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# Web-Based Intervention for Teachers of Elementary Students With ADHD: Randomized Controlled Trial

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## Abstract

**Objective:** To test the acceptability, satisfaction, and effectiveness of a web-based intervention for teachers of elementary school–aged children with ADHD. **Method:** Elementary classroom teachers (N = 58), along with their students with ADHD, participated in a randomized controlled trial. The program consisted of six sessions that included evidence-based intervention strategies for reducing ADHD symptoms and impairment in the classroom setting. Teachers also had access to a moderated Discussion Board and an online ADHD coach. Questionnaire data were electronically collected from teachers and parents pre-intervention, post-intervention (6 weeks), and after an additional 6-week follow-up. **Results:** Intent-to-treat analyses found significant improvements based on teacher (but not parent) reports of core ADHD symptoms and impairment for the Teacher Help for ADHD treatment group. Teachers reported a high level of acceptability and satisfaction. **Conclusion:** Web-based ADHD interventions have the potential to reduce the barriers to treatment utilization and implementation that are common problems for school-based ADHD interventions. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

## Keywords

ADD/ADHD, children, teachers, treatment, eHealth

ADHD is a chronic neurodevelopmental disorder characterized by three core symptoms, including developmentally inappropriate levels of inattention, hyperactivity, and impulsivity, which result in significant impairment in functioning (American Psychiatric Association, 2013). It is a highly prevalent and chronic disorder, with approximately 5% of school-aged children being affected, most of whom will continue to display symptoms into adolescence and adulthood (Schachar, 2009). ADHD can have a severe impact on quality of life and educational success (Danckaerts et al., 2010). While psychostimulant medication has been found to be highly effective in treating the core symptoms of ADHD (Schachar, 2009), pharmacotherapy is not always the most desirable or appropriate treatment for all individuals with ADHD (Toomey, Sox, Rusinak, & Finkelstein, 2012). Moreover, pharmacotherapy may not be as effective in the long term and may not address associated symptoms of ADHD (e.g., academic underachievement; Parker, Wales, Chalhoub, & Harpin, 2013). As such, psychosocial interventions are an important component of treatment for ADHD. The most widely evaluated psychosocial intervention is parent training, wherein parents are taught to use behavioral management strategies to modify their child's behavior (Fabiano et al., 2009; Hodgson, Hutchinson, & Denson, 2014). Parent training is often effective for creating positive behavior change in the home environment, but the benefits may not generalize to the school setting (Corkum, McKinnon, & Mullane, 2005; Pfiffner & Haack, 2014).

ADHD also has a significant impairing impact in the classroom (DuPaul & Jimerson, 2014), so it is important to focus evidence-based interventions for children in their school environments. DuPaul, Weyandt, and Janusis (2011) described several empirically supported school interventions for ADHD, including those based on antecedents (i.e., modifying situations that make the behaviors more problematic) and consequences (changing teachers' responses to children's behavior). Other school-based treatments for ADHD include teaching students self-regulation (e.g., monitoring the level

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of effort they put in each assignment), providing academic interventions (e.g., remedial instruction and assistive technology), and increasing home–school communication (e.g., daily report cards). Results from a meta-analysis indicated that school-based interventions for children with ADHD, such as those described above, yielded moderate to large effects for behavioral and academic outcomes (DuPaul, Eckert, & Vilardo, 2012).

Despite growing support for the effectiveness of school-based ADHD interventions, there are some obstacles limiting this treatment approach including teachers' lack of knowledge and/or misconceptions about ADHD, barriers to accessibility, and treatment integrity. Martinussen, Tannock, and Chaban (2011) found that the majority of general education teachers, and almost half of special education teachers, reported having no or only brief in-service training on ADHD. Moreover, Blotnicky-Gallant, Martin, McGonnell, and Corkum (2015) found that teachers do not regularly implement evidence-based strategies for intervening with ADHD-related classroom challenges. Educators' attitudes toward the diagnosis and treatment of ADHD, as well as social stigma due to misconceptions surrounding etiology and treatment, may also affect educators' help-seeking behaviors for children with ADHD (Moldavsky & Sayal, 2013). In addition, treatment barriers such as lack of time and minimal professional development opportunities often lead to low rates of implementation of evidence-based interventions in the classroom (Schultz, Storer, Watabe, Sadler, & Evans, 2011).

To our knowledge, there is no published research outside of our pilot study (Barnett, Corkum, & Elik, 2011) that examines the effectiveness of web-based interventions for teachers of students with ADHD. There are, however, studies that indicate that in-person teacher training/consultation interventions result in improvement in the primary symptoms of ADHD in children as well as in multiple domains of children's functioning as seen by both parents and teachers (Miranda, Presentación, & Soriano, 2002; Owens, Johannes, & Karpenko, 2009). These studies highlighted the potential effectiveness of improving a range of outcomes for children, including reduction of ADHD symptoms and functional impairment, as well as improving teacher knowledge.

eHealth interventions have been found to be efficacious and to offer highly accessible, scalable, and cost-effective treatment delivery and, as such, have become increasingly common as a means of mental health support (e.g., Ritterband & Tate, 2009). There are a number of models that seek to explain the mechanism of behavioral change for Internet interventions (e.g., Mohr, Schueller, Montague, Burns, & Rashidi, 2014; Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). These models highlight the interplay between the users and how the content is delivered and supported, as well as the importance of an iterative process in the development of eHealth interventions. It would seem that eHealth interventions would be an ideal way to reduce the barriers to access for evidence-based interventions in school settings; however, there are currently no published evaluations of eHealth interventions targeted at teachers to help them implement classroom-based interventions for their students with mental health challenges or learning disorders/disabilities.

