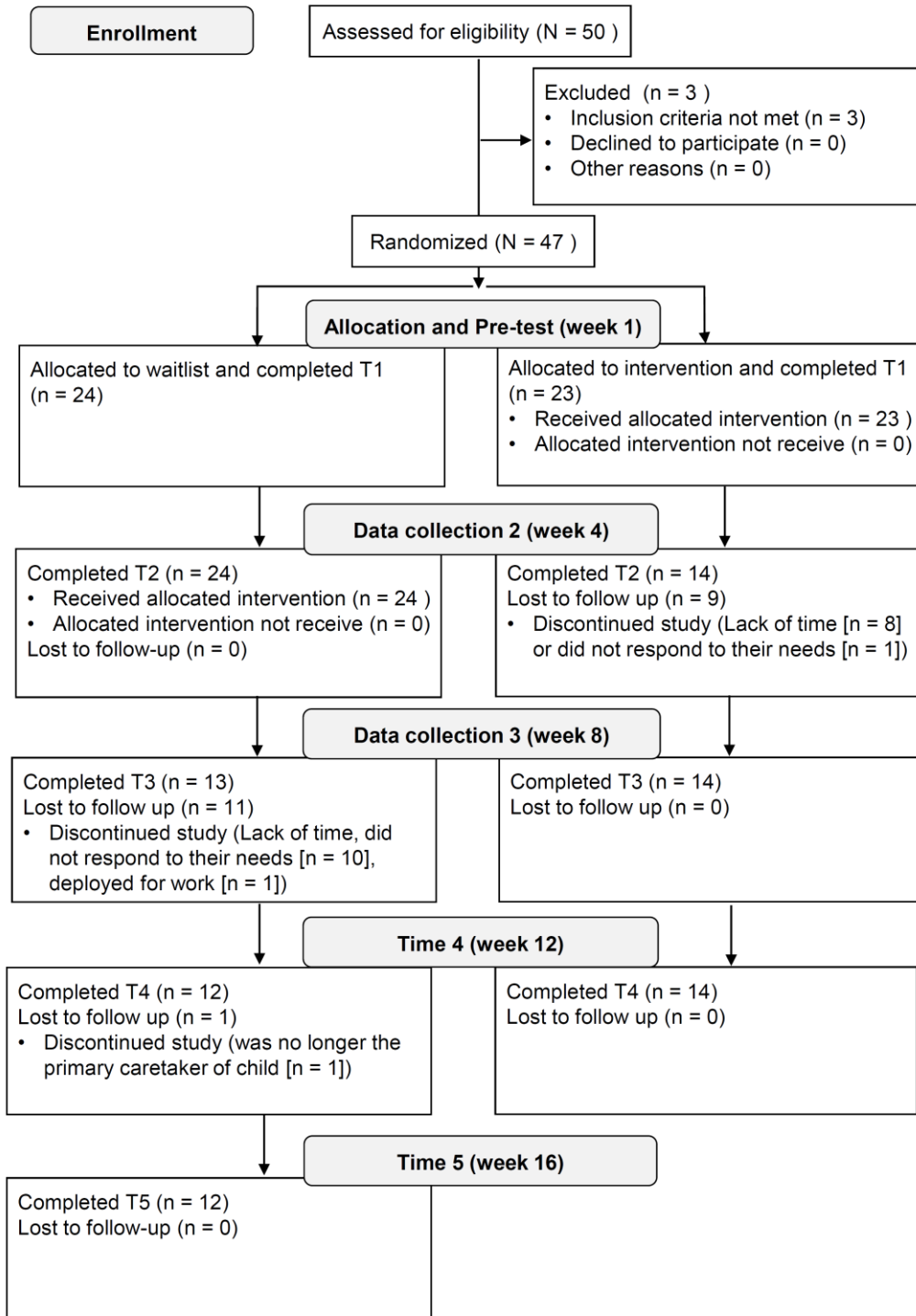


Figure 1. CONSORT flow diagram of our randomized controlled trial with waitlist control.

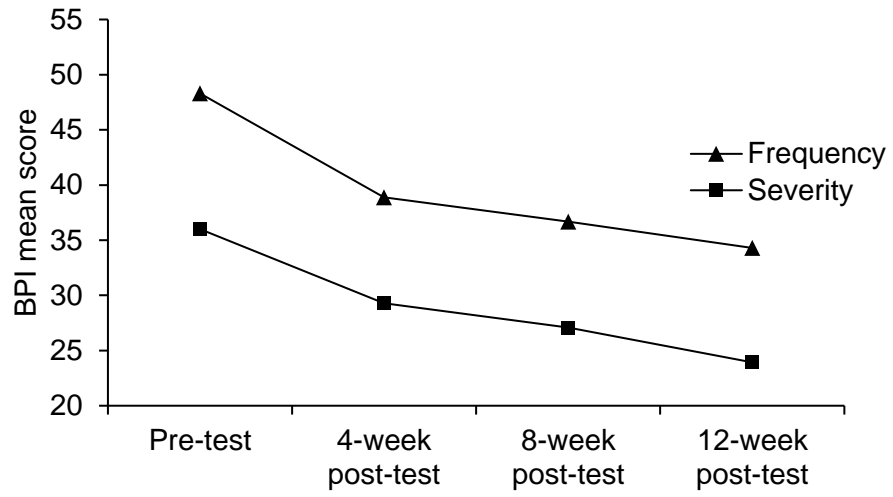


Figure 2. Mean frequency and severity scores on the Behavior Problem Inventory (BPI) at pre- and post-tests.

**Appendix**

**Behavioral Intervention Use Questionnaire**

1) I give my child what he wants regularly throughout the day.

0 Never	1 Sometimes	2 Often	3 Always
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2) I modify or remove the triggers associated with challenging behavior to prevent my child from engaging in them.

0 Never	1 Sometimes	2 Often	3 Always
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3) When my child engages in challenging behavior, I immediately give him what he wants (e.g., attention, object, break). \*

3 Never	2 Sometimes	1 Often	0 Always
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4) I teach my child behaviors that allow him to keep himself busy in an acceptable manner and/or to express his needs.

0 Never	1 Sometimes	2 Often	3 Always
------------	----------------	------------	-------------

5) When my child engages in good behavior, I congratulate him or give him something to acknowledge it.

0 Never	1 Sometimes	2 Often	3 Always
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6) I clearly explain to my child what he must do, how and where to get what he wants. \*\*

0 Never	1 Sometimes	2 Often	3 Always
------------	----------------	------------	-------------

7) Prior to tasks or requests, I provide advanced notice to my child. \*\*

0 Never	1 Sometimes	2 Often	3 Always
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8) When I present a demand to my child, it is brief, direct, clear and specific. \*\*

0 Never	1 Sometimes	2 Often	3 Always
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\* Reversed scoring

\*\*These items may involve the use of nonverbal communication (if necessary), such as pictograms, images, or gestures.