

26 Technology and Parenting: Challenges and Opportunities

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The past three decades have brought a monumental shift in the use of digital technology with the integration of Internet and mobile networking in all aspects of our lives; including how we connect with one another, gather information and conduct our day-to-day lives. The release of the World Wide Web in 1991 allowed billions of people to use the Internet; showing a virtual exponential growth (Pew, 2014). In under 30 years, 90 percent of adult Americans use the Internet daily, with the youngest populations reaching 100 percent saturation (Pew, 2019). In the typical age range of parents, 95 percent of Americans adults aged 18–49 years old own a smartphone and 81 percent use at least one social media site daily. While there is still the presence of a digital-divide (Brodie et al., 2000; Lopez et al, 2013; Van Dijk, 2020), there is diffusion of Internet utilization among low-income families of children. From 2006 to 2008, Internet use among Latino adults rose from 54 percent to 64 percent; while the rates for Whites rose only 4 percentage points during that same time (Livingston, et al., 2009). The growth in mobile technology has enabled many people to access online content. Smartphone ownership has increased dramatically from 35 percent in 2011 to 81 percent in 2019 (Anderson, 2019). Thirty-seven percent of Americans go online, mostly using a smartphone (Anderson, 2019), 10 percent of Americans own a

smartphone but do not have broadband at home, and 15 percent own a smartphone but say that they have a limited number of options for going online other than their cell phone (Smith, 2015). These “smartphone-dependent” adults have relatively lower income and educational attainment levels, and are younger and non-White. Smartphones are used for navigating numerous important life activities, from researching a health condition to accessing educational resources. Lower-income and “smartphone-dependent” users are especially likely to turn to their phones for navigating job and employment resources. A majority of smartphone owners use their phone to follow along with breaking news, and to share and be informed about happenings in their local community. Smartphones help users navigate the world around them, from turn-by-turn driving directions to assistance with public transit. This is especially true for younger users. Providers of parent support interventions in group, family, and individual settings are leveraging the virtual ubiquity of mobile devices and Internet connectivity to deliver services via tele-health methodologies.

As technology has advanced, so, too, have innovative methods of service delivery. Tele-health, or the use of technology to provide health-related services, is an emerging avenue for the provision of health and mental health services. As the word suggests, the term “tele-health” was originally coined to describe the provision of health services at a distance.

Today, however, the term has come to describe not just the provision of services at a distance, but also the use of various forms of technology to assist in the provision of medical, health, and mental health services (Liss, 2005). Tele-health technology has become critical in providing continuing care for patients during the current COVID-19 pandemic (Wong et al., 2021). Virtual care has now been adopted by health care providers across the spectrum, including medical providers and mental health providers (Mekkar et al., 2020; Scholl et al., 2021).

Parenting Interventions to Ameliorate Conduct Problems: Efficacy and Barriers

There has been substantial progress over the past 50 years in early intervention strategies for disruptive behavior among children (Bagner & Eyberg, 2007; Brestan & Eyberg, 1998; Kazdin, 1995; Nowak & Heinrichs, 2008; Reid, Webster-Stratton, & Hammond, 2003; Taylor & Biglan, 1998; Webster-Stratton, Reid, & Beauchaine, 2013; Zisser & Eyberg, 2010). Extensive research indicates that behavioral parent training (BPT) is very effective for reducing early conduct problems that are precursors of conduct disorders and substance abuse. Reviews of published (efficacy) studies involving behavioral parenting skills interventions found moderate to large effect sizes (Lee et al., 2012; Maughan et al., 2005; Piquero et al., 2016; Serketich & Dumas, 1996) and BPT was identified by the Chambless Task Force (Chambless et al., 1998) as being an empirically-supported treatment for child problems.

While BPT interventions have the potential to serve important protective and remedial functions for families of young children, unfortunately, barriers to service delivery and utilization often result in parents' limited access to preventive mental health services in general or

parenting interventions in particular (e.g., Franke-Ogg & Pritchard, 1989; Friedrichsen & Stamm, 2003; Gale & Deprez, 2003; Nordal, Copans & Stamm, 2003; Sheeber et al., 2002). Overall, estimates suggest that only approximately 20 percent of school-aged children with an indicated mental health need have received any mental health services in the past year (Kataoka, Zhang, & Wells, 2002). This gap between treatment need and treatment receipt is likely to be even higher for younger children, approximately 20 percent of whom meet diagnostic criteria for a mental health disorder, particularly Oppositional Defiant Disorder, Attention-Deficit Hyperactivity Disorder, and Separation Anxiety Disorder (Egger & Angold, 2006).