*Teacher Help for ADHD* is a web-based intervention designed to respond to the challenges of accessibility and limited treatment support for school-based ADHD interventions. The intervention, based on empirically validated strategies, was designed by the first and second authors of this article and focuses on targeting elementary school classroom teachers who currently have students with ADHD in their classes. Prior to pilot testing, *Teacher Help for ADHD* was reviewed by mental health clinicians specialized in ADHD as well as by school board personnel, including teachers and student services staff, whose feedback was incorporated into the intervention design. This beta version of the program consists of six online sessions, which are composed of PowerPoint slides, worksheets, and supplemental materials including websites as well as a non-moderated Discussion Board. The program was designed so that teachers would review one session every week. Teachers are encouraged to collaborate with parents throughout the program, but parents do not directly access the intervention. A web-based, password-protected learning management system was used to manage the delivery of the intervention program.

A pilot test of *Teacher Help for ADHD* with 19 Grade 1 to 6 teachers was conducted (Barnett et al., 2011). Results showed improved teacher ADHD-related knowledge and attitudes as well as a high level of satisfaction with the intervention but only a moderate level of satisfaction with the Discussion Board. When asked for constructive feedback, teachers requested that interactive expert coach support be added to future versions of the intervention. This feedback was used to revise the *Teacher Help for ADHD* intervention prior to conducting the randomized controlled trial (RCT). The main change from the pilot phase intervention to the RCT intervention was the addition of a personalized web-based support from an ADHD coach via the Discussion Board and private email messages within the learning management system.

The purpose of the current study was to test the acceptability, satisfaction, and effectiveness of the *Teacher Help for ADHD* program through a RCT (i.e., intervention group, waitlist control group). Questionnaire data pertaining to students' core ADHD symptoms and level of impairment at school and home were collected from teachers and parents pre-intervention, post-intervention (after 6 weeks), and after an additional 6-week follow-up period. At the end of the treatment phase, the teachers in the active intervention provided acceptability and satisfaction ratings. The primary hypothesis was that the intervention would result in reduced

ADHD symptoms and impairment in the school setting. The secondary hypothesis was that the intervention group would also demonstrate improvements in ADHD-related behaviors and reduced impairment in the home setting. The other hypotheses were that teachers (and parents, when relevant) in the treatment group would report a high level of acceptability and satisfaction with the program.

## Method

This study was a parallel group RCT with 1:1 allocation to the treatment and waitlist group. Waitlist group did not receive any intervention but were free to access usual care. This study received ethical clearance from the IWK Health Centre, a tertiary children's hospital, and was approved by all participating school boards. The RCT is registered with ClinicalTrials.gov (identifier: NCT01547702). The study implementation occurred during the 2011-2012 and 2012-2013 school years, which allowed us to reach our target participant numbers.

### Participants

Participants were recruited from seven English-language school boards in Nova Scotia, Canada. Fifty-eight teacher/student dyads participated across three waves of study implementation (Wave 1: $n = 25$; Wave 2: $n = 14$; Wave 3: $n = 19$). Inclusion criteria included that the child was (a) attending Grades 1 to 6 in a participating public school board; (b) enrolled in an English classroom, or if French Immersion the teacher was able to complete the program in English; (c) previously diagnosed with ADHD by a health care provider who was certified to make mental health diagnoses (i.e., physician, psychologist); and (d) on a stable dose of medication for ADHD or was taking no medication, with no plan to start or change medications for the duration of the study. Exclusion criteria included that the child could not (a) currently have an Individualized Program Plan (IPP) due to significant physical, behavioral, communication, or intellectual difficulties; (b) have significant co-occurring mental health problems aside from ADHD (e.g., no depression, anxiety, or severe conduct problems); (c) have a moderate or severe intellectual impairment; and that the teacher could not (d) have had previous involvement with the *Teacher Help for ADHD* program (e.g., provided feedback during the development stage, participated in the pilot study). Only one teacher was eligible to participate per school to prevent possible confounding effects of teachers sharing information within schools.

### Measures

All measures were collected electronically, with the exception of the screening questionnaire that was administered over the telephone. Assessment measures were collected through Opinio (Version 6.9.1; ObjectPlanet), a survey site hosted on the same secure server.

*Screening.* The *Teacher Help for ADHD Screening Questionnaire* (author made) was completed over the phone with parents and teachers prior to randomization and included questions to assess the inclusion and exclusion criteria for this study (as described above in the Participant section). For example, the questionnaire asked about the child's ADHD diagnosis (when diagnosed, by whom, and diagnostic procedures), medication status, and planned stability of medication regime.

*Intake.* During the intake stage, evidence for a diagnosis of ADHD and lack of any other primary mental health diagnosis was confirmed. The *Achenbach System of Empirically Based Assessment* (ASEBA; Achenbach & Rescorla, 2001) forms were completed once participants passed the initial telephone screening. The *Child Behavior Checklist* (CBCL; parents) and *Teacher Report Form* (TRF; teachers) are parallel forms, each containing 118 items, which obtain parent and teacher reports of children's (age 6-18) levels of competency and problem behaviors and assess for a wide range of mental health problems in children, including both externalizing and internalizing problems. The Attention Problems Syndrome Scale and the ADHD Problems *DSM*-Oriented Scale were used to confirm diagnosis. To participate in the study, in addition to the information provided during the screening assessment by parents about their children's diagnosis, the child had to have a *T* score of 65 or greater on one of these two scales on at least one of the questionnaires (CBCL, TRF) or the diagnosis had to be confirmed during a follow-up interview. The child could not meet the criteria for another primary mental health disorder such as depression, anxiety, or conduct disorder.

*Baseline and outcome measures.* The teacher and parent *Demographic Information Questionnaires* (author made) were completed at pre-intervention only. The teacher questionnaire asked about teachers' age, sex, years of experience as a teacher, number of children taught with ADHD, and perceived knowledge of ADHD rated on a 5-point scale ranging from 0 (*no knowledge*) to 4 (*very knowledgeable*). These data were used for description of the sample only. Parent demographic questionnaires also included information for describing the sample (e.g., family income, ethnicity, marital status).

