Technology-assisted Interventions for Parents of Young Children: Emerging Practices, Current Research, and Future Directions

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Abstract

Technology can potentially expand the reach and cut the costs of providing effective, evidence-based interventions. This paper reviews existing publications that describe the application and evaluation of technology-assisted interventions for parents of young children. A broad review of the early childhood literature revealed 48 studies describing technology-assisted parent education and interventions. Across these studies, multiple forms of technology were used, including web-based platforms, discussion forums, mobile devices, and video conferencing. Results are described moving from feasibility and acceptability of technology-based delivery systems to more rigorous evaluations examining their impact on parent and child outcomes. Potential exists for technology to deliver interventions to parents. Limitations are discussed including differential acceptability and elevated attrition associated with internet-only intervention delivery.

The use of technology-assisted communications to deliver and enhance health and mental health interventions (e-health and m-health) emerged in 2000 and has proliferated rapidly (Pagliari et al., 2005). Behind this rapid growth is the belief that technology (including web-based information delivery, online discussion forums, mobile devices, and video-conferencing) has substantial potential to improve the quality of intervention delivery and to enhance the engagement of universal and at-risk populations (Jones, 2014). In particular, new technologies offer hope for the widespread diffusion of evidence-based interventions, by increasing accessibility and reducing costs (Jones et al., 2013; Self-Brown & Whitaker, 2008).

Increasingly, technology-assisted strategies are being incorporated into parenting interventions. For example, recent reviews have described innovative technological applications in parent management training programs (Breitenstein, Gross, & Christophersen, 2014; Jones et al., 2013), child maltreatment prevention and intervention

(Self-Brown & Whitaker, 2008), and programs to promote child health (Nieuwboer, Fukkink, & Hermanns, 2013). The use of technology to enhance parenting interventions has particular relevance for practitioners and researchers focused on early childhood. A wide array of parenting interventions have been developed and evaluated for use with young children, resulting in a large number of evidence-based programs, but promoting wide diffusion remains a challenge (for reviews see Brooks-Gunn, Berlin, & Fuligni, 2002; Welsh, Bierman, & Mathis, 2014). This paper provides a review of the way that technology is being incorporated into interventions designed for parents of young children (ages 0-5 years). It describes the scope of the efforts to use various forms of technology, reviews evidence that supports the potential and impact of technology-assisted interventions, and describes limitations and future directions.

The Importance of Providing Interventions to Support Parents of Young Children

There is no doubt that the quality of parenting that children receive during the first five years has life-long consequences for physical, emotional, social, and cognitive development (Bornstein, 2002). A large number of interventions have been developed to improve the parental care of young children and enhance the quality of parent-child relationships, typically by promoting positive parenting practices and coping skills, and increasing social support and parental efficacy (Welsh et al., 2014). By intervening with parents during early childhood, the hope is to promote positive short-term outcomes for parents and children and, in addition, to foster positive developmental trajectories in the future (Brooks-Gunn et al., 2002).

Many of the programs designed to promote positive parenting in early childhood have been evaluated in carefully controlled trials, resulting in a substantial number of evidence-based parenting interventions targeting children in the age range of 0-5 years. For example, in a recent review, Child Trends identified 32 parenting interventions for young children as evidence-based, based on findings from controlled research trials of positive impact in at least one domain of child functioning (e.g., physical health, cognitive development, externalizing behavior, social skills, mental health) or parent functioning (e.g., substance use, child maltreatment, parent-child relationship quality, parenting skills) (Kahn & Moore, 2010). Similarly, the Department of Health and Human Services launched a review of the effectiveness of home visiting programs in 2009. In their review of programs serving families with young children (age 0-5 years), 14 interventions met criteria for evidence-based early childhood home visiting interventions (Avellar, Paulsell, Sama-Miller, & Del Grosso, 2013).

Despite the importance and availability of evidence-based interventions for parents of young children, diffusing these programs remains a challenge. Key issues limiting the reach of evidence-based parenting programs include: a lack of sufficiently trained providers and challenges in maintaining high-fidelity implementation as programs "go to scale", difficulties engaging and retaining parents in interventions, and limited accessibility due to the cost and pragmatics of delivering the intervention, particularly in remote areas.

Conceptually, the use of technology-assisted communication strategies has the potential to reduce these challenges and promote the broad diffusion of evidence-based interventions.

Potential of Technology to Improve Reach and Impact of Parenting Interventions

In their 2008 review of technology applications in the field of child maltreatment, Self-Brown and Whitaker describe how internet applications can improve child maltreatment screening, deliver and extend evidence-based interventions to at-risk parents, and support staff training and high-fidelity intervention delivery. In addition, telemedicine and internet conferencing can reach parents who are isolated geographically (e.g., in the military; in rural locations) or have very specialized treatment needs (e.g., children with rare or complex medical problems). In such cases, technology can provide increased access to information and professional advice, as well as offering supportive networks for providers (i.e., communities of practice) and parents experiencing similar challenges.

A variety of technology-assisted parenting interventions have emerged in the field of early childhood, ranging from universal programs for new parents to indicated interventions targeting various child difficulties, including attention deficit-hyperactivity disorder (Deitz, Cook, Billings, & Hendrickson, 2009; Reese, Slone, Soares, & Sprang, 2012), traumatic brain injury (Antonini et al., 2014), and fetal alcohol spectrum disorders (Kable, Coles, Strickland, & Taddeo, 2012), among others. A variety of technology tools are applied in these programs, including the use of the internet to deliver information, the use of online discussion forums to improve parent social support networks, the use of mobile phones or texts for brief interventions or to enhance interventions, the use of video teleconferencing to connect providers and parents, and multi-component or hybrid models that blend different forms of technology use and face-to-face intervention delivery.

Emerging applications and current research suggest that technology may have considerable potential to improve the reach of evidence-based interventions for parents of young children. At the same time, much of the available research focuses on parent attitudes toward and reactions to different forms of technology-assisted intervention. Although a growing number of studies use randomized designs to evaluate the impact of technology-assisted interventions, most rely on parent report to assess outcomes. Only a few randomized-controlled trials (RCTs) of technology-assisted interventions include multiple or direct measures of parent and child outcomes (Antonini et al., 2014; Baggett et al., 2010; Sheeber et al., 2012; Vismara, McCormick, Young, Nadham, & Monlux, 2013), and only a very few compare the impact of interventions delivered via technology versus face-to-face to determine their relative efficacy (e.g., Bert, Farris, & Borkowski, 2008; Kable, Coles, Strickland & Taddeo, 2012). For this reason, it is premature to draw strong conclusions about the utility of technology-assisted interventions, but important to encourage further rigorous study of their potential.

