A Randomized Controlled Trial Examination of a Remote Parenting Intervention: Engagement and Effects on Parenting Behavior and Child Abuse Potential

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Abstract

Technology advances increasingly allow for access to remotely delivered interventions designed to promote early parenting practices that protect against child maltreatment. Among low-income families, at somewhat elevated risk for child maltreatment, there is some evidence that parents do engage in and benefit from remote-coaching interventions. However, little is known about the effectiveness of such programs to engage and benefit families at high risk for child maltreatment due to multiple stressors associated with poverty. To address this limitation, we examined engagement and outcomes among mothers at heightened risk for child abuse, who were enrolled in a randomized controlled, intent-to-treat trial of an Internet adaptation of an evidence-based infant parenting intervention. We found that engagement patterns were similar between higher and lower risk groups. Moreover, an intervention dose by condition effect was found for increased positive parent behavior and reduced child abuse potential.

Keywords

Internet; evidence-based treatment; infants; intervention research; technology; parenting

Very young children living in poverty are at particularly high risk for child maltreatment (Centers for Disease Control and Prevention [CDC], 2016a). A complex interplay of stressors heighten the potential for multiple forms of child maltreatment (Evans, Li, & Whipple, 2013; Slack, Holl, McDaniel, Yoo, & Bolger, 2006; Zielinski & Bradshaw, 2006). These stressors include financial strain (Conger, Elder, Lorenz, Simons, & Whitbeck, 1994), household crowding (Evans et al., 2013), intimate partner violence (McTavish, MacGregor,

Wathen, MacMillan, 2014), maternal depression (Ammerman, Putnam, Bosse, Teeters, & Van Ginkel, 2010), lack of social support, low parenting self-efficacy, low education level, and limited knowledge of child development (CDC, 2016a).

Parental experiences of disadvantage, distress, and high conflict can compromise maternal parenting resources and, in turn, lead to less nurturing and more punitive responses toward their children (Duncan, Magnuson, & Votruba-Drzal, 2014). Maltreating parents are less supportive, affectionate, playful, and responsive to their children's needs (Duncan et al., 2014). They are more likely to use harsh discipline and verbal aggression than positive parenting strategies (http://www.apa.org/pi/families/resources/child-abuse-article.pdf). Compromised parenting behaviors during routine interactions with infants, which are characterized by less sensitive and flexible responding and less verbal scaffolding, are associated with poor behavioral and developmental outcomes throughout early childhood (Landry, Smith, Swank, Assel, & Vellet, 2001) and the life span (Black et al., 2016; CDC, 2016b; Evans et al., 2013).

Research has demonstrated the positive effects of parent sensitivity and responsiveness on reducing subsequent child maltreatment and behavioral health risk as well as on promoting infant cognitive, social-emotional, and language development (World Health Organization, 2004). Consequently, promoting parent sensitivity and responsiveness is a crucial aim of parenting interventions designed to reduce risk for child maltreatment (CDC, 2016c) and foster the behavioral foundations of infant social-emotional health. In the past decade, targeted interventions, such as the Play and Learning Strategies (PALS) program, have been rigorously tested and shown to strengthen maternal responsiveness and sensitivity, which protect against child maltreatment and improve infant social-emotional behavior and developmental outcomes (Akai, Guttentag, Baggett, Willard-Noria, & the Centers for the Prevention of Child Neglect, 2008; Guttentag et al., 2014; Landry, Smith, Swank, & Guttentag, 2008). These behavioral foundations, improved by intervention, include infant social-emotional competencies comprised of emotional regulation skills of self-soothing, clear social-communication signaling, and behavioral organizational skills of establishing and sustaining joint attention (Akai et al., 2008; Guttentag et al., 2014; Landry et al., 2008).

Although evidence-based interventions such as PALS are available, they have not by and large achieved the reach necessary to enable low-income families to access them (Baggett et al., 2010). Although home visiting is the most common mechanism to support early parenting, particularly for low-income families, we know that these programs reach on average less than 4% of the population in need of such intervention and, in some cases, are prohibitively costly to bring to scale with sufficient intensity (Dodge, Goodman, Murphy, O'Donnell, & Sato, 2013). Moreover, home visits are not a viable avenue of service delivery for many mothers due to family life circumstances such as unpredictable work schedules, the need for appointments outside of typical office hours, and living in multifamily homes in which other individuals may not want home visiting (Vismara et al., 2016).