The *Treatment Tracking Form* (TTF; author made) included six items for the teacher version and nine items for the parent version and asked questions about medication treatment for ADHD or other mental health disorders, as well as psychosocial treatments, including those focused on behavior and social skills. For the current study, this measure

was used to identify any changes in medication status during the study period.

The *Conners 3rd Edition Parent and Teacher Rating Scales* (Full-length; *Conners3-P, Conners3-T*; Conners, 2008) are 110-item and 115-item behavior rating scales designed to evaluate problem behaviors in the home and school settings in children aged 6 to 18 years. These copyrighted measures are the most widely used measures of ADHD symptoms in treatment trials and were completed at pre-intervention, post-intervention, and follow-up by all teacher and parent participants. The *Conners ADHD Index T* score reflects the 10 items most highly related to ADHD. The teacher report was one of the two primary study measures, whereas the parent report was a secondary measure.

A modified version of the *Impairment Rating Scale* (IRS; Fabiano & Pelham, 2002) assesses the areas of functioning that are affected most by the symptoms of ADHD. It consists of six questions on the teacher version and seven questions on the parent version which measure the child's academic, behavioral, and social functioning, as well as self-esteem. Scores range from 0 (*no problems*) to 6 (*extreme problems*), with higher scores indicating greater impairment. The scale was modified by asking informants to provide ratings on a Likert-type scale rather than select a place along a line. For the current study, only the mean severity of impairment questions was used. The teacher report was one of the two primary measures, whereas the parent report was a secondary measure.

*Acceptability and satisfaction measure.* Teachers completed the *Acceptability Questionnaire*, which asked the teacher to estimate the percentage of PowerPoint slides they reviewed, individual worksheets completed, and supplemental materials accessed. Also, the number of Discussion Board posts and the number of email messages to the ADHD coach were recorded by the learning management system.

*Teacher and Parent Satisfaction Ratings* (TSR/PSR; adapted from Ervin, DuPaul, Kern, & Friman, 1998) were used to assess participant satisfaction with the intervention. The teacher version consisted of 20 items, whereas the parent version consisted of 6 items which were all rated on a 6-point Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Items focused on intervention efficacy, feasibility, and social validity. Open-ended questions were also included, but these results are reported elsewhere (Elik, Corkum, Blotnicky-Gallant, & McGonnell, 2015).

## Procedure

*Recruitment.* Student services coordinators from each of the participating school boards emailed information about the study to elementary school principals and teachers, and schools were telephoned by research assistants to remind principals about the study and answer any questions. Interested teachers with interested principals contacted the research coordinator via telephone or email, at which point the coordinator sent them more detailed information packages. Teachers who were interested in the study contacted parents of the student with ADHD with whom they wanted to implement this program and encouraged them to take part. Interested parents then contacted the research coordinator via telephone or email. Screening questions from the *Parent Screening Questionnaire* were completed over the telephone to determine whether students met initial criteria for participation. If the parent report fulfilled the initial criteria, parents received a link to complete the CBCL online to determine whether the participant was eligible; if eligibility criteria were not met, parents and teachers were notified. In cases where parent screening was successful, parents followed an email link to an electronic information and consent form and child assent form. Upon receipt of the parents' electronic consent and children's electronic assent, teachers were contacted to complete the same screening and consent procedures.

*Randomization.* Following eligibility screening, parent/teacher informed consent, and child assent, teacher–student dyads were randomly assigned to either the active treatment (*Teacher Help for ADHD* group) or the waitlist control group in randomization blocks of 10 participants, using random number assignment via the randomization.com website. Randomization procedures were based on the principles outlined in the Consolidated Standards of Reporting Trials (CONSORT) statement (Moher, Schulz, & Altman, 2001), with all randomization assignments completed by an individual not involved in the study. Given the nature of the study, participants could not be blind to group; however, all research assistants who supported the completion of online questionnaires (e.g., calling to remind participants to complete measures) were blind to group.

Participants in each group were expected to maintain their group assignment for 12 weeks from the start of the treatment period. Once the study was completed for all participants in each wave, those in the waitlist control group were given access to the intervention (this was always in the same school year that they consented to participate in the study, and no additional outcome measures were obtained). This time frame was chosen as it was long enough to assess the stability of change in the active treatment group but was not an unreasonable wait time for the control participants. Researchers obtained outcome measures at three time periods: pre-intervention, post-intervention (6 weeks after the start of the intervention), and at follow-up (12 weeks after the start of the intervention).

*Intervention.* The intervention was accessed through a learning management system hosted on a secure server at Dalhousie University (i.e., Online Web Learning [OWL]/Blackboard [BBLearn]).[1] Teachers reviewed the intervention content,

which included PowerPoint presentations and supporting documents, online through the OWL/BBLearn learning management system. Teachers were given access to one new session each Monday for 6 weeks along with a Discussion Board reminder to encourage them to access and work through the session. Introductory videos for each session featured co-investigators describing the content of the session and encouraging active participation. Each week's session ended with a brief questionnaire based on that week's session, and participants were contacted if weekly questionnaires were not completed within a few days of the end of the session. If the teachers encountered problems when implementing intervention strategies with their students, the ADHD coach was available on the Discussion Board and privately through the internal email system to answer questions and clarify information.

The 6-week program included the following topics:

- Session 1 targeted common myths about ADHD and provided information about impact, etiology, and effective treatments.
- Session 2 addressed the teacher's role in working with students with ADHD, focusing on the importance of home–school cooperation and using a team approach; target goals were set for the intervention, and the behavior program was introduced.
- Session 3 supported teachers as they developed a structured behavior program specific to the goals developed in Session 2; teachers learned to use a reward-based behavior program that was specific to the student to decrease unwanted behavior and increase wanted behavior.
- Session 4 guided teachers in structuring their physical classrooms, providing schoolwork tasks, and building positive relationships with their students with ADHD.
- Session 5 addressed instructional interventions for ADHD focused on academic and cognitive needs of students with ADHD and co-occurring learning disabilities.
- Session 6 supported teachers in improving students' study skills, meta-cognition, and self-monitoring; it concluded by helping teachers to evaluate progress, phase out the behavior program, and make plans for dealing with relapses of unwanted behaviors.