The Present Review

This paper provides a broad overview of the existing published research on the use of technology to deliver interventions to parents of young children, focusing on children age 0 – 5 years. Studies are described in three broad sections including: 1) uncontrolled studies that examine the feasibility and acceptability of technology-assisted interventions, 2) controlled studies that examine intervention impact on parent and child outcomes, and 3) controlled studies that compared the impact of an intervention when delivered via technology or using an alternative format, such as via print or face-to-face delivery.

To elicit articles addressing technology-assisted parenting interventions, a broad search was conducted using the terms *parenting* or *parenting intervention* in combination with the following terms: telehealth, technology, computer, internet, web-based education, videodisk, video, cell phone, videoconferencing, smart-phone, and *internet-based treatment.* PubMed, ERIC and PsychINFO were searched separately. This combination of searches yielded 654 references although many of these were repeated across search terms and engines. The results were inspected by hand in order to determine relevance to parents of young children. In addition, the references for each of these papers were inspected for any additional relevant citations.

Studies that targeted children over age 5 years were excluded. In some cases, studies targeted children in a wide age range that included young children (0-5 years) along with older children; these studies were retained. New technologies were the focus, hence when technology use was limited to radio or podcast delivery, DVD models, telephone calls, or video feedback, studies were not included. When multiple articles from the same research group or study were found, only those that described primary outcomes or follow-up findings were included; initial papers describing program design or pilot-testing were not included. Studies that focused solely on interventions directed toward children but not parents were excluded, as were articles on professional development. These criteria led to a set of 48 studies reviewed in this paper.

Exploring the Feasibility and Acceptability of Technology-assisted Interventions

This section includes studies that explored the feasibility and acceptability of technology-assisted interventions by assessing parent use, response to, and ratings of the parenting materials. In several of these studies, parents are not necessarily in need of or require specific intervention but rather are seeking parenting advice and information. These studies did not include a comparison group to assess program impact. They are organized according to the type of technology used: web-based platforms, online discussion forums, mobile devices, and videoconferencing. For a summary of studies, see Table 1.

Web-based platforms for information delivery

The most common use of technology has been to post intervention materials on the web, so that they are accessible and can be used by parents at their convenience. Some studies have examined parental response to existing web resources, whereas others have designed specific

web-based programs for parents. The hypothesis is that, relative to other forms of written or oral communication, web-based platforms are more accessible and engaging because they can include photographs, audio, and video to animate educational materials (Pagliari et al., 2005).

Several studies have used surveys or focus groups to determine how parents feel about getting parenting information electronically. For example, in a naturalistic study, Lerner, Ciervo, and Parklakian (2012) surveyed parents through *Zero to Three* magazine asking them about their preferred sources of parenting information, and found that half of the respondents reported that they used the internet to get information about their infant. Targeting a more ethnically and socioeconomically diverse sample in focus groups, Mackert, Kahlor, Tyler, and Gustafson (2009) found that 43 parents reported using the web to find information about child health and child obesity prevention, but avoiding websites with *.edu* or *.gov* extensions which they assumed would be too complex to be helpful. Two additional studies identified some socio-economic differences in the acceptability of the internet as a source of parenting information. Larose, Bedard, Hammami, and Terrisse (2008) surveyed 1,406 parents of preschool children about their preferred medium of receipt for parenting information. Parents who had lower income reported that they preferred pamphlets, books, television, or radio whereas higher income parents preferred email. Similar findings regarding social class differences emerged in a more recent survey conducted by Walker, Im, & Vaughan (2012) with 145 new mothers. Although almost all mothers noted they used the internet, email, and cell phone on a daily basis, slightly fewer than half (45%) indicated an interest in receiving parenting advice through the internet. Mothers with higher incomes more often preferred the internet, whereas mothers with lower incomes more often preferred printed materials delivered by mail.

Overall, this set of studies suggests that about half of parents are receptive to and actively pursue the use of the internet to receive information about child development and parenting issues (Lerner et al., 2012; Walker et al., 2009). However, social class differences are evident in some studies, with higher income parents being more receptive and lower income parents less receptive to internet intervention delivery (Larose et al., 2008; Mackert et al., 2009). Some of these differences may be related to experience, access or comfort with technology. Further exploration may elucidate the nuances of these differences in ratings.

Online discussion forums to promote social support

In addition to providing information designed to promote positive changes in parenting practices, many interventions for parents also aim to enhance social support and promote feelings of parenting efficacy. In face-to-face interventions, this is often done by delivering parenting interventions in groups. Technology offers several ways to link parents with each other, strengthening social support via the use of chat rooms, discussion blogs, or social media. A number of studies have explored the feasibility and acceptability of online discussion forums for parents of young children, either as "stand alone" interventions or as components included in more comprehensive interventions.

Several of these studies focused on new parents who have unique needs for social support. For example, in a naturalistic study of 150 new mothers and fathers, Bartholomew and

colleagues (2012) tracked the use of Facebook and its association with parent feelings of stress and support. More than half of the mothers and fathers in their sample reported that their use of Facebook stayed the same or increased after the birth of their child. In general, frequent updates to Facebook (e.g., uploading photos, posting) were associated with increased stress. However, when Facebook networking was limited to existing relationships (e.g., close family and friends) and when parents received frequent positive comments to their postings, parents reported more satisfaction with their parenting role. Interestingly, when Kaufman and Buckner (2014) sampled the contents of posts on Facebook pages that were aimed at mothers, a large percentage focused on the promotion of parenting products (e.g., advertisements), reflecting the challenge associated with trying to control content in publically-accessible online discussion forums. Nonetheless, respondents to a survey posted on a Swedish parenting website indicated that they appreciated the online discussions and valued assistance from peers more than assistance from experts (Sarkadi & Bremberg, 2005), and similarly, first-time parents rated a discussion board designed for them as safe and supportive, and reported using it to de-mystify parenting myths and to join discussions focused on maternal caregiving to infants (Brady & Guerin, 2010). Of note, the Sarkadi and Bremberg (2005) respondent sample was mostly female (95%), relatively young (M_{age} = 30), and lower income (68% with income levels below the national average), suggesting that online discussion forums may particularly appeal to younger and lower-SES mothers.