To address financial and geographical barriers to intervention access (Katz, La Placa, & Hunter, 2007), we adapted the evidence-based PALS program (Landry et al., 2008) for Internet delivery with remote coaching for low-income mothers (e-PALS: Infant-Net;

Baggett et al., 2010; Feil et al., 2014; Feil et al., 2008). Examination of Infant-Net within a randomized controlled pilot trial with 40 low-income mothers and their infants showed high retention and engagement with medium to large effects on maternal parenting practices and infant behavior (Baggett et al., 2010). Subsequently, we conducted a larger randomized controlled, intent-to-treat trial of the Infant-Net program, which was renamed Baby-Net when made available in English and Spanish. In one examination from this trial, with 159 low-income families, we found significant improvement in maternal language-promoting behavior and infant communication behavior within a book sharing activity (Feil et al., in press). While these are encouraging results that low-income mothers, at general risk for child maltreatment, do engage in and benefit from the evidence-based, technology-adapted parenting intervention, it remains to be seen whether mothers at more elevated risk for child maltreatment will engage in and benefit from such intervention.

Study Purpose and Research Questions

The purpose of this study is to examine a subset of mothers at highest risk for child maltreatment within a randomized controlled, intent-to-treat trial of an evidence-based Internet parenting program. In particular, we are interested in patterns of intervention engagement for this high-risk sample of mothers as compared to lower risk mothers. Moreover, we are interested in whether mothers at heightened risk for child maltreatment benefit from a targeted remote intervention focused on infant parenting skills as compared to an attention control intervention focused on awareness of infant developmental milestones. Toward this purpose, we address the following research questions:

> **Research Question 1:** What is the pattern of intervention engagement and satisfaction for high-risk mothers as compared to lower-risk mothers?

> **Research Question 2:** Do high-risk mothers, who receive a targeted remote-coaching intervention aimed at improving infant parenting skills, benefit in terms of prepost increases in observed positive parenting behavior and reductions in child abuse risk, when compared to high-risk mothers who receive a general remote-coaching intervention to promote maternal awareness of infant developmental milestones?

The current study stands to increase our knowledge about whether or not mothers at elevated risk for child maltreatment would engage in and benefit from an evidence-based, technology-adapted parenting intervention. Our focus on expanding the reach of evidence-based parenting intervention to low-income mothers, particularly those at highest risk, falls squarely in line with the CDC's strategic framework for helping states and communities to prioritize prevention activities based on the strongest available evidence, namely, enhancing parenting skills to promote healthy child development and intervening to lessen harm and prevent future risk (Fortson, Klevens, Merrick, Gilbert, & Alexander, 2016)

Method

Participants

Participants included 159 English- and Spanish-speaking low-income mothers and their infants who were between the ages of 3½ and 7½ months old at the start of intervention. Dyads were recruited from a Midwestern metropolitan area and from rural and suburban areas in the Pacific Northwest. Mothers were recruited from family support and early intervention service providers serving low-income families (e.g., Women Infants and Children (WIC) and Early Head Start). Mother–infant dyads were part of an intent-to-treat sample within a randomized controlled trial, examining the effectiveness of an Internet adaptation of an evidence-based, remote-coaching parenting intervention ($n = 83$) when compared to an Internet-based, attention-control developmental awareness intervention ($n = 76$). For inclusion in the controlled trial study, we defined low income as at or below 130% of the federal poverty guideline as required for service eligibility for WIC and Early Head Start. Exclusion criteria included homelessness, living in an area without cellular service, or receiving inpatient mental health or substance abuse treatment at the time of screening.

In this economically disadvantaged sample, 43% of mothers self-identified as an ethnic or racial minority. Approximately half of the sample had a high school diploma or less. Many mothers were experiencing symptoms of depression, with the average preassessment Postpartum Depression Screening Scale (PDSS; Beck & Gable, 2002) score at the clinical cutoff for significant depressive symptoms. Not surprisingly, given the low-income inclusion criteria, 70% of mothers reported experiencing financial strain as defined by having "at least some difficulty paying bills each month." For a fuller description of sample recruitment and matriculation into intervention, see Feil and colleagues (2014).