### *Statistical Analysis*

Power analyses (conducted via http://www.dssresearch.com/toolkit/spcalc/power.asp) indicated that a total sample size of 50 participants (25 participants in each group) would give at least 80% power. Descriptive statistics, as well as *t* tests and chi-square tests, were used to describe the sample and to determine whether any significant differences existed between treatment and control groups at pre-intervention. These tests were also used to ascertain whether those participants who completed protocol and provided a full data set differed from those who dropped out of the study or did not complete measures at all three time periods. Repeated-measures ANOVAs were used to compare groups on the primary and secondary outcomes across the three time points (pre-intervention, post-intervention, and follow-up). Little's Missing Completely At Random (MCAR) test was used to analyze the randomness of missing data for primary and secondary outcomes, and analyses followed intent-to-treat guidelines, which means that all participants who were randomized were included in the analyses, regardless of adherence or completeness of data. For significant group by time interactions, paired t-tests were conducted for the intervention group across the three time points. Complete case analyses (i.e., completer analyses) were also reported for primary outcome data. Series means were imputed to deal with attrition and missing values. Descriptive statistics were used to examine the acceptability ratings and satisfaction ratings.

## Results

Of 67 teacher/student dyads screened for inclusion, 58 met criteria, completed pre-intervention measures, and were randomized to either the treatment ($n = 28$) or waitlist control ($n = 30$) group. Of the 58 randomized teachers, 52 (89.7%) completed the post-intervention and follow-up measures (treatment $n = 24$; control $n = 28$). Attrition included four treatment group teachers (two withdrew before treatment started, one due to personal family issue, and the other due to time constraints; two were lost to follow-up) and two control group teachers (one withdrew due to health reasons and one was lost to follow-up). See CONSORT flowchart in the appendix for further details. Post-intervention and follow-up measure completion was lower for parents, with a 74.1% completion rate (treatment $n = 19$; control $n = 24$). No pre-intervention differences were found in demographics (i.e., *Teacher*: teacher age, years of teaching, perceived knowledge of ADHD; *Child*: age, grade, sex, ethnicity; *Family*: income, marital status) or baseline measures (i.e., parent and teacher ADHD ratings and impairment ratings) between those teachers and parents who completed all outcome measures at all the time points and those who did not (these analyses are available upon request). Little's MCAR was conducted on teacher data and was not significant, $\chi^2(392) = 380.69$, $p = .65$, indicating randomness in missing values for primary outcome data.

### *Sample Characteristics*

Teachers from the two groups differed in age (the intervention group was younger than the waitlist group) but

**Table 1.** Demographic and Baseline Continuous Variables for the Intervention and Waitlist Groups.

| | Intervention ($n$ = 28) | Waitlist ($n$ = 30) | $F$ value | $p$ value |
|---|---|---|---|---|
| Demographic variables | | | | |
| Child variables | | | | |
| Age | 8.82 (1.83) | 8.83 (1.64) | 0.001 | .98 |
| Grade | 3.74 (1.70) | 3.76 (1.50) | 0.002 | .97 |
| Parental income[a] | 4.32 (2.34) | 5.37 (2.34) | 2.62 | .11 |
| Teacher variables | | | | |
| Age | 37.89 (8.05) | 43.57 (9.88) | 5.70 | .02 |
| Years teaching | 12.28 (7.00) | 15.50 (9.41) | 2.16 | .15 |
| Number of children taught with ADHD | 12.73 (11.25) | 15.41 (11.04) | 0.73 | .40 |
| Perceived knowledge of ADHD[b] | 2.44 (0.58) | 2.63 (0.67) | 1.29 | .26 |
| Baseline variables | | | | |
| CBCL—Attention Problems Syndrome Scale ($T$ score) | 65.56 (10.90) | 65.10 (10.51) | 0.03 | .88 |
| CBCL—ADHD Problems DSM-Oriented Scale ($T$ score) | 66.52 (9.62) | 64.14 (6.82) | 1.56 | .29 |
| TRF—Attention Problems Syndrome Scale ($T$ score) | 63.63 (6.88) | 67.33 (8.76) | 3.11 | .08 |
| TRF—ADHD Problems DSM-Oriented Scale ($T$ score) | 65.19 (6.52) | 67.20 (9.13) | 0.90 | .35 |
| Conners3-T ADHD index ($T$ score) | 79.00 (14.92) | 79.01 (15.40) | 0.00 | .99 |
| Conners3-P ADHD index ($T$ score) | 83.59 (10.54) | 84.03 (10.59) | 0.03 | .88 |
| Teacher overall impairment rating[c] | 3.32 (1.40) | 3.54 (1.22) | 0.40 | .53 |
| Parent overall impairment rating[c] | 3.52 (1.49) | 3.57 (1.49) | 0.01 | .91 |

*Note.* CBCL = Child Behavior Checklist; TRF = Teacher Report Form; Conners3-T = Conners 3rd Edition Teacher Rating Scale; Conners3-P = Conners 3rd Edition Parent Rating Scale

[a]Parental income: 1 = less than Cdn$20,000; 2 = between Cdn$21,000-Cdn$30,000; 3 = between Cdn$31,000-Cdn$40,000; 4 = between Cdn$41,000-Cdn$50,000; 5 = between Cdn$51,000-Cdn$60,000; 6 = between Cdn$61,000-Cdn$70,000; 7 = between Cdn$71,000-Cdn$80,000; 8 = more than Cdn$80,000.

[b]Perceived knowledge: 0 (*no knowledge*) to 4 (*very knowledgeable*).