A major obstacle in accessing services is the scarcity of mental health providers in rural communities (Benson, 2003; Roberts, et al 1999; Stamm et al, 2003); specialists, such as those with expertise in child development and psychopathology, are rarely available (Roberts et al., 1999). Additional barriers to service utilization include lack of medical coverage, absence of public (or reliable private transportation), lack of child care, and difficulty leaving work (DeLeon, et al, 2003; Nordal, et al., 2003; Organista et al., 1994; Stamm et al., 2003). These barriers differentially affect women, minorities, and the poor (Connell et al., 1997; NIMH, 2003; Weissman & Jensen, 2002). In addition, psychological barriers to service utilization are also a significant issue in rural communities. In particular, concerns about confidentiality, dual relationships, and the stigma associated with seeking psychological services are especially acute in sparsely-populated and remote communities (Cellucci et al., 2003; Roberts et al., 1999). When parenting classes are offered, attendance is often poor and because parents are required to attend "special" parenting classes, they may feel stigmatized (McGoron & Odersma, 2015).

Parenting intervention needs to be flexible in delivering formats, ease of administration, and accessibility to meet all of the needs of parents. Having every family receive a long intervention at a single venue is not only cost ineffective but may also be unnecessary and undesirable from a family's perspective (Prinz, 2009).

Advantages of Interactive Internet/mobile Computer-Mediated Interventions for Parent Training and Support

The primary benefit of mobile/Internet technology as a mode of information and support delivery is that it reduces barriers by changing the time-space relationship inherent in person-to-person interventions. Mobile/Internet technology can provide 24-hour access, at relatively low cost, to many kinds of information – including state-of-the-art treatment options and short- or long-term support groups. The two most common benefits include: (1) increased access and (2) improved convenience and flexibility. These benefits are enjoyed by families as well as service providers (Ramos et al., 2021). For example, families who receive virtual service that would otherwise require an in-person visit save time and money (and possibly aggravation) by not driving or securing other transportation to receive services. Additionally, providers who typically present in families' homes to provide services (e.g., home visitors), may be able to offer services to more families with the time saved in travel from home to home. Interactive Internet/mobile Computer Mediated Interventions (IICMIs) in the home overcome common obstacles for parent participation, such as lack of transportation, harsh weather, long distances or schedule conflicts (Breitenstein et al., 2014; Webster-Stratton et al., 1998). IICMIs have the capacity to provide menus of choices

efficiently, tailor information to subject characteristics and interests, manage interactive programming, and provide support to professionals and peers. Mobile/Internet technologies allow demand-based “just in time” interventions for those needing immediate support to avert the use of ineffective (and possibly abusive) parenting practices. In addition, the use of the Internet for training staff in areas of the country where face-to-face training is not available (or in concert where trainers are available) will further increase access to research-based interventions (Landsverk et al., 2009).

While an IICMI has high initial start-up and development costs, the marginal costs of delivery are low. Through automated systems, interactive and dynamic interventions as well as data collection can be incorporated with minimal additional costs. There are also no material consumables. IICMI programs offer a low-cost, ongoing, repeated-contact intervention that tracks the progress of each user over time and responds to user requests. Repeated contact with parents over time may also enhance the effectiveness of BPT effects. Compared with face-to-face treatment, the use of IICMI programs may be more cost-effective, appealing, and accessible. IICMI programs can either be (a) facilitated by a professionals or paraprofessionals with varying amounts of contact via phone or teleconferencing, or (b) be stand-alone and completely automated.

Gamification. To sustain interest, many developers of IICMI include gamification in their interventions. Gamification is the application of game-design elements and principles in non-game contexts to improve user engagement by creating an evolving set of access-dependent tools instruction (Sailer & Homner, 2020). Such features as points, levels and leaderboards have functioned as extrinsic motivation for promoting engagement

(Mekler et al., 2017). A review of research shows that a majority of studies on gamification find positive effects (Hamari, Koivisto, & Sarsa, 2014). In the program developed by Breitenstein and colleagues (2017), parents automatically earn “badges” as they complete module content that seems to motivate participation. A meta-analysis of the effects of gamification on cognitive, motivational, and behavioral learning outcomes found that competition augmented with collaboration is an effective method for instruction (Sailer & Homner, 2020). Love et al (2016) examined the feasibility (accessibility, engagement, and impact) of adding social media and gaming features (e.g., social sharing with anonymity, badges to incentivize skills practice, an accredited facilitator for support) and access via smartphones to an evidenced-based parenting program. The participants engaged in the online community and valued its flexibility, anonymity, and shared learning.

Characteristics of Effective IICMI programs

Research review manuscripts have documented the characteristics of effective IICMI programs that support parents (Baumel et al., 2016; Breitenstein et al., 2014; Harris et al., 2020; Thongseiratch et al., 2020). In a review of the literature to determine common characteristics of parent training interventions utilizing digital delivery methods (electronic text, audio, video, or interactive components delivered via the Internet, DVD, or CD-ROM), Breitenstein and colleagues (2014) found that among all the delivery methods, the Internet was the primary delivery method. Ninety percent of interventions included exemplar videos of parent–child interactions in the instructional content. Video modeling is an effective teaching strategy that translates from face-to-face interventions to digital formats