Several studies have also explored the use of online forums and discussions to create social support networks for parents whose children have complex and unusual medical conditions. For example, Van der Zanden, Speetjens, Arntz, and Onrust (2010) conducted a pilot study (pre-post with no comparison group) of an interactive web-based chat room for parents with mental illness. Eight 90-minute lessons were conducted in a chat room with trained facilitators. Parents reported improved parenting skills and feelings of parenting competence. Unfortunately, this study had a low completion rate (58%), suggesting that a substantial subgroup of participants became disengaged during the intervention. In a second example, an email list-serve was used to increase support for parents of children with cancer (Bragadottir, 2008). Parents were encouraged to share their experiences, thoughts, and feelings on a list-serve facilitated by a nurse or social worker. After four months of access to the list-serve, pre-post measures suggested reduced depressive symptoms (for mothers) and anxiety (for fathers).

Blogs have also been used to improve parent-teacher communication. For example, as part of a comprehensive program that included home visits, preschool teachers serving children with autism spectrum disorders used blogs to update parents on school activities (Powell & McCauley, 2012). The program developers noted that the blogs had the potential to reduce barriers, such as those caused by parent work schedules, lack of transportation, or comfort levels that might otherwise decrease parent-teacher communications. However, the study did not include data regarding the use of the blogs by parents or how parents felt about them.

In summary, online discussion forums and blogs are viewed as intervention components that might foster social support and feelings of parenting efficacy for new parents and parents with special needs. Although most of the uncontrolled studies described here describe positive parent responses, controlled comparisons are needed to validate these findings.

Some of the study findings suggest that social media (chat rooms, blogs, Facebook) may not always engage parents effectively or provide the intended support. Further study is clearly needed to determine how various online networking options are best used to benefit parents of young children.

Use of mobile devices and videoconferencing

Whereas web-based platforms and online discussion forums are designed to provide information to groups of parents, technology has also been used to deliver or enhance individualized interventions. In particular, mobile phones, text messaging, email, and videoconferencing (VTC) can all be used to support contacts between individual families and intervention staff. Interventions may use mobile device delivery as the sole intervention component. For example, in the *Text4baby* intervention described in more detail in the following section, the entire intervention is delivered via text messages (Evans, Abroms, Poropatich, Nielsen, & Wallace, 2012). However, more often, mobile devices are used as an ancillary intervention component, to enhance parent engagement and expand therapist-parent contact. For example, email communication with a therapist was combined with online learning modules in an intervention designed to address post-partum depression. Pugh, Hadjistavropoulous & Fuchs (2014) reported a case study showing strong therapeutic alliance, treatment satisfaction, and reduced depressive symptoms. Similarly, Danaher and colleagues (2013) designed *MomMoodBooster* for women suffering from postpartum depression. This intervention included a 6-session cognitive-behavioral intervention for mothers combined with an online peer support discussion board and supplemented with individualized coach phone calls. In an initial pilot feasibility trial, the study had a high completion rate (87%) and the number of mothers meeting diagnostic criteria for depression dropped from 55% to 10% post-intervention.

In contrast, VTC is often used alone, as a means of delivering a face-to-face intervention in real time across distances. Although at first dependent upon dedicated systems, recently developed software such as *Skype®* now supports videoconferencing using computers making it much more accessible and portable. Conceptually, offering an intervention via VTC may be equivalent to providing intervention face-to-face, as parents can converse with therapists in real time, and therapists can observe parent-child interactions and offer feedback in real time. VTC is viewed as a strategy that can increase access to services in remote locations and can also be used to replace or augment face-to-face interventions to decrease costs.

This review identified four studies that evaluated the feasibility of videoconferencing for parents of young children. In one study, Hamren and Quigley (2012) demonstrated the feasibility of using VTC to provide services to parents of young children with hearing loss, but did not report data on implementation or outcomes. In another study, Kelso and colleagues (2009) delivered an early intervention program using *Adobe Connect Pro*. In a small sample of four families, there was mixed satisfaction among parents using the new model due to technical difficulties and issues with hardware. However, initial analyses in this study showed a reduction of costs by about $500 (as compared to rural home visiting programming) for the four children served. In a third study of parents of children with

traumatic brain injury, six therapists worked with 13 parents of children with brain injuries, using the Internet-Based Interacting Together Everyday Recovery After Childhood TBI (I-InTERACT). This parenting skills program includes 10-14 sessions that combine self-guided web modules with live therapist coaching via VTC (Wade, Oberjohn, Conaway, Osinska, & Bangert, 2011). The study focused primarily on establishing the viability of VTC, and managing issues associated with privacy and boundary-setting. Initial findings suggested that therapists and parents both liked the system and found it helpful. Finally, in the fourth study, Lipman, Kenny, and Marziali (2011) adapted a 10-week face-to-face group parent education and support program for a single mothers' group connected through VTC. Participants reported decreased isolation, increased knowledge, and increased parenting efficacy. VTC sessions have also been integrated with other forms of intervention delivery (Harris et al., 2013). For example, designed for parents of children with complex medical conditions, the Behavioral Family Systems Therapy model utilizes home visits, email, clinic visits, VTC, and text messages. The hybrid model was designed to increase engagement and reduce burden on already-taxed parents, although impact data were not available at the time of this review.

Studies reviewed in this section focused on the feasibility and acceptability of technology-assisted interventions for parents of young children, using descriptive evaluations without comparison groups. They show that a variety of technologies are being used, but fall short of evaluating impact. In general, web-based platforms for information delivery, online discussion forums, mobile devices, and VTC all appear feasible. At the same time, some evidence of mixed acceptability and responsiveness also emerged. Two studies suggested that web-based and email information delivery may be less attractive to low than to high SES families (Larose et al., 2008; Mackert et al., 2009), although another suggested that online discussion forums may attractive to low SES families (Sarkadi & Bremberg, 2005). More nuanced studies of technology-assisted intervention components are needed to address user factors that may moderate acceptability.

Evaluating the Impact of Technology-Assisted Parenting Interventions

Moving beyond evaluations of feasibility and acceptability, researchers have begun to use controlled designs to evaluate the impact on technology-facilitated interventions on parent and child outcomes. This section includes single case experimental designs, quasi-experimental comparison studies, and RCTs that compared technology-assisted interventions with no treatment, waitlist, "usual care", or minimal treatment control groups. Studies are organized by delivery mode, including web-based platforms and online discussion forums, mobile devices, and VTC. For a summary of these studies, refer to Table 2.

Web-based platforms and online discussion forums

The most basic use of the web has been to provide resources and information for parents. For example, *KidzGrow Online* provided a resource library to parents of children aged 0-6 years. Parents randomly assigned to access, relative to a wait list, showed positive gains in child development knowledge and more confidence in their parenting (Na & Chia, 2008).