[c]Impairment: 0 (*no problems*) to 6 (*extreme problems*).

did not significantly differ with respect to sex, number of years of teaching experience, number of children with ADHD previously taught, or self-reported pre-intervention ADHD knowledge (see Tables 1 and 2). Student participants (Grades 1-6) ranged in age between 6 and 12 years ($M$ = 8.83, $SD$ = 1.72), with 51 male students and 7 female students. Students in the treatment and control groups did not significantly differ with respect to age, sex, medication status, grade, parent marital status, parent income, ethnicity, CBCL or TRF screening variables, or pre-intervention scores on teacher and parent Conners3 ADHD Index or overall impairment measures (see Tables 1 and 2).

Treatment tracking revealed that despite the fact that as part of the inclusion screening process, parents indicated that children were not expected to change their medication status over the duration of the study, medication status and dosing did change for some students. During the course of the study, one student started medication (waitlist group), two had a dosage increase of more than 5 mg (one treatment, one control), and six switched medication type (three treatment, three control).

## *Primary Outcome: ADHD Symptoms and Impairment as Reported by Teachers*

Intent-to-treat analyses were conducted, and all missing data were replaced with the overall mean for that assessment period (intervention: $n$ = 28; waitlist: $n$ = 30). For the teachers' Conners3 ADHD Index $T$ scores (see Table 3), there was a significant main effect of time ($\lambda$ = .72), $F(2, 55) = 10.97$, $p < .001$, $\eta^2 = .15$, and a significant group by time interaction ($\lambda$ = .84), $F(2, 55) = 5.21$, $p = .008$, $\eta^2 = .07$. For the treatment group, average Conners 3-T ADHD Index scores decreased by ≈8 $T$-score points from pre-intervention ($M$ = 79.00, $SD$ = 14.92) to post-intervention ($M$ = 71.02, $SD$ = 14.57) and by ≈5 $T$-score points from post-intervention to follow-up ($M$ = 66.03, $SD$ = 14.63), with a total change of ≈13 $T$-score points (which represents more than 1.0 $SD$ change). For the control group, average ADHD Index scores decreased by ≈1 $T$-score point from pre-intervention ($M$ = 79.07, $SD$ = 15.40) to post-intervention ($M$ = 77.85, $SD$ = 14.69) and by ≈1 $T$-score point from post-intervention to follow-up ($M$ = 76.57, $SD$ = 15.12), with a total change of 2.5 $T$-score points (which represents less than 1/3 of an $SD$ change). T-tests for the intervention

**Table 2.** Demographic Categorical Variables for the Intervention and Waitlist Groups.

| | Intervention ($n$ = 28) | Waitlist ($n$ = 30) | $\chi^2$ value | $p$ value |
|---|---|---|---|---|
| Child variables | | | | |
| Sex | | | | |
| Male/female | 26/2 | 25/5 | 1.24 | .27 |
| Ethnicity | | | | |
| Caucasian/non-Caucasian | 24/3 | 28/1 | 1.24 | .54 |
| Parents marital status | | | | |
| Two-parent/single-parent home | 19/7 | 23/6 | 0.30 | .59 |
| Medication status | | | | |
| On/not on medication for ADHD | 24/4 | 23/7 | 0.77 | .38 |
| Teacher variables | | | | |
| Sex | | | | |
| Female/male | 26/2 | 27/3 | 0.15 | .70 |

**Table 3.** Means and Standard Deviations for the Primary and Secondary Outcome Measures.

| | Intervention ($n$ = 28) | Waitlist ($n$ = 30) |
|---|---|---|
| Conners3-T ADHD Index *T* scores | | |
| Pre-Intervention | 79.00 (14.92) | 79.07 (15.40) |
| Post-Intervention | 71.02 (14.57) | 77.85 (14.69) |
| Follow-up | 66.03 (14.63) | 76.57 (15.11) |
| Teacher impairment ratings raw score | | |
| Pre-Intervention | 3.32 (1.40) | 3.54 (1.22) |
| Post-Intervention | 3.26 (0.86) | 3.31 (1.04) |
| Follow-up | 2.79 (1.12) | 3.52 (1.20) |
| Conners3-P ADHD Index *T* scores | | |
| BPre-Intervention | 83.59 (10.54) | 84.03 (10.59) |
| Post-Intervention | 79.80 (14.40) | 82.71 (13.12) |
| Follow-up | 76.66 (14.61) | 80.41 (12.76) |
| Parent impairment ratings raw score | | |
| Pre-Intervention | 3.52 (1.49) | 3.57 (1.50) |
| Post-Intervention | 3.68 (1.61) | 4.26 (1.02) |
| Follow-up | 3.55 (1.73) | 4.50 (1.07) |

*Note.* Conners3-T = Conners 3rd Edition Teacher Rating Scale; Conners3-P = Conners 3rd Edition Parent Rating Scale.

group indicated that there was a significant change from pre-intervention to post-intervention, t(25) = .65, p = <.001, and a trend for significant change from post-intervention to follow-up, t(24) = .39, p = .06. For teacher impairment ratings based on the IRS (see Table 3), there was no significant main effect of time ($\lambda$ = .92), $F(2, 55) = 2.36$, $p$ = .10, $\eta^2$ = .04, but there was a significant group by time interaction ($\lambda$ = .86), $F(2, 55) = 4.67$, $p$ = .01, $\eta^2$ = .06. Similar to the ADHD core symptom ratings (above), there was improvement at both the post-treatment and follow-up periods for the intervention group; however, there was no significant change across the assessment periods for the waitlist control group. For the intervention group, paired t-tests indicated that there was a significant change from pre-intervention to post-intervention, t(25) = .63, p = .001, and from post-intervention to follow-up, t(24) = .590, p = .002.

Note that the above analyses were rerun with participants who completed all outcome measures at all phases of the study (i.e., completer analysis; treatment $n$ = 24; control $n$ = 28). The results were very similar and as such are not reported in the article. Similarly, there were no significant-differences in findings when the children who had medication changes were removed from the analyses (treatment $n$ = 24; control $n$ = 25).