easily. Also, an analysis of seven studies found higher effect sizes for digital interventions with interactive components over programs with more passive noninteractive programs (e.g., watching video clips) (Baumel et al., 2016). Of the few studies that reported behavioral outcomes of the interventions, the average effect size (Cohen’s *d*) for child outcomes was 0.61 and for parent outcomes 0.46, showing that digital delivery methods can be effective. A recent meta-analytic review (Harris et al., 2020) examined the effectiveness of technology-based parenting interventions in low-income families. A literature search yielded nine studies published between March 2007 and June 2019 that met inclusion criteria. The reviewers found that interventions that did not include facilitation by an interventionist were generally less effective than those that incorporated human facilitation. Facilitated interventions were associated with significant improvements in parenting and child behavior, giving further evidence of the potential for the use of technology-assisted parenting interventions in populations experiencing social disadvantage. Another review of the components of effective online parent programs on children’s behavioral problems found that including parental reminders to engage with the program was an important component (Thongseiratch et al., 2020). Technology-based parenting interventions, including tele-health, are being used with children from birth in newborn intensive care units (Mekkar et al., 2020) through adolescence. Below are described several IICMI programs with and without facilitation by a therapist or paraprofessional.

Facilitated Research-based IICMI Programs

Parent–child interaction therapy (PCIT). This is a widely available behavioral parent training intervention for parents with children aged 2–7

years, and is designed to reduce child externalizing behaviors via improving parenting skills and parent–child positive interactions (Eyberg et al., 2001). Traditional PCIT is conducted with a therapist observing and coaching a parent through a one-way mirror; it uses a bug-in-the-ear device during a parent–child play interaction to encourage the parent to attend positively, consistently, and predictably to the child’s play and other behaviors. PCIT has two sequential phases (i.e., child-directed interaction and parent-directed interaction) that begin with a didactic session to teach the parent skills relevant to that phase, which is then followed by direct coaching sessions throughout the rest of each phase. Direct coaching sessions also provide the parent with immediate feedback and remediation of skill implementation. PCIT is particularly amenable to an IICMI delivery (i.e., video-teleconferencing), given that, by design, the PCIT therapist is not in the same room as the family for most of the treatment, but rather is remotely monitoring from another room and providing real-time feedback to parent(s) via the parent-worn device (Wilsie & Brestan-Knight, 2012). Comer and colleagues (2015; 2017) conducted a randomized study using video-teleconferencing via home-based laptop webcams and parent-worn Bluetooth earpieces in a sample of 40 racially/ethnically diverse families with children ages 3–5 years old. Parent–child dyads were randomized to Internet-delivered, parent–child interaction therapy (I-PCIT) or standard clinic-based PCIT. Intent-to-treat analyses found 70 percent and 55 percent of children treated with I-PCIT and clinic-based PCIT, respectively, showed “treatment response” after treatment, and 55 percent and 40 percent of children treated with I-PCIT and clinic-based PCIT, respectively, continued to show “treatment response” at six-month follow-up. Both treatments had significant effects on children’s

symptoms and burden to parents, and many effects were very large in magnitude. I-PCIT was associated with significantly fewer parent-perceived barriers to treatment than clinic-based PCIT. Both treatments were associated with positive engagement, treatment retention, and very high treatment satisfaction. This research demonstrated that PICT delivered via video conferencing is feasible and effective. As society has been pushed online with the COVID-19 pandemic, such video conferencing technology (such as Zoom) is now a typical part of our post-pandemic lives, making such adaptations acceptable and accessible.

Play and Learning Strategies (PALS). This is an empirically-supported cognitive-behavioral skills intervention home-visiting program aimed at teaching a constellation of sensitive and responsive parenting behaviors from multiple theoretical perspectives that promote child development (Landry & Smith, 1996; Landry et al., 2001; Smith, Landry, & Swank, 2000). The PALS program involves 10 sessions implemented by trained facilitators that unite direct teaching, frequent practice, and video reflection with feedback to build skills. The facilitator uses pre-recorded exemplar videos to model and demonstrate key principles and behaviors. In addition, the facilitator video-records a parent–child play session that is co-viewed by parent and coach to build parent reflective skills and provide detailed, descriptive feedback. PALS’ use of video modeling and practice lends itself to adaptation to an IICMI program. The Internet-based intervention, ePALS, incorporated four primary components: (a) self-regulated learning of parent skills content presented using dynamic multimedia presentations, interactive queries, and principals of effective instructional design (Kameenui & Carnine, 2001) to facilitate knowledge acquisition and parental engagement; (b) a