Web-based platforms have also been used to deliver specific parenting programs that involve a sequence of lessons or sessions. Working with parents who were diagnosed with depression or schizophrenia, Kaplan and colleagues (2014) compared access to a 12-week online parent education program and moderated list-serve with access to an online healthy lifestyle course. Relative to the healthy lifestyle control, parents in the intervention condition reported decreased parenting stress and improved parenting and coping skills. In a second example, Salonen and colleagues (2008) studied the impact of an online breastfeeding and infant care class that included opportunities to ask questions online and participate in discussion forums. Although a preliminary study suggested that the intervention promoted breastfeeding (Salonen et al., 2008), two later trials showed no significant differences between parents in the intervention group relative to a comparison group who received standard care (Salonen et al., 2011; Salonen, Pridham, Brown, & Kaunonen, 2014).

In some cases, evidence-based face-to-face parenting programs have been adapted for online delivery. For example, the COMET (COmmunication METhod) parent management training program was adapted for online delivery in Sweden and evaluated with a RCT (Enebrink, Hogstrom, Forster, & Ghaderi, 2012). Seven sessions, each 90-minutes long, addressed communication skills, positive parenting, and behavioral principles. Online modules with video examples were combined with an online discussion forum moderated by the research team. Relative to a waitlist control group, parents in the intervention group demonstrated a significant decrease in reported child behavior problems with improvements maintained at 6-month and 18-month follow-up assessments (Enebrink et al., 2012; Hogstrom, Enebrink, Melin, & Ghaderi, 2014). The number of sessions and amount of homework completed during intervention predicted sustained improvements (Hogstrom et al., 2014).

These studies suggest that online interventions can effectively promote improvements in parent knowledge and feelings of parent efficacy, as well as reduce parenting stress (e.g., Kaplan et al., 2014), although they do not always do so (e.g., Salonen et al., 2011, 2014). The most comprehensive program in this group, *COMET* also produced reductions in child behavior problems, based on parent report (Enebrink et al., 2012).

Use of mobile devices

In addition to web-based program delivery, researchers have examined the use mobile devices (text, mobile phones, email) to deliver or enhance parenting interventions. In this review, we found only one study that evaluated mobile devices for "stand alone" intervention delivery. *Text4baby,* designed for expectant parents, involves a series of personalized texts (three per week) on topics such as prenatal nutrition, health care, developmental milestones, breastfeeding, and infant care (Evans, Abroms, Poropatich, Nielsen, & Wallace, 2012). A trial compared 90 mothers randomly assigned to receive *text4baby* along with usual clinic care to a control group who received usual care alone. Participants reported feeling more prepared for motherhood in the *text4baby* condition, and among those with a high school education or higher, also endorsed stronger attitudes against prenatal alcohol use.

More often, mobile devices supplement or extend interventions. For example, Jabaley, Lutzker, Whitaker, and Self-Brown (2011) used iPhones to augment the safety module of the *SelfCare*® child maltreatment prevention program. Parents used the phone to show

intervention staff how they were implementing the program and reducing home hazards, and then received feedback via the phone. A multiple baseline study with three families showed hazards reduced to almost zero, indicating that the iPhone visual and oral communication promoted safe home environments and reduced the need for face-to-face home visitations.

Email has also been used to supplement other interventions. For example, in the *New Mothers and New Fathers Networks* designed for young African American parents, online parenting information and discussion boards are complemented with email access to nurses, which new parents use to discuss their experiences and concerns, as well as to attain support. An initial study showed increased satisfaction and parenting efficacy among fathers over eight weeks of intervention (Hudson et al., 2003). However, a larger trial with mothers showed no significant intervention effects on parenting stress, maternal depression, parenting competencies, loneliness or satisfaction relative to "usual care", although intervention mothers were less likely to take their infants to the emergency room (Hudson, Campbell-Grossman, & Hertzog, 2012).

A set of studies have focused on women coping with postpartum depression, using a combination of web-based information, online discussion boards, and individualized phone calls with a therapist. For example, O'Mahen and colleagues (2014) used compared a 12-week online cognitive-behavioral therapy program (*NetmumsHWD*) and weekly phone calls to usual care (access to an online chatroom and listserv). Relative to the control condition, mothers randomized to the multi-component intervention had fewer symptoms of depression and anxiety and showed improved work and social adjustment, with sustained effects 6-months later.

A study that deserves special mention focused on mothers of children in Head Start who reported elevated depressive symptoms (Sheeber et al., 2012). Mothers were randomly assigned to *Mom-Net*, which included eight online sessions teaching cognitive-behavioral strategies and weekly coach phone calls. Relative to a waitlist condition, intervention participants had low attrition, were highly engaged in the program, and reported reduced depression and increased parenting satisfaction and efficacy. A unique feature of this study was the inclusion of direct observations showing decreases in harsh parenting practices in the intervention condition.

Focusing on young children with disruptive behavior problems, Sanders, Baker, and Turner (2012) evaluated the efficacy of a technology-assisted version of Triple P (Positive Parenting Program). This version included eight online learning modules, video examples, and printable forms; text and email reminders were also used to support parent engagement and skill practice. The RCT included 116 parents of children age 2-9 years with disruptive behavior problems; participants were primarily middle class families with internet access and at least a fifth grade reading level. Just under half of parents (43%) actually completed the modules. Relative to the control group with internet access to parent resources, parents assigned to online Triple P reported a decrease in problematic parenting behaviors such as laxness and over-reactivity, and a decrease in parental anger. Based on parent report, children in the intervention group showed greater reductions in problem behaviors and were

more likely to move out of the clinical range on measures of child conduct and emotional problems.

Text messaging has been used to augment face-to-face, as well as online parenting programs. A good example is the Cellular Phone-Enhanced PAT (CPAT) program, which enriched an existing home visiting program (PAT) with weekly parent phone calls and twice daily text messages. Designed to increase engagement and program skill acquisition, texts followed a prescribed scope and sequence, focusing on specific CPAT skills or activities, suggestions for parent-child activities, supportive statements, and CPAT questions. In the evaluation study, 371 mothers at-risk for child maltreatment were randomly assigned to CPAT or PAT as typically delivered (control group) (Carta, Lefever, Bigelow, Borkowski, & Warren, 2013). Mothers in the CPAT condition had lower symptoms of depression at 6-months than control mothers and children had higher ratings of adaptive behavior than control children (Carta et al., 2013). Examining CPAT engagement, Lefever, Bigelow, Carta, and Borkowski (2013) found mothers with higher levels of engagement early in the trial were more likely to complete the intervention, and early engagement, in turn, was predicted by better baseline parenting skills.