## *Secondary Outcome: ADHD Symptoms and Impairment as Reported by Parents*

Intent-to-treat analyses (intervention: $n$ = 28; waitlist: $n$ = 30) were conducted to assess changes in parent report of ADHD symptoms and impairment in their children (see Table 3). For the parents' Conners3 ADHD Index *T* scores,

there was a main effect of time ($\lambda = .85$), $F(2, 55) = 4.80$, $p = .01$, $\eta^2 = .09$, but there was no group by time interaction ($\lambda = .98$), $F(2, 55) = 0.56$, $p = .58$, $\eta^2 = .01$. Both groups were reported to have fewer ADHD symptoms across time with an overall change of ~7 *T*-score points for the children in the intervention group and a ~3.6 *T*-score point change for the children in the waitlist group. Both these changes represent less than 1 standard deviation change across the 12 weeks of this study.

Similar to the parent report of ADHD symptoms, for the impairment ratings there was a marginal main effect of time ($\lambda = .90$), $F(2, 55) = 3.08$, $p = .054$, $\eta^2 = .07$, but there was no group by time interaction ($\lambda = .92$), $F(2, 55) = 2.31$, $p = .11$, $\eta^2 = .05$. Impairment ratings stayed the same across time for the treatment group but worsened over time for the waitlist group (see Table 3).

### *Fidelity*

The intervention was delivered as planned in terms of releasing the content at the planned times via our web-based learning management system. On average, teachers reported reviewing 98.4% of the PowerPoint slides and completing 88.1% of the worksheets. They also reported accessing 74.1% of the supplemental materials. On average, teachers posted 4.56 times on the Discussion Board and contacted the ADHD coach via email on average 1.48 times across the six sessions. However, there was large variability among teachers, with a range of 0 to 16 posts for the Discussion Board and 0 to 9 for email messages to the ADHD coach. Engagement with the Discussion Board and coach was not related to treatment outcomes for ADHD core symptoms based on the Conners3-T ADHD Index difference scores between pre-intervention and post-intervention (Discussion Board: $r = -.28$, $p = .15$; ADHD coach: $r = -.32$, $p = .10$).

### *Treatment Satisfaction*

Only those teachers and parents whose children were randomized to the treatment group completed the post-intervention satisfaction measures. Qualitative data were reported in Elik et al. (2015). In most cases, teacher satisfaction was high, with a mean rating of 4.81 on a scale ranging from 1 to 6. Discussion Board was given the lowest rating, while the supplemental links and worksheets were rated more favorably as was the collaborative and easy-to-use format of the intervention. Average means and standard deviations for each of the teacher satisfaction ratings are presented in Table 4.

Average parent satisfaction ratings (Table 5) were lower than teacher ratings, with a mean rating of 3.11 on a 6-point scale (possible range of 1-6). While parents reported that they were included in the intervention, they did not notice improvements in their children's behavior at school or home and also did not believe that they themselves learned any new information.

**Table 4.** Average Teacher Intervention Satisfaction Ratings.

| Statement | *n* | *M* (*SD*)[a] |
|---|---|---|
| 1. The content of the intervention was presented in a manner that was easy to understand. | 25 | 5.28 (0.84) |
| 2. The content of the intervention was easily adaptable to meet the particular needs of my student. | 25 | 4.72 (0.94) |
| 3. The intervention encouraged a collaborative process between the student, teacher, and parent. | 24 | 5.00 (0.98) |
| 4. The intervention was presented in a collaborative manner (as opposed to authoritarian manner). | 25 | 5.52 (0.56) |
| 5. My student's behaviors at school improved as a result of this intervention. | 24 | 4.25 (0.68) |
| 6. My student seemed to enjoy the intervention. | 23 | 4.48 (0.79) |
| 7. The delivery of the intervention through the Internet was accessible and user-friendly. | 25 | 4.80 (1.08) |
| 8. The Discussion Board was useful and informative. | 25 | 4.00 (1.26) |
| 9. The worksheets that went along with the PowerPoint presentations were useful. | 25 | 5.16 (0.90) |
| 10. The supplemental information (i.e., web-links) was useful. | 25 | 5.20 (0.91) |
| 11. The delivery of the intervention in a flexible format (so I could work on it based on my schedule) made it easier to implement. | 25 | 4.24 (1.74) |
| 12. My communications with the coach were helpful. | 16[b] | 4.56 (1.31) |
| 13. I learned new things in this intervention. | 25 | 5.36 (0.86) |

[a]Answer options were as follows: 1 = *strongly disagree*; 2 = *disagree*; 3 = *slightly disagree*; 4 = *slightly agree*; 5 = *agree*; 6 = *strongly agree*.
[b]Not all teachers chose to utilize the available coach support; therefore, fewer teachers provided an answer for this item ($n = 16$).

## Discussion

The primary purpose of the current study was to evaluate the acceptability and effectiveness of an eHealth intervention for teachers of elementary students with ADHD. To our knowledge, this represents the first time that an eHealth format has been used to provide teachers with knowledge and support to implement evidence-based interventions with

**Table 5.** Average Parent Intervention Satisfaction Ratings.

| Statement | *n* | *M* (*SD*)[a] |
|---|---|---|
| 1. As a parent, I felt included in the school-based intervention. | 24 | 4.33 (1.52) |
| 2. My child's behaviors at school improved as a result of the intervention. | 21 | 3.43 (1.29) |
| 3. My child's behaviors at home improved as a result of the intervention. | 23 | 2.44 (1.24) |
| 4. My child seemed to enjoy the intervention program. | 19 | 3.47 (1.26) |
| 5. I learned new things through my child's participation in this intervention. | 19 | 1.90 (0.94) |

[a]Answer options were as follows: 1 = *strongly disagree*; 2 = *disagree*; 3 = *slightly disagree*; 4 = *slightly agree*; 5 = *agree*; 6 = *strongly agree*.

their students with ADHD. A RCT was conducted in which students' core ADHD symptoms and impairments were evaluated through teacher and parent questionnaire data pre-treatment, post-treatment (after 6 weeks), and after an additional 6-week follow-up period. Teacher acceptability of the intervention program as well as teacher and parent satisfaction with the *Teacher Help for ADHD* program was measured for those randomized to the intervention group. The program was found to be efficacious in reducing core ADHD behaviors and reducing impairment in the school setting based on the ratings of teachers, the primary users of the intervention. Parents, who did not have access to the intervention but with whom the children's teachers had been encouraged to collaborate, did not endorse any improvements in their children's ADHD symptoms at home. Teachers reported very high levels of acceptability of the program (i.e., completion of the majority of the intervention components). Similarly, teacher satisfaction with the program was strong. Unsurprisingly, given their report of no change in the children's ADHD symptoms at home, parent satisfaction was lower than teachers.