mechanism to remotely record and transfer parent–child interaction videos, captured through a computer camera, to encourage practice and facilitate reflection through coach discussion; (c) an electronic system for professional support designed to facilitate learning and promote engagement; and (d) an online tracking system of participant knowledge acquisition and treatment engagement to facilitate progress monitoring as well as supervision by coaches (Feil et al., 2008). See Figure 26.1 for screen shots of ePALS content. Three randomized control trials on Internet/computer-based and mobile-based adaptations have demonstrated significant maternal and child change for low-income mothers with varied educational, reading, and comprehension levels. The first study consisted of a community sample of 40 mothers of infants living in poverty (based on adapted Women, Infants and Children (WIC) program guidelines) randomized to ePALS or a control condition (Baggett et al., 2010). Session completion rate was very high: 84 percent (16/19) completed all 11 sessions. Instructional materials were rated as “easy to understand”, with a mean of 4.90 out of 5 points ($SD = 0.31$). In the adaptation of the program to computer and telephone, given that past research shows powerful effects of the relationship between home visitor and mother, we paid special attention to the mother–coach relationship. EPALS mothers rated the level of coach understanding (mean = 4.75, $SD = 0.55$) and support/interest (mean = 4.90, $SD = 0.31$) as very high. Overall, mothers enjoyed the program; 84 percent (16/19) said they would recommend the program to a friend. With regard to primary outcomes, we conducted $2(\text{Time}) \times 2(\text{Condition})$ repeated measures ANOVAs on infant engagement and maternal responsiveness behaviors as observed during mother–infant interactions, as well as on maternal depression. With regard to infant functioning, ANOVA results

indicated a significant moderate effect, with infants in the ePALS condition improving more than those in the control condition did. In the second randomized control trial, 164 economically disadvantaged mothers of infants living in rural and urban settings in Oregon, Missouri, and Kansas were randomized to either ePALS or to a robust attention control condition (Feil et al., 2020). Outcomes included direct observations of maternal behavior in naturalistic interactions with infants, questionnaires about maternal functioning and parenting knowledge, and real-time program usage. For maternal language-supportive behavior, we found significant group differences (medium effect) and for infant language behavior, we observed a small positive experimental trend (small effect). Mothers reported high (a) acceptability of intervention procedures, (b) acceptability of information taught, and, (c) perceived program impact. In a third project using mobile devices, we recruited economically disadvantaged mothers of young children enrolled in Head Start in Houston (Landry et al., 2021). This study randomized 630 preschool-age children in 69 classrooms to either an online or business-as-usual condition. Preliminary results showed that parents in ePALS, as compared to controls, showed greater increases in contingent responsiveness, language-building strategies, book comprehension techniques and positive engagement, while the children had greater increases in language use, book engagement, and enthusiasm (effect sizes ranging from 0.48 to 0.75). In addition, ePALS effects were found for children’s attention focus and decreased impulsivity (Landry et al., 2021). Results suggest that the ePALS IICMI program is effective as a remotely delivered intervention for economically disadvantaged families to strengthen early parenting behaviors that promote communication and child language development.

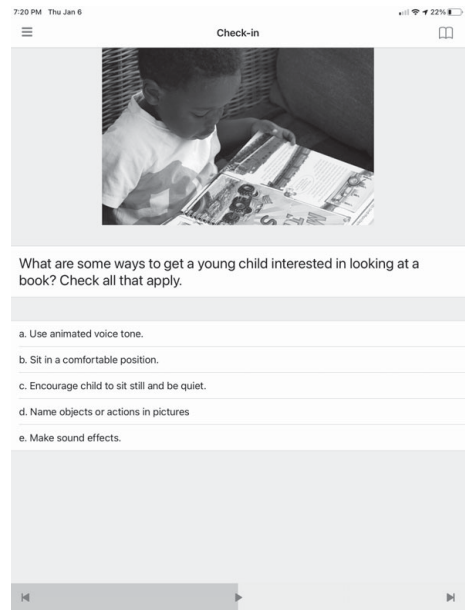
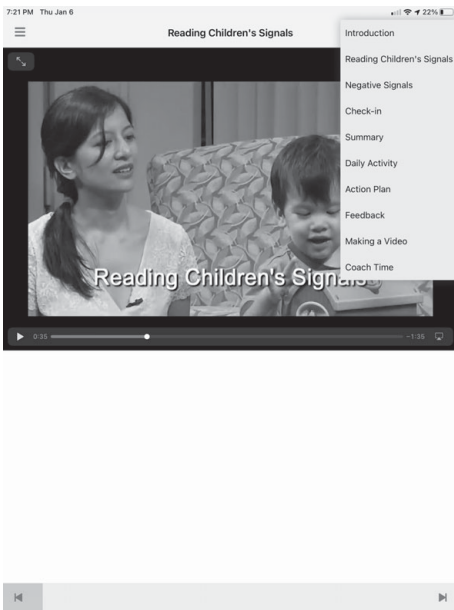
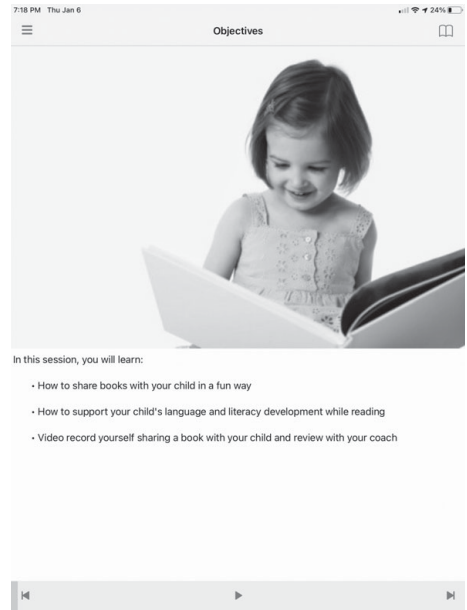
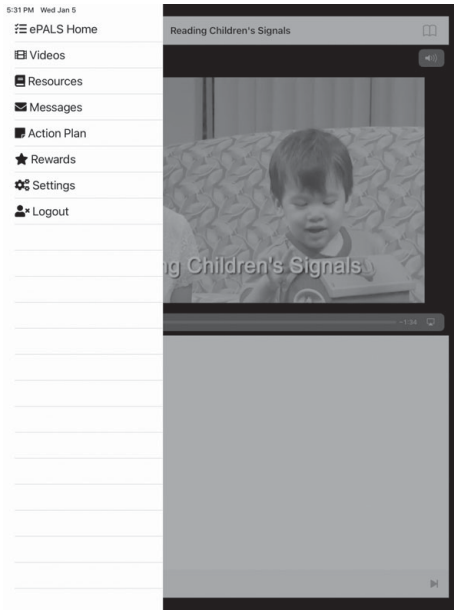