Another example of an evidence-based parenting program adapted for online delivery is *InfantNet*, an adapted version of the *Play and Learning Strategies* (PALS) aimed at parents of children who are at-risk for developing disabilities (Baggett et al., 2010). To create *InfantNet*, the researchers systematically adapted each of the PALS components for remote delivery, using the modeling videos that were part of PALS and adding knowledge assessments and parenting skill practice (homework). In addition, telephone calls or email were used to maintain a level of contact and personal coaching with a therapist that paralleled the original PALS program. A majority of the parents randomly assigned to *InfantNet* (84%) completed the program, and reported it was easy to use (95%), they were satisfied with it (95%), and they would recommend it to their friends (85%). Relative to a control group with access to internet resources alone, coded videotape interactions revealed more positive infant behavior in the intervention group, although there were no significant intervention effects on positive maternal behavior or maternal depression, possibly due to the small sample size and limited statistical power.

Across these studies, there is variation in program impact, likely reflecting variations in the intervention programs themselves, as well as the target populations and research designs. However, overall, the results suggest considerable potential for the augmentation of parenting interventions with mobile phone coaching, texting, or email, particularly when these contacts are embedded strategically to support an evidence-based parenting program.

Videoconferencing

The I-InTERACT program, designed for parents of young children with traumatic brain injury, was evaluated in a RCT. Twenty families participated in this program that combined web-based self-study modules on parent management training with VTC therapist coaching to promote parent skill acquisition, and were compared with 17 families who had access to web resources alone (Antonini et al., 2014). Three intervention families dropped out, but 6% of the remaining participants completed 9 or more sessions. The use of praise increased in

the intervention conditions and parent-rated child behavior problems decreased for some sub-groups, with effects generally stronger among the low-income families and predicted by the number of sessions completed (Antonini et al., 2014).

The value added of videoconferencing and other synchronous coaching with online learning has also been studied in programs designed for parents of children with autism. In a single case experimental design involving five parent-child dyads in a multiple baseline, Wainer and Ingersoll (2014) studied the impact of an online learning program designed to deliver reciprocal imitation training for parents supplemented with VTC coaching sessions. The study utilized parent ratings of behaviors and pre- and post- video coding of parents interacting with their children. Results of this trial indicated that parents not only improved in knowledge and use of the techniques taught, but children also increased their imitation behaviors.

Using a similar design, Vismara and colleagues (2013) adapted the Early Start Denver Model for young children with autism, combining online learning modules with VTC for 12-weeks. Eight families participated in this multiple baseline single case experimental design study. Although the children in the study were all receiving various levels of additional multidisciplinary team services (such as occupational, speech, or physical therapy), multiple-baseline analyses suggested that all 8 children demonstrated an increase in verbal communication as a function of parent use of the online intervention. Parents reported that they found the intervention useful and felt confident about the use of techniques that they learned.

Each of these studies suggest that delivering educational materials and providing modeling and guidance to parents online produces gains in parent-reported knowledge, attitudes, and (sometimes) behavior relative to comparison groups that involve no intervention or minimal intervention controls. In the studies below, a direct comparison was made in order to determine whether the same intervention was equally effective when delivered via technology versus delivered via an alternative method, usually via printed material or face-to-face sessions.

Comparing Intervention Effects When Delivered With or Without Technology

Three studies examined technology-assisted delivery of an intervention to parents and compared the impact to the provision of the same (or similar) intervention using alternate delivery methods – either face to face delivery or printed materials. Whereas the studies in the prior section assessed the impact of technology-assisted interventions, these studies assess the *relative impact* of an intervention when delivered using (or not using) technology (see Table 3).

Marsac and colleagues (Marsac, Kassam-Adams, Hildenbrand, Kohser, & Winston, 2011) assigned parents of young children with brain injuries to an interactive website called *AfterTheInjury.org* or provided them with a DVD that contained all of the materials on the website (but without the interactivity component). In general, parents in both conditions

were able to generate more ideas for how to help their children after the injury and no differences between the conditions emerged on any aspect of parent knowledge. However, more parents in the web condition reported a willingness to use the materials in the future.

In a second study, MacKenzie and Hilgedick (1999) developed the Computer-Assisted Parenting Program (CAPP) and randomly-assigned parents of children age 3 to 5 years to a computer condition, booklet condition, or no treatment control condition. Relative to the booklet and no treatment condition, no significant effects for CAPP emerged on parent knowledge, parent reports of child behavior problems (Child Behavior Checklist), or parent stress (Parenting Stress Inventory). However, parents who received CAPP reported better limit-setting. The general lack of effects may be related to limited statistical power given the small sample size, or a ceiling effect associated with low rates of child behavior problems at baseline.

In another well-controlled study, Kable et al. (2012) randomly-assigned parents of children with fetal alcohol spectrum disorders to one of three conditions: 1) information packet, 2) set of two in-person workshops, and 3) internet intervention delivery, which included content adapted from the in-person workshops. Parents showed gains in knowledge about the disorder and in areas of advocacy in both the face-to-face workshop condition and the internet delivery condition, relative to the information packet condition. Significant decreases in parent reports of child behavior problems (Child Behavior Checklist) were documented only for children whose parents received the face-to-face workshop, although externalizing problems also decreased more in the information packet condition relative to the internet condition. The authors also noted an issue with differential attrition, as parents whose children had higher ratings of alcohol-related dysmorphia (facial and other physical markers of FASD) were less likely to complete the internet condition relative to the other two conditions. These findings highlight potential challenges in engaging parents effectively in intervention-only interventions.

A similar RCT was conducted by Bert, Farris, and Borkowski (2008) who assigned parents of two- and three-year old children to face-to-face parenting education sessions, internet sessions, or an information booklet. In this study, both the face-to-face condition and the internet condition had high levels of attrition, with 34% and 30% of the participants, respectively, participating in no sessions. In both conditions, non-participants included higher risk parents, as reflected in lower levels of cognitive readiness to parent before their child was born (in both conditions), ethnic minority status (African-American), low levels of paternal involvement, and less likely to have reported having a parenting plan before having their child (in the internet condition). Of those who participated, parents in the face-to-face and internet conditions showed significantly better scores on knowledge of parenting principles at post-intervention than parents in the booklet-only condition. Parents with lower risk-profiles (e.g., lower internalizing symptoms and fewer challenging life circumstances) demonstrated better gains in the program than higher-risk parents.