Procedures

Experimental condition: e-PALS Baby-Net—Baby-Net is an 11-session bilingual version of the e-PALS Infant-Net program (Baggett et al., 2010), which is an Internet adaptation of the PALS program (Landry et al., 2008). Baby-Net includes the seven original PALS (Landry et al., 2008) home-visiting session content topics: (a) reading infant signals (signals); (b) responding with warm and sensitive behaviors (responding); (c) maintaining infants' focus of attention (maintaining interest); (d) finding opportunities to introduce an object or social game (introducing); (e) using rich verbal content in combination with physical demonstrations (words and actions); and (d) incorporating this constellation of behaviors in everyday activities such as dressing, feeding, and playing (daily activities) with the addition of reading with babies (Read to Me, Inc.; http://www.readtomeprogram.org/index.html) to promote very early preliteracy development. In addition to the unique content sessions above, an introductory session orients parents to the program, and three review sessions are interspersed throughout the program, including two review sessions that parents can share with a significant other and a cumulative summary session at the end.

The Baby-Net adaptation of PALS (Feil et al., 2008, 2014), replicating the original PALS in-home learning structure, includes the following key component structure in each intervention session: (a) self-directed learning of PALS skills through video-based examples

and nonexamples, with check-in questions using immediate individualized feedback; (b) action plan outlining daily activity practice (homework) based on skills taught; (c) video-recorded practice creating a 5-min, computer-collected, mother–infant interaction video demonstrating skills learned and uploaded to a project server; and (d) coach call involving mothers and coaches coviewing weekly mother-created videos to provide individualized support for conceptual learning and skill acquisition. Prior to each coach call, coaches prepare by accessing weekly mother-created video and auto generated reports that display the amount of time mothers spend in the program and their responses to check-in questions. The primary purpose of the 30-min weekly coach call is to answer questions and support mothers in their weekly session learning, draw out mothers' observations to build their reflective capacity about their baby and their use of PALS skills, elaborate successes in practicing the PALS, and provide support to try out new skills.

Baby-Net coach training—Baby-Net coaches held a minimum of a bachelor's degree in a helping profession such as counseling, psychology, social work, or early childhood education. Prior to the study, coaches completed a 2-day training conducted by a national PALS trainer and were taught to adhere to a coach call implementation guide. Following initial training, coaches (a) met with a Baby-Net coach supervisor to preview the Baby-Net program, (b) completed all session content as a "parent," (c) listened to three model coach calls, (d) practiced completing coach and parent implementation fidelity forms, and (e) completed two audio-recorded coach call practices certified as meeting 85% or higher implementation fidelity by the national PALS trainer and Baby-Net supervisor. Ongoing weekly supervision and monthly implementation fidelity checks were completed by a supervisor.

Attention-Control Condition: Developmental Awareness Skills (DAS)—We designed the DAS program to be a strong attention-control condition in which mothers received the same learning component structure as in Baby-Net: (a) the same number of sessions with information provided about infant developmental milestones, (b) weekly video recording of infant behavior, and (c) the same number of weekly coach calls to coview infant videos uploaded to ePALS and discuss developmental milestones observed each week. This parenting intervention focused on maternal awareness of infant developmental milestones and not on targeted parenting practices.

DAS coach training—DAS coaches had at least a bachelor's degree in a helping profession such as counseling, psychology, social work, or early childhood education. Prior to the study, coaches completed training and received certification as having achieved at least 85% implementation fidelity on two audio-recorded DAS coach calls. Because all coaches were dually trained to implement both PALS and DAS coaching, we trained coaches to adhere to a DAS coach call guide and to avoid using PALS concepts and engaging in any parenting skill instruction or coaching during their call.

Assessment and randomization procedures—The pre- and postassessment included a multi method approach to examining maternal, infant, and family characteristics, with direct observation of mother and infant behavior as well as questionnaires pertaining to

maternal, infant, and family functioning. Trained assessors conducted a 2-hr home visit to complete both pre- and postassessments with mothers. Following preassessment, mother–infant dyads were randomly assigned, in a 1:1 allocation, to either the experimental condition or the attention control. All mothers were given a cellular-activated computer to use for up to 6 months to complete the intervention. Mothers completed postassessment 6 months after preassessment (see Feil et al., 2014).

Measures—In the current study, questionnaire assessments addressed indicants identified in recent summaries of the contextual, interpersonal, and intrapersonal risk factors for child maltreatment (CDC, 2016a; Child Welfare Information Gateway, 2004). Child age and low income are two important factors also noted in this literature as linked to child maltreatment, substantiating the relevance of our current study.