Figure 26.1 Tablet screen shots from ePALS program

The Strongest Families Smart Website (SFSW) is an IICMI adaptation of the Strongest Families intervention that helps parents develop skills to strengthen relationships with their child, reinforce positive behavior, manage daily transitions, and plan for difficult situations through handbooks, videos, and weekly telephone sessions from a coach (McGrath et al., 2011). Like the PALS program, Strongest Families lends itself to IICMI adaptation with both video and telephone support central to its delivery. The 11 web-based sessions include exercises, instructional videos, and audio clips demonstrating the application of new skills and the website is personalized with the child's name, problems, strengths, and preferred activities. Each week participants receive an approximately 45-minute telephone call from a facilitator, a licensed health care professional who receives intensive training. On the calls, facilitators review the new skills, respond to questions, and provide encouragement. The web-based IICMI program was translated into Finnish and a randomized control trial was conducted in Finland (Sourander et al., 2016). A total of 464 parents of four-year-old children with disruptive behavioral problems were randomized into experimental or attention-control groups. Follow-up results at six and 12 months found significant improvements in parent self-reported parenting skills and parent-reported child aggression, affective anxiety, and sleep problems. Furthermore, parents reported high satisfaction with the program. These findings indicate that the Strongest Families program, combining parent training with support from a professional facilitator, is effective when adapted as an IICMI and may be a valuable resource for the public health system.

Stand-Alone Research-Based IICMI Programs

The *Positive Parenting Program (Triple P)* is a multilevel program to offer treatment for and prevent severe behavioral, emotional, and developmental problems in children aged 0 to 16 years through enhancing the knowledge, skills, and confidence of parents. Triple P incorporates five levels of interventions on a tiered continuum of increasing intensity (Sanders, Markie-Dadds, & Turner, 1999). Level 1 is a form of universal prevention that delivers psychoeducational information on parenting skills to interested parents. Level 2 is a brief intervention of one or two sessions for parents of children with mild behavioral problems. Level 3 is a four-session intervention that targets children with mild to moderate behavioral difficulties, and includes active skills training for parents. Level 4 is an intensive, 8- to 10-session parent training program for children with more severe behavioral difficulties, or those who are at risk of developing such problems, which can be offered either individually or in a group setting. Triple P On-Line (TPOL; Tumer & Sanders, 2011) is an eight-session Internet-based adaptation of the Level 4 Triple P program. TPOL is designed to promote engagement and program compliance through user-friendly navigation, appealing graphics, video demonstrations of parenting skills, and "vox-pops" from parents describing their experiences. Additional features include computer-assisted goal setting, probes and exercises to check mastery, and downloadable worksheets, tip sheets, and podcasts. The program provides parents with a customizable and printable notebook that automatically records parents' goals and exercise responses. In a randomized control trial,

97 families of children with externalizing behaviors were assigned to either experimental or business-as-usual groups (Sanders et al., 2012). At post-intervention assessment, parents receiving TPOL had significantly better outcomes on measures of problem child behavior, dysfunctional parenting styles, parents' confidence, and parental anger. At six-month follow-up assessment, intervention gains were generally maintained, and in some cases enhanced. Consumer satisfaction ratings for the program were high. In another study, 52 mothers with elevated parenting stress were randomly assigned to the experimental or waitlist/control condition (Ehrensaft et al., 2016). Mothers who completed at least the first four TPOL core modules had lower scores on the Parenting Scale's subscales (Overreactivity, Verbosity, and Laxness), compared to those who did not complete four or more modules. These studies provide evidence of the efficacy of this self-directed online parenting program.