Finally, in an interesting and unique study, Sanders and colleagues (Sanders, Calam Durand, Liversidge, & Carmont, 2008) evaluated the effect of watching a reality television show depicting the Triple P intervention (standard television control group) relative to watching

the television show with web-based intervention supports (enhanced television intervention group). All parents were encouraged to watch the television program broadcasts via reminder emails. In addition, parents in the enhanced condition received the Triple P Self-Help Workbook with specific tips and activities to practice the Triple P parenting skills. Parents in the enhanced intervention condition could also access an email helpline. To compare the effects of these two conditions, the investigators took advantage of the public television broadcast of *Driving Mum and Dad Mad* which depicted the experiences of five families with young children going through the Triple P group intervention program. A total of 454 parents with a child aged between 2 and 9 years responded to advertisements, registered for the study on the television website, and completed study assessments. Group comparisons suggested that, relative to the standard television condition, parents in the enhanced television condition were more satisfied with the program and reported significantly fewer child behavior problems post-intervention, less parental conflict, and greater improvement in parenting practices. Although these findings are promising, the study was limited by a reliance on maternal report as the only source of outcome data and a high rate of attrition. By the 6-month follow-up assessments, which were completed by only 35% of the sample, group differences had dissipated.

Given the very few studies that have compared interventions delivered with (and without) technology, it is premature to draw conclusions regarding the relative efficacy of different delivery methods. In these few studies, assisted programs did not demonstrate superiority (e.g., Kable et al., 2012; MacKenzie & Hilgedick, 1999), but they represent only a small number of approaches and a limited set of technology enhancements. More research of this kind is needed.

Status of the Evidence Base for Technology-assisted Parenting Interventions

The wide range and rapidly developing number of publically-available telecommunication and internet tools have vastly expanded the potential to reach parents of young children where they live and work. Web-based platforms, online discussion forums, mobile devices, and synchronous communication tools such as VTC all have the capability to contribute in unique ways to the delivery of interventions to parents of young children, traversing geographical boundaries and optimizing convenience and accessibility. At the same time, evidence documenting the ways in which and degree to which these various technologies may improve the impact or cost-effectiveness of early childhood parenting interventions is still needed. The studies reviewed in this paper reveal a wide range and growing number of creative applications of technology in the service of improved parenting in early childhood. The findings reveal considerable potential of technology tools to enhance early childhood parenting interventions, but also reveal important limitations. As technology becomes an increasingly prominent and integral facet of everyday life, it is particularly important to track the progress of research evaluating technology-assisted interventions, as well as to conduct additional research to critically evaluate the benefits (and limitations) of different technology-assisted innovations.

As reflected in the studies reviewed in this paper, most technology-assisted parenting interventions have focused on issues of feasibility and impact, and just a few studies have examined relative impact or cost-effectiveness compared to other delivery modalities. A prevailing expectation is that the use of technology might greatly increase the accessibility of evidence-based interventions and more effectively engage parents than programming provided via written or oral presentations. Supporting these positive expectations, the studies reviewed here show a high level of feasibility, in that parenting interventions have been designed using multiple forms of technology, and delivered to a wide range of parents over large distances.

However, in terms of acceptability, parent engagement, and impact, the current findings are somewhat equivocal, supporting both optimistic and pessimistic conclusions. For example, the studies reviewed here suggest that about half of the parents of young children surveyed are interested in receiving parenting information electronically (Larose, et al., 2008; Lerner et al., 2012; Mackert et al., 2009). Some studies suggest that technology-assisted interventions may appeal more to higher income, well-educated parents and less to lower income, highly stressed, and less well-educated parents. Although, in contrast, at least one study found that users of a parenting web-site were predominantly young and lower-income (Sarkadi & Bremberg, 2005). In the studies evaluating intervention engagement, the internet-based interventions generally experienced similar levels of attrition as interventions delivered face-to-face (in the 30%-50% range; Bert et al., 2008; Enebrink et al., 2012; Kable et al., 2012; Sanders et al., 2008; Sanders et al., 2012; Van der Zanden et al., 2010), with some notable exceptions such as *InfantNet,* with only 16% attrition (Baggett et al., 2010).

Although it is too early to draw firm conclusions based on the existing research, this review suggests that stronger effects in terms of both engaging parents and promoting positive outcomes for parents and children may emerge in blended intervention approaches that use technology along with personal contacts between intervention staff and parents (rather than "stand alone" technology-based programs). For example, along with an elaborate audio-visual display of educational materials for parents, the *InfantNet* intervention also included access to synchronous communication and coaching via phone or internet with a personal coach (Baggett et al., 2010). The high levels of engagement and positive impact of the *InfantNet* program may in part be related to having access to real-time communication and personal coaching opportunities. Other studies that relied on technology-assisted program delivery without personal contacts (Enebrink et al., 2012; Sanders et al., 2012) often struggled to keep parents engaged, experiencing high non-completion rates. Further studies are needed to understand challenges with parent engagement with internet learning materials and conditions under which they are most effective and how they may be integrated with face-to-face or synchronous communication delivery or coaching options.

In terms of impact, technology-based interventions generally produced gains in parent-reported knowledge and attitudes relative to no treatment control groups. Only a few studies compared technology-assisted interventions with alternative forms of intervention delivery (e.g., printed material or face-to-face delivery), making it hard to determine whether technology-assisted interventions perform as well as (or better or worse than) other delivery formats (e.g., Bert et al., 2008; Kable et al., 2012). However, several studies demonstrated

that adding technology-assisted components to existing interventions could improve outcomes (Carta et al., 2013; Sanders et al., 2012) and reduce costs (Kelso et al., 2009).

It is difficult to reach firm conclusions about the potential of different technological tools, because the existing studies vary widely in terms of intervention content and intensity, target audience, and research design. Some of the existing research suggests that benefits for parents and children may vary as a function of how the technological tool is employed. For example, existing research suggests that access to online discussion forums or related social media such as Facebook may sometimes increase feelings of social support and other times contribute to feelings of parental stress (Bartholomew et al., 2012; Brady & Guerin, 2010). In this area, as in others, more nuanced research is needed to better understand the characteristics of online communities or online intervention programs that benefit parents. The question becomes for whom and under what circumstances does online support lead to better outcomes. Related to this issue, a recent study found that Facebook users who were exposed to newsfeeds that included more positive language were more likely to post positive messages themselves than when exposed to news from online contacts that was more negative (Kramer, Guillory, & Hancock, 2014). This study highlights the potential drawback of online discussion options that may be difficult to regulate and thus have the potential to disseminate inaccurate information and be overwhelming or non-supportive in some cases.