Demographic characteristics—Demographics included educational level, reported on a 5-point scale ranging from "less than high school" to "bachelor's degree or higher," dichotomized into high school or less and more than high school. The number of people living in the home assessed through two open-response questions asking for the number of adults and the number of children currently living in the mothers' home. Financial strain, assessed via 9 questions, rated on a 5-point Likert-type scale, pertaining to perceived financial strain. Questions assessed the areas of difficulty paying bills, money left over after paying bills, and money availability for necessities and other activities (Conger et al., 1994; Pearlin, Menaghan, Lieberman, & Mullan, 1981). Internal consistency on the current sample was high, $\alpha = .82$.

Partner aggression—Partner aggression was assessed via the Conflict Tactics Scale, (Straus, 1979), a widely used measure with strong psychometric properties for identifying intimate partner maltreatment. The scale has 39 items in five categories: reasoning and negotiation, psychological aggression, physical assault, sexual coercion, and consequence (physical injury). In this study, we used the total score for maternal reports on the Partner Psychological Aggression (8 items) and Physical Assault (5 items) subscales. Internal consistency estimates for these two subscales for the current sample were adequate, $\alpha = .76$ and .86, respectively.

Maternal knowledge of child development—Knowledge was assessed via the Concepts of Development Questionnaire (Sameroff & Feil, 1985), a 20-item, Likert-type 4-point scale that assesses parenting beliefs. Constructs include flexibility and child-centeredness in contrast to parent-centeredness. The internal consistency estimate on the current sample was adequate, $\alpha = .65$.

Maternal depression—Depression was assessed via the PDSS (Beck & Gable, 2002), a 35-item Likert-type self-report instrument that demonstrates strong sensitivity and specificity for postpartum depression. In the current sample, internal consistency was high, $\alpha = .97$.

Maternal social support—Support was assessed using the Personal Relationship Inventory (Guttentag, Pedrosa-Josic, Landry, Smith, & Swank, 2006), a 20-item true/false

scale used in prior PALS studies. Mothers were asked to identify up to 6 people who provide them with support and respond to 20 items, reflecting positive and negative levels of support for each person. We weighted total positive support by the amount of total negative support in a mother's life to achieve an overall index, with a high score reflecting "high positive/low negative" and a low score "low positive/high negative" support.

Maternal parenting self-efficacy—Self-efficacy was assessed via 6 items, rated on a 7-point Likert-type scale, resulting from extensions of the Pearlin Mastery Scale (Pearlin & Schooler, 1978) and related to mothers' view of their efficacy as a parent (Whitman, Borkowski, Keogh, & Weed, 2001). Three items were stated in a negative fashion (e.g., "I am uncertain about whether I can provide emotional support to my children"). These were recoded such that a higher total score reflected higher self-efficacy.

Maternal child abuse potential—To measure child abuse potential, we used the total score from the 77-item Abuse subscale within the Child Abuse Potential Inventory (CAPI), which has demonstrated acceptable internal consistency, test–retest reliability, and predictive validity (Milner, Gold, & Wimberley, 1986). The CAPI is a well established and extensively used measure (e.g., Zelenko et al., 2001). The internal consistency estimate within the current sample was high, $\alpha = .89$ at preassessment and .92 at postassessment.

Maternal parenting behavior—Behavior was recorded using the Landry Parent–Child Interaction Scales (Landry, Smith, Miller-Loncar, & Swank, 1998). Behavior was coded during 30 min of direct observation of maternal and infant behavior across two activities: a 20-min free play and a 10-min book read activity. Maternal parenting behaviors of interest across both activities included (a) warm, positive affect and (b) flexible responding. These positive behaviors that have been shown to be protective against child maltreatment and are associated with more positive child behavioral and developmental outcomes. Trained observers at the University of Texas, naive to condition and time point, rated mother–infant interaction videos. Inter observer agreement ICCs ranged from .77 to .96, mean = .86 (Feil et al., in press). In order to reduce the number of variables analyzed, the four observational codes (i.e., warm/positive and flexible responding codes in book and play activities) were factor analyzed in an attempt to form a single behavioral parenting construct. For both T1, pre intervention, and T2, post intervention, a principal component analysis indicated these behaviors merged into a single parenting factor, with factor loadings of .3 or greater and explaining 44% and 47% of the variance in observation codes, respectively. Observational variables were created at both time points by summing the standardized unit weighting of each observational code.

Intervention engagement—For the present study, we were interested in the number of sessions completed as indicated by last session page viewed. Progression from session to session required that mothers actively engage in activities such as answering check-in questions, create a video with their baby relevant to session content, and create a weekly action plan during the upcoming week.