The *Parenting Wisely (PW)* IICMI was initially developed as a CD-ROM parent training program (Gordon, 2000) and then adapted to web-based delivery (Feil et al., 2011). Through self-administration, parents view video clips of nine common family problems. After selecting a problem, parents view a video clip depicting a family struggling with that problem. Parents select a solution to the problem out of the alternatives, view a video enactment of their selected solution, and participate in a critique of that choice. Strategies such as contracting, contingency management, "I statements," active listening, assertive discipline, and praise are presented. After viewing the most effective solution, a series of multiple-choice questions reviews the concepts and skills depicted in that section. Parents complete the program in a little over two hours. In a randomized controlled trial, Kacir and Gordon (1999) found that parents increased their knowledge of parenting skills, and child behavior problems

decreased from clinical to normal levels with average effect sizes of 0.46. O'Neill & Woodward (2002) found PW to improve child problem behavior (ECBI) among families attending a community mental health clinic in Ireland, compared to a randomly assigned delayed treatment group (which also improved after treatment). PW has been shown to be an effective and low-intensity IICMI program.

Phone-Assisted Parenting Support Intervention

In addition to computer-based programs, text-message-based approaches are another example of IICMI to promote parent engagement in research-based curricula and enhancing parenting outcomes. In one illustration, Bigelow, Carta and colleagues (Bigelow et al., 2020; Carta et al., 2013) developed a text-message component to support an eight-session home-visiting program focused on language-promoting strategies (PC TALK) (Walker & Bigelow, 2008). As a supplement to the home-visiting sessions, parents also received text messages prompting them to use a specific strategies or engage in positive interactions with their child, and a second series of texts inquiring about parents' use of the PC TALK skills, their implementation of a planned activity or interactions with their child, or their child's behavior. An online text messaging service was used by home visitors to allow for remote access and scheduling to the text messaging service as well as to generate reports used to monitor and provide feedback on the fidelity of implementation of the text messaging intervention. The text message content was individualized for each parent and related to the focus of recent intervention visits. Interspersed with text message prompts and questions were messages with suggestions for low-cost or free activities within the community and supportive messages to the parents

that did not directly pertain to the intervention (e.g., providing resources or praising mothers' efforts). As well, home visitors called mothers once per week between home visits to engage mothers in talking about their use of PC TALK skills or their interactions with their child. A sample of 371 low-income mothers and their 3–6 year-old children were randomized to (a) cell-phone-supported home visiting compared with (b) traditional home visiting. While there were no significant main outcomes, mothers in the cell-phone condition used the PC TALK skills more than mothers in the comparison group and experienced greater reductions in depression and stress (Carta et al., 2013). Secondary analyses within the cell-phone group found that the number of skill-focused text messages sent were related to significantly greater parent engagement and parent skill use and fidelity, and, consequently, child language outcomes (Bigelow et al., 2020).

Chu and colleagues (2019) developed MyTeen, a tailored program of text messages of evidence-based parenting tips for establishing and maintaining positive relationships with adolescents; strategies to increase adolescent autonomy; advice about adolescent development, family functioning, and parental self-care; information to help parents recognize depressive symptoms and understand treatment options; and links to evidence-based support and informational resources (Chu et al., 2019). The research team scheduled once-daily text messages to participants at a preferred time of day. Participants were able to discontinue the program at any time by replying "stop" to the messages received. They recruited a sample of 221 parents and primary caregivers of adolescents aged 10–15 years via community outreach and social media and randomly allocated 1:1 into the control or the intervention group. The program of one month of daily text messages led to a significant improvement in ratings of parents' sense

of competence. Parents who received the program reported significantly higher parental competence, lower levels of parental stress, and improved parents' knowledge of help-seeking options than parents in the control group with sustained effects at three months. The program, via text messages, was well received, with participants stating that they would recommend it to others. Low attrition rates suggest that parents have an interest in receiving the text messages. The program required minimal time commitment and was conducted with no therapist support. Text-messaging interventions are intrinsically proactive and can be accessed by users at any time. Compared with other computerized modalities, text messaging does not require logging in or tunneling through web pages, thus reducing perceived barriers to engagement. Text-based IICMI programs can be easily scaled up for delivery as an early preventive intervention and may represent a less expensive option for service delivery (Chu et al., 2019).

Technological Advancements

One of the challenges to telehealth research and programs is the rapid rate of technology development – by the time a research or service program has been created and studied, the technology used could be obsolete (Liss, 2005). Therefore, there is a great need to monitor advancements and how they can be applied to IICMI programs. Below are two new technologies, Natural Language Processing and Smart Speakers, that are being applied to IICMI programs.