The primary outcome measure for the study was teacher report of students' ADHD symptoms and impairments, as indicated on the *Conners3-T ADHD Index* and *IRS*. It was hypothesized that compared with pre-treatment scores, post-treatment and follow-up scores would reveal significantly fewer ADHD symptoms and reduced impairment. This hypothesis was supported, with intent-to-treat analyses showing significant improvement in ADHD scores and impairment scores for those participants randomized to the treatment group compared with those in the control group. Statistical significance and low-medium effect sizes indicate that the *Teacher Help for ADHD* intervention effectively improved teacher's report of students' core ADHD symptoms in the classroom. Although students in the treatment group still displayed ADHD symptoms post-intervention, teacher report of symptoms and impairments was sufficiently reduced to significantly improve classroom functioning. In fact, there was greater than 1 standard deviation change, and the average *T* score approached the average range based on the Conners' scoring criteria (i.e., a *T* score of 65 or below is considered to be in the average range, and the average *T* score for the treatment group at follow-up was 66). Interestingly, it was found that significant improvement was found between pre- and post-intervention for both ADHD symptoms and impairment and that improvements continued between post-intervention and follow-up (significant for impairment ratings and a strong trend for ADHD symptoms). These results potentially imply that teachers continued to implement the strategies after the intervention which resulted in additional improvements after the formal intervention period. Our findings are generally consistent with past research that demonstrates that in-person teacher educational interventions are effective in improving ADHD symptoms and impairments in children with ADHD (DuPaul et al., 2012; Miranda et al., 2002; Owens et al., 2009).

The secondary outcome for the study was parent reports of students' ADHD symptoms and impairment ratings. It was expected that the parents of the participants assigned to the treatment group would experience significant improvements in ADHD symptoms at home, as it was thought that the skills learned at school would generalize to the home setting through parent–teacher collaboration. However, this hypothesis was not supported. This non-significant result, while unexpected, was not surprising, as generalization of skills to an environment other than the one in which the treatment is delivered is rare and the *Teacher Help for ADHD* program did not explicitly attempt to generalize these skills.

The final hypotheses tested were that teachers would provide strong acceptability ratings of the intervention, and that teachers and parents would report high levels of satisfaction with the intervention. Excellent acceptability to the key intervention components was found (e.g., teachers reported reviewing 98% of the PowerPoint presentations and completing 88% of the worksheets); however, use of the Discussion Board and ADHD coach was lower than expected. Moreover, use of these communication tools was not associated with increased benefits in terms of improvements in the children's ADHD symptoms. However, it is important to note that these communication options may have improved satisfaction and adherence to the program, and as such may be valuable components even though they may not directly affect overall effectiveness of the intervention.

Post-intervention satisfaction scores for treatment group teachers were high, indicating that teachers found the intervention to be readily accessible, feasible, well presented, collaborative, and effective. The majority of teachers also agreed or strongly agreed that they learned new things during the intervention. Parent responses were less positive. Most parents reported that while they felt included in the school-based intervention, they did not learn new things throughout the intervention. Again this finding is not surprising, given that there were no specific intervention components for parents.