Intervention satisfaction—A satisfaction questionnaire was administered to mothers at postassessment. Twenty-eight items, rated on a 5-point Likert-type scale, pertained to five

dimensions of satisfaction: acceptability of intervention procedures (3 questions), acceptability of information taught (4 questions), perceived program impact on you as a parent (8 questions), and satisfaction with remote-coaching process (13 questions). We recoded questions such that a high score on each item represented a positive view of the intervention.

Data reduction: Mothers at highest risk for child maltreatment—To address our research questions, we were interested in identifying a subsample of participants at highest risk for child maltreatment. To do so, we empirically defined high-risk mothers using two criteria: the clinical cutoff of 166 on the CAPI and a model-predicted CAPI cutoff score conceptually informed by the literature on parent and family risk predictors of child maltreatment. Within our sample, approximately 15% of mothers ($n = 25$) obtained a CAPI score above the clinical cutoff (Milner et al., 1986). Given that the most common form of detection error with the CAPI is due to false negatives, we created an empirical model of risk prediction for child abuse potential (see Figure 1) to capture mothers at heightened potential for child abuse who might not be captured by the CAPI. We first performed principal component factor analysis on family and intrapersonal factors related to child maltreatment, including maternal depression, self-efficacy, social support, knowledge of infant development, and education level as well as financial strain, partner aggression, and number of people living in the home. Using the criteria of factor loadings of .5 or greater on a single factor, with no cross-loading greater than .3, three risk factors were formed: *maternal coping strain* (26% of variance explained by indicants), *family strain* (13% of variance explained by indicants), and *maternal knowledge limitations* (21% of variance explained by indicants). The three factors explained a total of 60% of the variance in the observed variables. It should be noted that the "number of people living in the home" variable cross-loaded on all three factors and, as such, was excluded to ensure independence.

With the three-factor measurement model established, we created factor scores for each risk construct by summing the standardized unit weighting of each indicant. We then regressed mothers' CAPI score onto the three risk construct scores, allowing all three risk variables to enter on the same regression step. All three constructs remained significant in the model to explain 55% of the variance in mothers' CAPI scores, Model $F(3, 155) = 69.11$, $p < .0001$, *coping stressors: b* = .69; $t = 12.53$, $p < .001$; *family stressors: b* = .16; $t = 2.90$, $p < .01$; *knowledge limitations: b* = .11, $t = 2.01$, $p < .05$. Given that the CAPI clinical cutoff of 166 identified approximately 15% of our participant mothers as higher risk ($n = 25$), we applied the same approximate distribution cutoff to our risk-predicted CAPI score based on shared variance with maternal coping stressors, family stressors, and knowledge limitations. A predicted z-score of 1.0 or higher served as the cutoff, which identified 18 of the mothers previously identified by the CAPI clinical cutoff. Sixteen additional mothers were identified by only one of the two risks indices (i.e., either CAPI cutoff or risk-predicted cutoff). Mothers meeting either or both risk criteria resulted in a subsample of 34 mothers (21% of the total study sample; Feil et al., 2014). These 34 mothers, when compared to the remainder of the sample ($N = 125$), had significantly higher levels of family strain, $t(158) = -3.73$, $p < .01$, $d = .818$, and coping strain, $t(158) = -9.91$, $p < .001$, $d = 2.17$, engaged in significantly lower observed levels of warm/positive and flexible parenting behavior toward their infant,

average z scores of .10 vs. −.37; $t(158) = 2.50$, $p < .05$; $d = .47$, and evidenced significantly elevated CAPI scores, average of 191 vs. 65; $t(158) = −10.37$, $p < .001$, $d = 2.31$.

High-risk mothers' matriculation into intervention—Three of the 34 high-risk mothers in our sample experienced extreme life circumstances at the onset of the study, which prevented self-selection to continue engaging in the intervention. After completing the first session, one mother died, one child was removed from a mother's care and custody, and one mother who reported not being safe in her neighborhood moved and could not be located. Hence, 31 mothers, 91% of our sample at highest risk for child maltreatment, were free to self-selectively engage in intervention sessions. These mothers, in comparison, to lower risk mothers, experienced significantly higher coping strain, average z score of 1.20 vs. −.38; $t(154) = −12.92$, $p < .001$, $d = 2.43$, large effect, family strain, average z score of .77 vs. −.19; $t(154) = −3.74$, $p < .01$, $d = .86$, large effect, and significantly elevated child abuse potential, with an average CAPI score of 181 vs. 65, $t(154) = −10.54$, $p < .001$, $d = 2.39$, large effect, and significantly lower levels of warm, sensitive parenting behavior, average z score of −.35 vs. .10; $t(154) = 2.28$, $p < .05$, $d = .47$.