In general, more research is needed on the characteristics of technology-assisted intervention components that are associated with intervention impact. To be useful, technology-assisted interventions do not necessarily need to exceed the impact of other forms of intervention delivery, but careful comparative evaluations are needed to determine the relative impact of technology-assisted interventions and whether any decrease in impact is off-set by improved accessibility or cost-effectiveness. For example, the creation and provision of attractive and entertaining media displays may allow parents to learn in a way that decreases literacy demands and is more enjoyable than print or oral communication. However, the degree to which the quality of these visual products affects their impact on parent attitudes and behavior change has not yet been evaluated. The creation of professional-quality video, computer animation, signage, or webpages has become easier for amateur designers, but high-quality productions may be necessary to engage and impact parents. The relative cost and unknown threshold for capturing and keeping parents' attention in technology-delivered interventions is an issue that needs to be examined systematically in future research.

Concerns and Possible Limitations of Technology-assisted Interventions

One of the most central concerns regarding the use of technology-assisted early childhood parenting interventions involves the digital divide (Littlefield, 1996). The Pew Research Foundation has reported that about one third of people who make less than $20,000 annually are not online and that another third go online but do not have broadband internet access at home (Smith, 2013). Public libraries are reported to be an important way for lower income persons to have internet access as 81% of Americans said it was "very important" for libraries to provide free access and that 35% of low income Americans have accessed the internet outside of the home for free (Smith, 2013). On the other hand, the overwhelming majority of persons have cell phones in all income levels (Smith, 2013). So although the

present review found evidence that low-SES parents may be generally less interested in using the internet for parenting information (Larose et al., 2008; Lerner et al., 2012; Mackert et al., 2009) the use of smartphone applications or texts may be a way to reach younger parents and those of all income levels. Socioeconomic differences in both access and acceptability of technology-based intervention delivery require further study.

An important limitation of the present review to note is that it did not address the broad and emerging area of the use of technology for building communities of practice, professional development, and professional support and outreach. Technology-based applications are increasingly being used for professional development support, to train and enhance the performance of the intervention staff delivering parenting interventions (Funderburk, Ware, Altshuler, & Chaffin, 2008). This review focused specifically on technology-assisted interventions designed for parent use and thus did not take into consideration the possible role that technology may have in supporting professionals and teachers who serve young children and their parents.

Future Directions

One of the complications in designing and testing technology-based interventions is the rapid pace of new technology development and diffusion. For example, the status of the digital divide may change rapidly as new technologies become less expensive, and as organizations such as Connect2Compete's *EveryoneOn* campaign succeed in increasing access to internet, tablets, and computers (Schwartz, 2013). In this rapidly-paced field, research findings are quickly outdated, such as those focused on the technical hardships associated with video-conferencing. Intervention studies need to be attuned to the changing landscape of technology use and accessibility, updating current data on acceptability of different technology-assisted intervention components to different groups of parents.

In designing future intervention innovations and research designs, it becomes important to anticipate how emerging trends in technology might affect program accessibility and impact. For example, the increasing multi-purpose capacity of smartphones may be changing patterns of internet use in ways that will affect web-based intervention design. Parents may increasingly prefer to access parenting information or support through their phones, potentially decreasing the digital divide, but requiring a reworking of the platforms used for intervention delivery. In general, future research will need to monitor the accessibility and acceptability of technology use for various populations in an ongoing manner, in order to optimally navigate this rapidly developing landscape.

Researchers may also discover innovative new ways to use technology. For example, Ondersma and colleagues (2014) designed artificial intelligence software capable of simulating motivational interviewing, and tested its impact in an intervention for mothers at-risk for substance use (compared to waitlist). Mothers who participated in the one-session intervention showed 3-month drug use abstinence and continued abstinence at 6-months (based on hair analysis).

The rapid pace of changing technology also has implications for the cost (and cost-effectiveness) of technology-assisted interventions. Because of rapidly evolving technology platforms, costs associated with new intervention design, programming and technical support, as well as potential hardware costs add to the cost of technology-assisted intervention development and evaluation trials. A challenge for the field is to organize systematic study of technology-assisted components in terms of the function of the applications instead of the mechanics, so that there is more carry-forward of knowledge gained as technology forms shift. In addition, interventions may be more cost-effective and scalable if they use commonly-available technologies. For example, the use of existing low- or no-cost applications for synchronous communication (e.g., iPhone's FaceTime) may be more useful than developing tools for specific projects (e.g., developing a specific secure videochat for a specific project or intervention).

Important ethical questions will need to be addressed as more researchers, educators, and practitioners utilize technology-assisted delivery. Many are concerned with issues around the protection of confidentiality, privacy, and online security of information. As telehealth and eHealth have continued to grow, many private companies have begun to create synchronous communication tools that are designed to be compliant with the Health Insurance Portability and Accountability Act (HIPAA) such as CloudVisit® allowing for reasonably low-cost secure video chat and record management. Questions continue to remain around the appropriate use of existing social media tools such as Facebook, the vetting of online resources, and the monitoring of online communities to ensure a safe, supportive environment that includes accurate and reliable information. Although it would be nearly impossible to vet the quality of every website, blog, or Facebook group, it may be feasible for researchers to create informal or formal communities of practice that may provide lists of both recommended and not-recommended sources of information and online providers.

Conclusions

The present review demonstrates that there are reasons to think that there is promise in the use of technology-based delivery methods for interventions, yet there are many remaining questions that need to be addressed around acceptability for various socioeconomic groups, more rigorous evaluation of parent and child outcomes, and ethical considerations. Although many questions remain, "screens" in their many forms are here to stay for the foreseeable future and are making their way into the daily lives of families with young children. Researchers in particular areas of content expertise are in the best position to understand the most ethical, effective, and advantageous ways to proceed with how to leverage these tools for the betterment of families with young children.