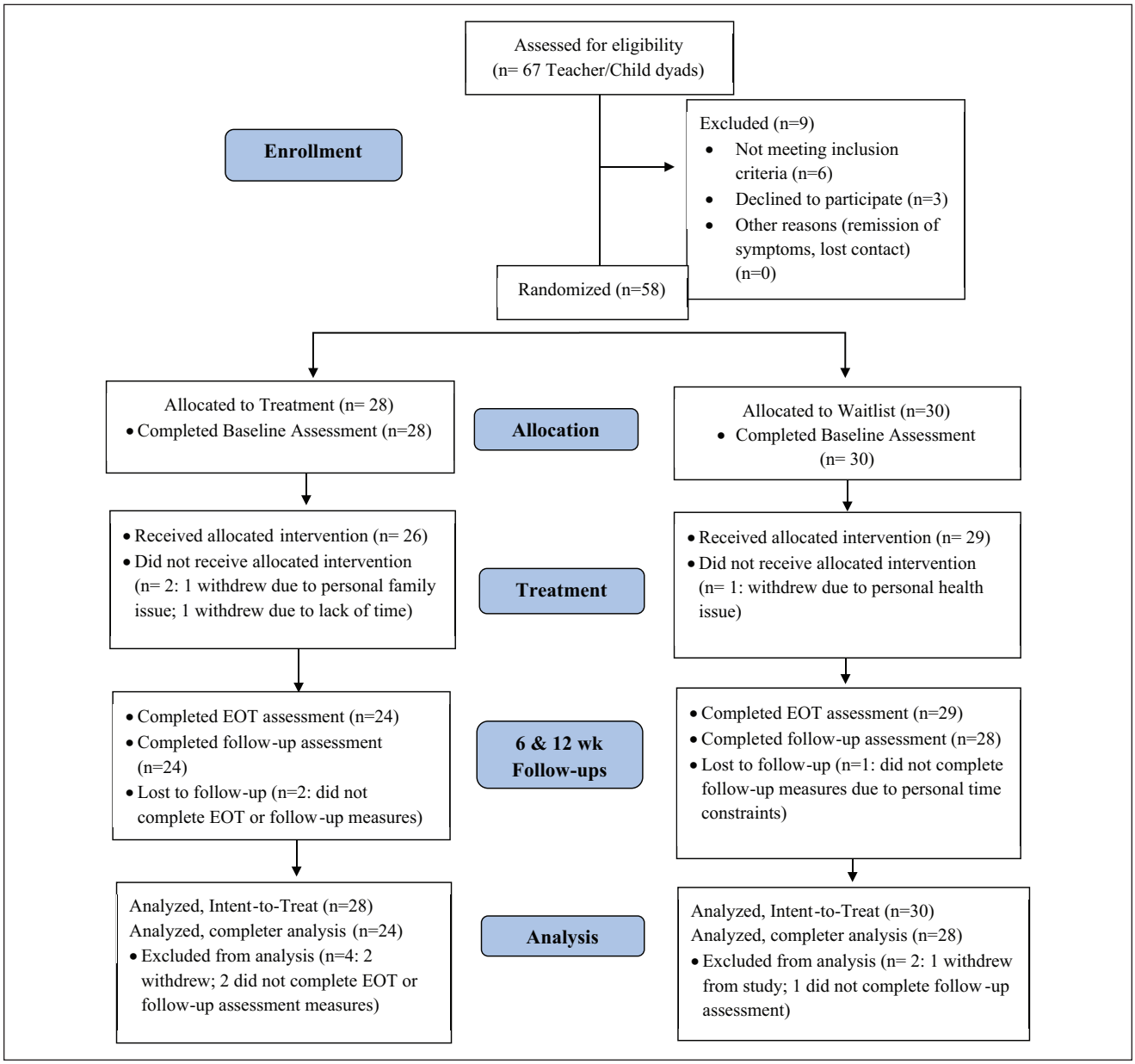
Results of the current study support and extend prior research on eHealth interventions for physiological and mental health conditions (Ritterband & Tate, 2009). Findings indicate that web-based treatments can effectively create behavioral change in children with ADHD, and that evidence-based school interventions can be delivered via this distance modality. Teacher acceptability and satisfaction was high for Internet delivery of the key intervention components and moderate for the Discussion Board and high for the available coach support, although only a handful of teachers chose to take advantage of coach availability. No deterioration was found on any study measure, and qualitative analysis of the teachers' feedback did not indicate any harms of the intervention (Elik et al., 2015). This information will be taken into consideration as we prepare this intervention for the next step (commercialization), which will allow the program to be sustainable over the long term.

Despite empirical support for school-based ADHD interventions, barriers to treatment prevent many teachers from being able to access evidence-based behavioral interventions. Results of the current study are promising for overcoming common treatment barriers such as a lack of professional development opportunities with respect to ADHD, lack of time, limited budgets for these opportunities, and a lack of ongoing consultative support, often leading to low treatment adherence (Schultz et al., 2011; Watabe, Stewart, Owens, Andrews, & Griffeth, 2013). The flexible, web-based delivery of the *Teacher Help for ADHD* program allows teachers to access a great amount of knowledge about ADHD at their own pace, whenever it is convenient, and at a low cost compared with resource-intensive traditional treatment programs. Future research should investigate how cost-effective *Teacher Help for ADHD* is compared with more traditional interventions.

Despite the promising results, it is important to note that there are a number of limitations that must be taken into consideration when interpreting these findings. First, despite exclusion criteria stating that child participants were not to have planned medication status or dose changes for the study's duration, several medication changes did take place. It is possible that in some cases, medication changes affected teacher and/or parent ratings across the study. It is important to note, however, that when analyses were run without data from these participants in the analyses, overall results remained the same. Second, there were some limitations with regard to sampling. Specifically, the student sample was largely male, the teacher sample largely female, and volunteer bias may have affected the generalizability of the study results to teachers who would be less likely to sign up for a study of this nature. These problems mirror the reality of the sex distribution for ADHD and for elementary school teachers, as well as problems with volunteer bias that exist in most research. The third and perhaps most important limitation is that the teacher and parent report of child behavior was not blinded, and the fact that teachers and parents were invested in helping children to achieve behavioral change may have biased their ratings. This is a common problem in psychosocial intervention research. In the future, researchers are encouraged to replicate the findings of this study using blinded observers in the classroom, as well as to use additional outcome variables such as tests of academic achievement.

Despite these limitations, the primary results of this study have exciting implications for the mental health and eHealth fields. We are currently preparing another paper that examines weekly changes in child outcomes as well as predictors of change such as changes in teacher's knowledge and attitudes. While school-based behavior programs, including the current intervention, have been shown to improve ADHD symptoms in the school environment (DuPaul, Eckert, & Vilardo, 2012; DuPaul et al., 2011), parent training programs have a great deal of research support for improving behaviors in the home environment. Given the success of the current online delivery of the *Teacher Help for ADHD* intervention, future research efforts could focus on expanding this program to become a multi-modal, non-pharmacological intervention that would include a complementary parent training component (see, for example, Pfiffner et al., 2014). For example, this intervention could be paired with an online parent intervention such as Strongest Families (McGrath et al., 2011). Our research group is also working toward preparing other modules of *Teacher Help* to extend the program to other grades and mental health disorders, and we have recently completed a feasibility study for *Teacher Help for Learning Disabilities*. To our knowledge, the current research represents the first application of an eHealth intervention delivered to elementary school teachers as a means to help them treat mental health symptoms of students in their classrooms.

# Appendix




CONSORT 2010 flow diagram for teacher help for ADHD Study.

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## Declaration of Conflicting Interests

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## Note

1. Cohort 1 accessed the intervention and completed pre-intervention assessment measures through Online Web Learning (OWL); however, following the first cohort, the research institution upgraded to a new generation of this learning system, named Blackboard Learn (BBLearn). The change to the new version was completed prior to Cohort 2 recruitment and did not alter the intervention components.

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