Analytic approach—To address our questions of interest, our analysis focused on the $n = 31$ subset of mothers identified as at higher risk for child maltreatment. We first examined, through between-group comparisons, higher risk mothers' intervention engagement (i.e., dosage) when compared to lower risk mothers and examined this engagement relative to intervention type. Effect sizes for between-group comparisons were viewed in relation to Cohen's d statistic (Cohen, 1988), with .2 associated with a small effect, .5 a medium effect, and .8 a large effect. Subsequently, we assessed the impact of Internet intervention on higher risk mothers through multiple regressions to view the effects of intervention condition dosage levels and their interaction in predicting change in child abuse risk and observed warm and flexible responding parenting behaviors. Intervention and dosage effects were viewed in relation to Cohen's (1988) incremental f^2 statistic, with .02 associated with a small effect, .15 a medium effect, and .35 a large effect. Finally, we viewed the satisfaction of high-risk mothers with their assigned intervention, when compared to lower risk mothers.

Results

Intervention Engagement

Our first question of interest focused on Internet-intervention engagement of high-risk mothers. Initially, we viewed session completion rates overall, regardless of the type of intervention received, to determine whether high-risk mothers engage in Internet-based interventions at a level on par with lower risk mothers. The average number of Internet-based sessions completed by lower risk versus higher risk mothers was not statistically significant overall, 9 sessions vs. 8 sessions; $t(155) = 1.23$, *ns; $d = .26$*, small effect, with both groups of mothers having a session completion range of 1 to 11 sessions. Within the Baby-Net-targeted skill intervention, the first 9 sessions cover all unique PALS skills content, which is an important indicant of intervention dosage. As such, we created a "completion" variable indicating mothers who completed 9 or more sessions within either intervention. The percentage of higher risk and lower risk mothers who completed

intervention at this level was not significantly different, with 76% of lower risk and 68% of higher risk mothers completing 9 or more sessions of either intervention, $t(155) = .94$, *ns*; no effect.

Next, we examined engagement for higher risk mothers relative to intervention type. As noted above in the description of the two interventions, Baby-Net is a targeted skills-based intervention whereas the DAS program is not. Skills-based programs place greater demands on participants for change, which may interfere with engagement. Our goal was to determine whether higher risk mothers were more likely to show differential engagement in the two interventions. Within the study, 14 higher risk mothers had been assigned to the Baby-Net intervention, with 17 assigned to the DAS control condition. Baby-Net higher risk mothers completed, on average, 8.1 sessions, while higher risk DAS mothers completed 8.4 sessions, $t(30) = .91$, *ns*; no effect, with both groups of mothers ranging from 1 to 11 completed sessions. There was also no significant difference in session completion levels for highest risk Baby-Net mothers when compared to lower risk Baby-Net mothers, 8.6 vs. 8.1; $t(79) = .44$, *ns*; no effect.

Internet Intervention Effects on High-Risk Mothers

Our second question focused on whether mothers at high risk for child maltreatment benefited more from a targeted-skills intervention as compared to a general developmental awareness intervention in terms of increasing warm and flexible parenting behavior that protects against child maltreatment (CDC, 2016c; World Health Organization, 2004). An important aspect of our trial was the intent-to-treat design and, for the current examination, the number of high-risk mothers who completed postassessment. When we viewed postassessment completion by our originally identified group of high-risk mothers ($n = 34$), we had a postassessment completion rate of 91% of this sample ($n = 31$). Only the three high-risk mothers who were forced by life circumstances to end intervention were missing postassessments. In comparison, our lower risk sample of mothers, $n = 8$ (6%) did not complete postassessment. Therefore, our highest risk subsample available for prepost intervention change examination is the full sample of highest risk mothers who were able to self-determine participation.