Natural Language Processing (NLP) refers to comprehending and analyzing natural spoken language transcriptions by using computer algorithms and programs (Zeng et al., 2015). NLP can be used to facilitate scale-up by limiting costs and increasing feasibility with the automation of fidelity assessment (Anglin & Wong, 2020; Atkins et al., 2014) during

training as well as implementation. Though fidelity is recognized as an important for the successful transfer of evidence-based programs to service settings (Ogden & Fixsen, 2015), monitoring intervention fidelity is traditionally costly as each monitored session requires review by trained human observers. NLP mitigates the need for human observation by using NLP techniques to quantify the similarity between facilitator–client session transcripts and “gold standard” scripts that are judged to model high-quality implementation. To monitor fidelity during scale-up, a set of ideal scripts representing the gold standard implementation are identified. These scripts, in combination with the transcripts of every facilitator–client session, make up the *text corpus*. The similarity between each transcript and the appropriate ideal script (matching the skill progression of a given coaching session) is calculated (Anglin & Wong, 2020). Natural language processing (NLP) offers methods for analyzing text, augmenting the understanding of intervention effects, and informing therapeutic decision making by creating statistical models to predict target variables, including user engagement, symptom change, and therapeutic outcomes. NLP techniques can improve the prediction of symptom changes in IICMI programs (Funk et al., 2020). IICMI programs are well positioned to leverage Natural Language Processing (NLP) to understand communication between users and the trained practitioners supporting them (Anglin & Wong, 2020; Atkins et al., 2014; Funk et al., 2020).

Smart speaker technology holds significant promise for bringing evidence-based parenting support to parents, accessed simply through voice commands, addressing the weaknesses in the prior research by overcoming barriers to engagement and providing in-situ guidance on implementing positive parenting strategies. Smart speakers utilize an in-home device (e.g. Amazon Echo, Google Home) involving a

sensitive microphone, small speaker, and Wi-Fi-based Internet access, to connect to cloud-based information and program services enabled by natural language understanding and artificial intelligence. The speaker/microphone device serves as the connection to the cloud-based services; users invoke the services by simply speaking to the device (“Alexa” for Amazon’s Echo). Smart speakers support using spoken natural language to get information, perform tasks, and interact with services and are becoming more common. In one recent study, Beneteau and colleagues (2020), sought to better understand diverse households with children and how families’ use of home-based voice interface technology impacted families. They introduced smart speakers into 10 diverse families in an urban area of the United States who identified having a total household income at or below the median household income. They found that the smart speaker caused occasional conflict in the home, and observed that parents leveraged the smart speaker to further positive parenting goals in three forms: (1) fostering verbal communication, (2) using it as a neutral third-party referee, supporting parenting tasks like playing music or lullabies, singing songs, setting reminders with routines, setting a timer for time outs, or telling stories to their children. They showed that smart speakers may provide a type of support for positive parenting practices. This descriptive study is an initial examination, but more research on the use smart speakers to deliver IICMI programs is needed.

Discussion

In order to meet the wide range of needs among parents today, as well as to take advantage of all that technology offers, those developing and offering parent training programs must ensure diversified delivery, creating a spectrum of services ranging from intensive face-to-face services to brief, self-

directed parent training (McGoron & Ondersma, 2015). IICMI programs have been shown to be effective and to appeal to many parents and providers. In addition, IICMIs have been able to circumvent many barriers to services, such as time, transportation, and inaccessibility to services, especially for parents living in rural areas (Liss, 2005). While technology can deliver much needed services, IICMI programs will not appeal to all parents. Acceptability of digital solutions may face challenges due to potential conflicts with users' cultural, moral, and religious backgrounds (Fagherazzi et al., 2020). Digital tools can provide public health benefits; however, they may be intrusive or leave vulnerable populations behind. For the widespread delivery of BPT, we need a diversity of options. While IICMI programs have many benefits, the technology won't appeal to all. But as we see with the COVID-19 pandemic, technology can provide a very valuable resource. The COVID-19 pandemic has demonstrated the strong potential of various digital health solutions that have been tested during the crisis.

The COVID-19 Pandemic and Technology

One of the key changes implemented by health systems throughout the world in response to the COVID-19 pandemic has been the rapid expansion of telemedicine (Ortega et al., 2020). As the COVID-19 pandemic demanded social distancing that limited in-person contact, a majority of Americans turned to digital means to stay connected as well as track information about the outbreak. Thirty-six percent of Americans say their own personal lives changed in a major way as a result of the COVID-19 pandemic (Auxier, Anderson, Perrin & Turner, 2020). A Pew Research Center survey of U.S. adults conducted found that 53 percent of Americans report that the Internet and mobile devices were essential

during COVID-19 pandemic. Amid this increased reliance, 93 percent of U.S. adults reported that a major interruption to their Internet or cell-phone service during the COVID-19 pandemic would be a problem in their daily life, including 49 percent who foresaw an outage being a very big problem for them and 28 percent who believed it would be a moderately big problem. (Anderson & Vogels, 2020). Asked to provide a summary of all the advantages and disadvantages of the Internet for them personally, nine in ten Americans say the Internet has mostly been a good thing for them. At the same time, 78 percent believe it has been a mostly good thing for society (Vogels et al., 2020).