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Table 1

Feasibility Studies

Citation	Technology Use	Target	Methodology	Summary of Findings
Bartholomew et al. (2012)	Social media	New Parents	Survey	Frequent Facebook posting increased stress, whereas limited networking with familiar others improved satisfaction and perceived support
Brady & Guerin (2010)	Social media	New parents	Survey	Parents who joined on-line discussions with other parents reported feeling safe, supported, and satisfied
Bragadottir (2008)	Email listserv	Child cancer	Quasi-experimental	Participants in an email listserv for parents of children with cancer reported decreased maternal depression and paternal anxiety
Danaher et al. (2013)	Intervention * w/ on-line blogs, phone calls	Post-partum depression	Quasi-experimental	High completion rate for this hybrid intervention using therapy groups with technology (87%), decreased rates of depression
Hamren & Quigley (2012)	VTC	Child hearing impairment	Case Study	Demonstrated the feasibility of providing intervention services to a parent with a hearing-impaired child using VTC
Harris et al. (2013)	Intervention * w/ VTC, email, texts	Child medical conditions	Mixed Method	Described a hybrid intervention using VTC, email, and texts to supplement face-to-face home visits and clinic appointments
Kaufman & Buckner (2014)	Social Media	Mothers	Qualitative	In a review of content of Facebook pages aimed at mothers, found that many posts were promotional or advertisements
Kelso et al. (2009)	VTC (Adobe Connect Pro)	Early intervention	Quasi-experimental	Four families received early intervention delivered via VTC. Technical difficulties emerged, but there were cost savings
Larose et al. (2008)	Web-based	Parents	Survey	Reporting on their preferred source of information, lower income parents selected print materials, higher income parents preferred email
Lerner et al. (2012)	Web-based	New parents	Survey	42% of respondents to a Zero to Three survey reported using the internet to obtain parenting information (52% of higher income parents)
Lipman et al. (2011)	VTC	At-risk mothers	Mixed Method	Mothers at risk for substance abuse received group therapy via VTC and reported less isolation, and increased parenting knowledge and efficacy
Mackert et al. (2009)	Web-based	Child obesity	Qualitative	Parents in focus groups reported using the internet for information, but avoiding .edu and .gov extensions because of their complexity
Powell & McCauley (2012)	Therapy * w/ on-line blogs	Child autism	Case Study	Described how home visits with parents of autistic children were supplemented with teacher blogs describing school programming
Pugh et al. (2014)	Web-based w/ therapist emails	Post-partum depression	Case Study	Intervention using on-line learning modules and therapist emails produced strong working alliance, satisfaction, decrease in depression
Sarkadi & Bremberg (2005)	Web-based with on-line blogs	Parents	Survey	Mothers using a publicly-available parent web-site reported valuing on-line discussions with peers (more than information from experts)
Van der Zanden et al. (2010)	Web-based with on-line chat room	Mentally ill parents	Quasi-experimental	8 on-line lessons in a chat room produced parent reports of improved parenting and increased competence; but a low completion rate (58%)
Wade et al. (2011)	Web-based with VCT	Child brain injury	Case Study	Web-based lessons with VCT therapy coaching produced high satisfaction ratings from parents and practitioners
Walker et al. (2012)	Web-based, email, cell phone	New mothers	Survey	Almost all mothers reported access to technology; 45% were interested in web-based parenting information with SES differences

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Table 2

Impact Studies

Citation	Technology Use [*]	Target	Methodology	Summary of Findings
Antonini et al (2014)	Web-based with ATV	Child brain injury	RCT	Direct observations revealed increased use of parental praise and (for subgroups) decreased parent-rated behavior problems
Baggett et al. (2010)	Web-based & online coaching	At-risk	RCT	High completion rate (84%), increased positive infant behavior (direct observation), trend toward significance on maternal depression and maternal positive behavior
Carta et al. (2013)	Home visits[*] with texts	At-risk for maltreatment	RCT	Reduced depressive symptoms, increased use of program strategies. Baseline skills and early engagement predicted intervention completion.
Enebrink et al. (2012)	Web-based & online discussion board	Child behavior problems	RCT	Decreases in child problem behaviors were maintained at 6-months; high attrition (53.4%). Homework completion predicted positive outcomes.
Evans et al. (2012)	Texts	New Parents	RCT	Participants felt more prepared for new motherhood
Hudson et al. (2003)	Web-based	New parents	Quasi-Exp	Increased father's self-efficacy and satisfaction
Hudson et al. (2012)	Web-based	New parents	Quasi- Exp	No impact on mothers stress, depression, loneliness, parenting competencies; decreased use of emergency room
Jabaley et al. (2011)	iPhone w/ camera	Maltreatment	Single Case	Reduction of home hazards to almost zero
Kaplan et al. (2014)	Web-based & email listserv	Mentally-ill parents	RCT	Decreased parenting stress and increased coping skills
Na & Chia (2008)	Web-based	Parents	RCT	Increased parenting confidence and child development knowledge
O'Mahen et al. (2014)	Web-based & cell phone, online chats	Post-partum depression	RCT	Decreased depressive and anxious symptoms, improved work and social adjustment. Effects sustained for 6 months.
Salonen et al. (2008) Salonen et al. (2011) Salonen et al. (2014)	Web-based & online discussion board	New parents	Quasi-Exp	A first study showed positive impact on breastfeeding. Subsequent studies showed no impact on breastfeeding, parent stress, or parenting efficacy
Sanders et al. (2012)	Web-based with text and emails	Child behavior problems	RCT	43% of parents completed all learning modules; improved parenting, decreased child problem behavior
Sheeber et al. (2012)	Web-based & cell phone	Depressed mothers	RCT	Improved parenting behavior (direct observations), increased parent satisfaction and efficacy
Vismara et al. (2013)	Web-based VTC	Child autism	Single Case	Parents found intervention useful, increased child verbal communication
Wainer & Ingersoll (2014)	Web-based VTC	Child autism	Single Case	Increased child imitation behavior, increased parent knowledge and use of techniques

[*] Indicates the use of face-to-face therapy sessions with technology components. RCT = randomized, controlled trial. Quasi-Exp = quasi-experimental.

Table 3

Relative Impact Studies Comparing Interventions Delivered With and Without Technology

Citation	Technology Use	Target	Methodology	Summary of Findings
Bert et al. (2008)	Web-based sessions vs. parent education sessions vs. booklet	Parents	RCT	Web-based and parent education sessions both increased knowledge of parenting principles, but had high attrition. Lower risk parents benefitted more across condition.
Kable et al. (2012)	Web-based vs. information packet vs. workshop	Child fetal alcohol disorder	RCT	Web-based and workshop promoted knowledge about the disorder relative to information packet; only the workshop promoted decreased behavior problems (web-based linked with increased behavior problems)
MacKenzie & Hilgedick (1999)	Web-based vs. booklet vs. no treatment	Child behavior problems	RCT	No effects on parent knowledge, child behavior problems, or parenting stress. Web-based promoted better limit-setting by parent report.
Marsac et al. (2011)	Web-based vs. DVD	Child brain injury	RCT	Knowledge increased in both groups; parents more likely to re-use internet materials than DVDs
Sanders et al. (2008)	Television with web-based & email vs. television alone	Child behavior problems	RCT	Technology-enhanced condition produced more satisfaction, lower child behavior problems (by parent report), less parent conflict, improved parenting. High attrition was evident.

RCT = randomized controlled trial