We conducted two regression analyses examining change in directly observed parenting behavior and self-reported child abuse potential. Into each regression equation, the T1 parenting construct score or CAPI variable was entered first, followed by the main effects for intervention condition and dosage, then the Condition × Dosage interaction term. Table 1 shows the final model from this analysis. For observed parenting behavior, the condition variable entered into the model accounted for significant variance in T2 parenting behavior ($b = .46$, $p < .01$; incremental $f^2 = .23$, medium effect), with the Baby-Net condition evidencing the largest positive change at T2. Intervention dosage entered as a main effect did not contribute significantly to explained variance in T2 parenting behavior. The addition of a Dosage × Condition interaction, however, as reflected in Table 1, contributed significantly to T2 parenting behavior ($b = .35$; $p < .05$; incremental $f^2 = .16$, medium effect). The total variance in T2 parenting behavior explained by the total model was 31%. High-risk mothers

in the Baby-Net condition, who received higher session dosage, evidencing the largest increase in positive parenting behavior.

For child abuse potential, neither the condition nor dosage variable entered into the model accounted for significant variance in T2 CAPI above and beyond T1 CAPI. The addition of a Dosage × Condition interaction, however, as reflected in Table 1, did contribute significantly to T2 CAPI ($b = -.48$; $p < .01$; $f^2 = .28$, medium effect). The total variance in T2 parenting behavior explained by the model was 31%. High-risk mothers in the Baby-Net condition, who received higher session dosage, displayed the largest reduction in T2 CAPI, child abuse potential.

Intervention Satisfaction

Table 2 presents the mean ratings for satisfaction with the Internet-intervention received. The ratings for lower risk mothers are presented alongside the ratings for highest risk mothers as a comparison. As well, ratings specific to each intervention type are also presented. There were no significant differences in satisfaction ratings between any group of mothers.

Discussion

This study contributes to the question of whether targeted Internet-based parenting intervention can reach and engage mothers as well as improve parenting practices and reduce child abuse potential among mothers and infants most in need. Initially, we established that mothers at high risk for child maltreatment, as compared to those at lower risk, engage in significantly less positive parenting behavior with their infants at preassessment. This finding underscores the need for evidence-based interventions to promote nurturing parenting practices that protect against child maltreatment and promote healthy infant development (Britto et al., 2016). Overall, results of this study showed that the majority of mothers at high risk for child maltreatment did engage in intervention. Moreover, we found a significant dose by condition effect. For high-risk mothers, those who received more of the targeted intervention showed significantly more observed positive parenting behavior and reductions in child abuse potential as compared to other mothers. It is particularly encouraging that we were able to reach these mothers with an Internet evidence–based parenting intervention to increase positive parenting behavior and reduce child abuse potential. This Internet intervention approach elicited higher average engagement rates for mothers than those currently reported for home visitation programs (Feil et al., 2014), which is understandable given the multiple stressors experienced by these mothers and the flexibility the Internet offers for service delivery that can fit more easily into their lives.

The current study is a first step toward understanding how to bring effective parenting interventions to high need mothers of infants. Nonetheless, there are limitations to the current study. This study was embedded within an efficacy trial of the Baby-Net program, not an effectiveness trial, and mothers were provided cellular activated laptops. This provision likely contributed to engagement by overcoming some of the access barriers associated with home visiting, especially for mothers in rural areas and those life situations

not conducive to home visiting (Vismara et al., 2016). We provided laptops to mothers to address issues related to the digital divide, most pronounced for computer and Internet access (Lopez, Gonzalez-Barrera, & Patten, 2013). Currently, national statistics suggest that smartphone technology is becoming more ubiquitous and reducing the digital divide (Zickuhr & Smith, 2012). As such, in the future, a fruitful line of investigation to engage parents in Internet-based intervention is to determine how to maximize cell phone use for effective delivery of evidence-based programs in an instructionally sound manner. As well, although smartphone use is nearly ubiquitous, consistent cellular service and connectivity continue to be problems for those who are poor (Holmes, Fox, Wieder, & Zubak-Skees, 2016). Hence, advances in on- and off-line applications are needed to determine whether some aspects of intervention can be delivered off-line in limited broadband regions, while other aspects that require video transfer (as in Baby-Net) can be undertaken when phones are in range of a stronger signal.

Another limitation of an efficacy as compared to an effectiveness trial is that in our controlled trial, we used research-based coaches, who received high levels of support with close attention to relationship building and implementation fidelity. This aspect allowed for a stronger implementation in our trial than may be possible within community agencies using paraprofessional staff, thereby potentially limiting generalizability for scaled-up dissemination. Another consideration for future research is that, on average, mothers in the sample obtained a score at the clinical cutoff for symptoms of maternal depression, and maternal distress was strongly related to both child abuse potential and lower levels of positive parenting behavior. Hence, there is a need for future research to merge effective depression treatments into targeted parenting interventions and to rigorously evaluate effectiveness for reducing depression as well as targeting promotion of nurturing parenting practices that protect against child maltreatment. In light of the fact that mothers at high risk for engaging in child maltreatment are themselves more likely to have histories of maltreatment (Milner et al., 1986), efforts to screen for and address maternal trauma and posttraumatic stress disorder should be considered in future research.