In a Pew survey prior to the COVID-19 pandemic, 71 percent of parents of a child under the age of 12 say they are at least somewhat concerned their child might spend too much time in front of screens, including 31 percent who are very concerned (Auxier, Anderson, Perrin & Turner, 2020). As school moved online for many families during the pandemic, parents and their children have experienced profound changes, with 93 percent of parents with K-12 children at home saying these children had some online instruction during the pandemic. Among these parents, 30 percent say it has been very or somewhat difficult for them to help their children use technology or the Internet (McClain, et al., 2021). Seventy-two percent of parents with children in kindergarten through twelfth grade reported that their children were spending more time on screens compared with the situation prior to the COVID-19 pandemic (McClain et al., 2021). An analysis found that 59 Percent of parents with lower incomes who had children in schools that were remote at the time said their children would likely face at least one digital obstacle, such as slow/absent Internet and lack of computer access (Auxier, 2020). While telehealth has enabled an

increase in access to health care and awareness of tools to help individuals manage their health, the COVID-19 pandemic has shown that vulnerable populations, including parents of school-aged children, continue to struggle to receive services (Doarn, 2021).

Underserved Populations

Tech struggles and usefulness alike vary by reported race and ethnicity. Americans' experiences also have varied across racial and ethnic groups. For example, Black Americans are more likely than White or Hispanic adults to meet the criteria for having "lower tech readiness." (McClain et al., 2021). Among broadband users, Black and Hispanic adults were also more likely than White adults to be worried about paying their bills for high-speed Internet access at home (McClain, et al., 2021). And a majority of Black and Hispanic broadband users say they at least sometimes have experienced problems with their Internet connection. Still, Black adults and Hispanic adults are more likely than White adults to report other technologies – text messages, voice calls, video calls, social media sites and email – that have helped them stay connected with social networks during the COVID-19 pandemic (McClain et al., 2021). Among these parents, 62 percent report that online learning has gone very or somewhat well, and 70 percent say it has been very or somewhat easy for them to help their children use technology for online instruction. Still, 30 percent of the parents whose children have had online instruction during the pandemic say it has been very or somewhat difficult for them to help their children use technology or the Internet for this. (McClain et al., 2021). Parents may require different levels of support for continued engagement in IICMI programs, based on their level of service seeking, family characteristics, risk profile, and motivation for change (Breitenstein et al., 2021).

Truth and accuracy. The Internet has made the process of getting accurate, best-practice information harder rather than less cumbersome because of the great amount and variable quality of parenting information available. A Google search for "parenting strategies" produced 102,000,000 results (5/24/2021) and "time out parenting" produced 7,860,000,000 results. Parents need a resources to receive trusted information in a digestible format that can assist them in using research-based programs with their children. Qualitative research has shown that the Internet and social media are rapidly becoming important and trusted sources of parenting and health information that mothers turn to when making child care decisions (Moon et al., 2018). For some parents, these electronic resources are more trusted than family members, friends, and health care professionals. It is becoming increasingly important that parents are provided guidance about accessing trustworthy, evidence-based health information. The ubiquitous social media landscape has created an information ecosystem populated by a cacophony of opinion, true and false information, and an unprecedented quantity of data on many topics (Chou et al., 2018). We are all confronted with the spread of false, inaccurate, or incomplete health information (Southwell et al., 2017). In the wake of the COVID-19 pandemic, we have entered an era of unprecedented "infodemic." There has never been a more urgent time to address the long-standing question of how to overcome the deleterious influence of exposure to online mis/disinformation. eHealth literacy, a skill set including media literacy, is key to navigating the web in search for health information and processing the one encountered through social media (Levin-Zamir & Bertschi, 2018). Studies assessing the impact of increasing eHealth literacy on behavioral attitudes and health outcomes in the general population are relatively scarce to date. Yet for many reasons, leveraging eHealth literacy skills, and,

more specifically, media literacy, could be of great value to help mitigate the detrimental effects of erroneous information on vaccination decision making (Dib et al., 2021).

Choice and Context for Interactive Internet/Mobile Computer Mediated Interventions (IICMI)

The research- and practice-informed strategies discussed above offer a basic understanding of virtual engagement best practices in family support services. However, the available literature does not identify a single strategy, or combination of strategies, as most effective (Ramos et al., 2021). IICMI and technology can be an excellent option but it can never be a complete replacement. Surveys of Americans amid the COVID-19 pandemic report that while the majority (64 percent) said that digital encounters were useful, only 27 percent state that digital encounters are just as good as in-person encounters and could be a replacement for in-person interactions (McClain et al., 2021). However, as has been discussed, significant practical barriers exist to the dissemination and utilization of effective interventions, especially within low-income and rural communities. Internet/mobile-facilitated delivery mechanisms have the potential to overcome many obstacles. Moreover, the use of phones, social media, and email to provide peer and professional support, feedback, and encouragement will likely be continued to be used by society and will augment both participation in and the effectiveness of parenting interventions. Because of the increasing saturation of computers and Internet/mobile use in our communities, IICMI programs have the potential for broad, low-cost dissemination.

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