Acknowledgments

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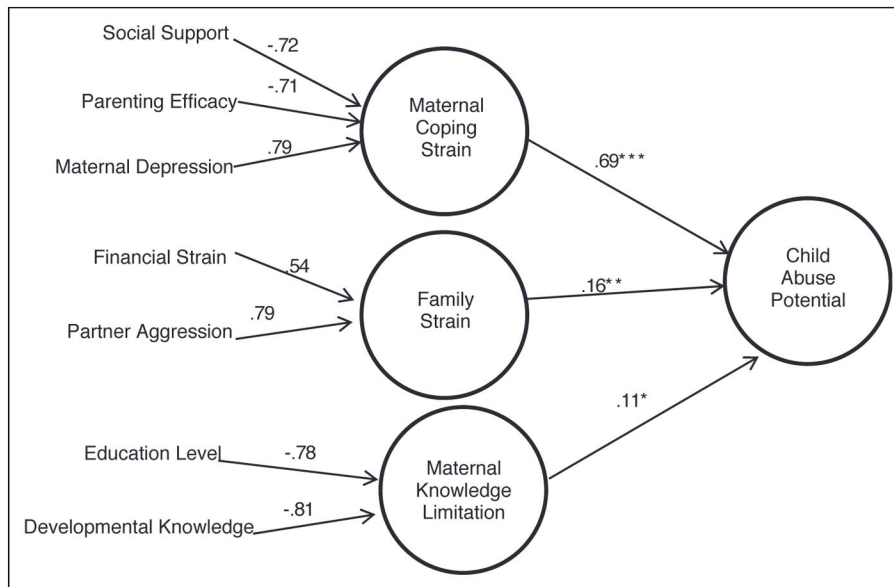
Figure 1.
Empirical model of risk.

Table 1

Dosage by Intervention Condition Effect on Child Abuse Potential and Parenting Behavior.

Measure	b	t	p	F(4, 26)	p
Maternal positive parenting behavior					
Parenting behavior T1	.44	2.67	.01		
Condition	.53	3.33	.00		
Dosage	−.17	−1.09	.29		
Condition × Dosage	.35	2.30	.03	4.49	.00
Maternal child abuse potential					
Child abuse potential T1	.55	3.25	.00		
Condition	−.27	−1.63	.12		
Dosage	−.09	−0.59	.56		
Condition × Dosage	−.48	−3.04	.00	4.38	.01

Table 2

Intervention Satisfaction Ratings.

Across intervention				
	At Risk (*n* = 31)		**Lower Risk (*n* = 119)**	
Item	**Mean (*SD*)**	**Range**	**Mean (*SD*)**	**Range**
Program acceptability	4.31 (.61)	3–5	4.27 (.76)	2–5
Information acceptability	4.47 (.64)	3–5	4.62 (.58)	2–5
Program impact	4.48 (.58)	3–5	4.52 (.64)	1–5
Relationship with coach	3.76 (.53)	2–5	3.86 (.52)	1–5
Baby-net intervention				
	At risk (*n* = 14)		Lower risk (*n* = 63)	
	Mean (*SD*)	Range	Mean (*SD*)	Range
Program acceptability	4.29 (.76)	3–5	4.35 (.71)	2–5
Information acceptability	4.48 (.65)	3–5	4.62 (.51)	3–5
Program impact	4.36 (.59)	3–5	4.56 (.54)	3–5
Relationship with coach	3.65 (.43)	3–4	3.84 (.40)	3–5
DAS intervention				
	At risk (*n* = 17)		Lower risk (*n* = 56	
	Mean (*SD*)	Range	Mean (*SD*)	Range
Program acceptability	4.33 (.49)	4–5	4.18 (.81)	2–5
Information acceptability	4.46 (.65)	3–5	4.61 (.65)	2–5
Program impact	4.57 (.56)	3–5	4.47 (.74)	1–5
Relationship with coach	3.86 (.60)	2–5	3.88 (.63)	1–5

Note. DAS = developmental awareness skill.