

Randomized Trial of a Cellular Phone-Enhanced Home Visitation Parenting Intervention

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KEY WORDS

home visitation, parenting, intervention, technology, randomized controlled trial, externalizing problems, internalizing problems, maternal depression, parenting stress

ABBREVIATIONS

BASC-2-PRS—Behavior Assessment Scale for Children-2-Parent Report Scale

CPAT—cellular phone enhanced PAT

CBRS—Child Behavior Rating Scale

KIPS—Keys to Interactive Parenting

PAT—Planned Activities Training

WLC—wait-list control

Dr Carta conceptualized and designed the study, wrote the introduction and discussion, and revised all portions of the paper; Dr Burke Lefever supervised data collection at one site, conducted all analyses, wrote the results section, and revised all other portions of the paper; Dr Bigelow developed the intervention, trained and certified all staff on the intervention, supervised the implementation of the intervention and data collection at one site, wrote the methods section, and participated in the writing and revision of all other portions of the paper; Dr Borkowski supervised the intervention and data collection at one site, and participated in the writing and revising of all portions of the manuscript; Dr Warren participated in the initial design of the study and critically revised all portions of the manuscript; and all authors approved the final manuscript as submitted.

This trial has been registered at www.clinicaltrials.gov (identifier NCT01294475).

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abstract

BACKGROUND AND OBJECTIVES: Although home visiting programs have been documented to improve parenting in high-risk families, their effectiveness is diminished when parents disengage from programs. Cellular phones offer an approach to promoting parent engagement and enhancing parenting outcomes. Our objective was to examine whether mothers in a parenting intervention, Planned Activities Training (PAT), or cellular phone-enhanced version (CPAT) of the intervention would demonstrate greater use of parenting strategies after treatment and at 6 months post-treatment compared with a wait-list control (WLC).

METHODS: A sample of 371 low-income mothers and their 3.5- to 5.5-year-old children were randomly assigned to condition and assessed at pre-test, post-intervention, and 6 months post-intervention. Treatment efficacy was evaluated through observations of mother-child interactions as well as maternal interviews about depression, parenting stress, and child behaviors.

RESULTS: Mothers receiving PAT and CPAT demonstrated more frequent use of parenting strategies and engaged in more responsive parenting than mothers in the WLC. Mothers receiving CPAT used more PAT parenting strategies than mothers in the other 2 groups and experienced greater reductions in depression and stress. Children of mothers receiving PAT and CPAT demonstrated higher rates of positive engagement, and children of CPAT mothers demonstrated higher levels of adaptive behaviors than children in the WLC. Importantly, changes in parenting, depression, and stress predicted positive child behaviors.

CONCLUSIONS: PAT and CPAT conditions improved parenting strategies and child engagement and reduced children's challenging behaviors. The addition of cellular phones to a home visiting program enhanced maternal responsivity and reduced depression and stress. *Pediatrics* 2013;132:S167–S173

Home visiting programs have demonstrated their potential to promote positive parenting outcomes and reduce child maltreatment.^{1,2} Two different meta-analyses have reported that the most successful prevention programs are those that focus on teaching specific parenting behaviors that lead to greater responsiveness and sensitivity.^{3,4} Yet even the most powerful interventions have limited effects if parents are not engaged in the intervention or drop out of the program.⁵

Families with specific risk factors, such as low maternal education or family income, are often at highest risk for poor parenting but are the least likely to remain engaged in intervention programs.⁶ A recently used innovation for preventing attrition and promoting engagement in a variety of health promotion interventions is the use of cellular phones to increase contact with patients, provide reminders to use newly learned behaviors, and to deliver messages of encouragement for maintaining involvement.⁷ This approach, however, has only recently been applied to interventions that aim to promote positive parenting among parents experiencing multiple risk factors.^{8,9} Although the use of cellular phones and text messaging in parenting interventions is growing in popularity (eg, txt4baby.org),¹⁰ the effectiveness of incorporating these types of technology-related enhancements to traditionally implemented interventions has not yet been tested.

This study compared the efficacy of an innovative, home-based parenting intervention Planned Activities Training (PAT) with PAT supplemented with cellular phones and text messaging (CPAT).^{9,11} PAT is a relatively short curriculum (5 sessions), designed to teach responsive parenting strategies such as engaging in positive interactions with their children, establishing rules and limits, and providing feedback about their children's

behavior. Cellular phone enhancements to PAT were used to promote engagement between home visits through daily text messages and occasional voice messages that provided encouragement and reminders of newly learned parenting strategies.

We hypothesized that mothers in both intervention conditions would improve their parenting skills and experience less stress and depression in comparison with a wait-list control (WLC) condition, but that these effects would be more pronounced in CPAT mothers who had the advantage of greater and more frequent contact with their family coaches. We also expected that their children would show improvements in positive engagement with their parents, more mature adaptive behavior, and decreases in externalizing and internalizing behavior. Finally, we expected that across all groups, greater use of parenting strategies would be accompanied by increases in children's positive behavioral outcomes and reductions in parenting stress and maternal depression.

METHODS

Participants

Participants were 371 mother-child dyads recruited from community health, early education, and social service agencies serving low-income families in metropolitan South Bend, Indiana and metropolitan Kansas City. Eligible mothers had a child between 3.5 and 4.5 years and at least 1 of the following risk factors for child maltreatment: age <18 years at first child's birth, having less than a high school diploma or equivalent, receiving financial assistance, or meeting the income eligibility requirement for Head Start or the Special Supplemental Nutrition Program for Women, Infants, and Children. Mothers self-identified as belonging to the following ethnic groups: 46% Hispanic, 33% African American, 17% European American, and 4% mixed race or other.

Children's mean age at enrollment was 4.56 years (SD = 0.57); more than half were boys (56%). Families' average estimated annual income was \$18 608 (SD = 15 835). Seventy-seven percent of enrolled mothers completed the intervention and post-test assessment; there was no evidence of selective attrition owing to sociodemographic factors except that non-Hispanic mothers were less likely to complete the intervention phase and post-test visits than Hispanic mothers.

Design and Procedures

A randomized experimental design, with pre-test, post-test, and 6-month follow-up assessments, was used to evaluate the efficacy of the 2 parenting interventions. Upon consent and enrollment, mothers were randomly assigned to 1 of 3 conditions: 142 (38%) to PAT, 113 (30%) to CPAT, and 116 (31%) to a wait-list control (WLC) condition. Mothers completed a social-demographic interview and surveys concerning maternal depression, parenting stress, and child adaptive and problem behaviors. Research assistants, who were naive to condition, also rated a 20-minute direct observation of mother's use of PAT strategies, mother-child interactions, and children's behaviors. Mothers were compensated for completing assessments and observations at baseline, post-intervention, and the 6-month follow-up (\$25 for each session). Assessment visits were administered in either English or Spanish, based on parent preference. All procedures were approved by the Institutional Review Boards at the participating universities as well as the Centers for Disease Control and Prevention.

Intervention Conditions

Planned Activities Training

PAT, a manualized component of the SafeCare¹¹ parent training model, aims at preventing challenging child behavior

and improving parent-child interactions by focusing on teaching specific parenting strategies. The 10 specific strategies taught in PAT included planning activities in advance, explaining activities, establishing rules and consequences, giving choices, talking about what you are doing, using positive interaction skills, ignoring minor misbehavior, giving feedback, and providing rewards or consequences.

In the first treatment session, a family coach (research staff with a BA degree) introduced PAT by describing its rationale and each of the 10 PAT strategies within a play activity. During this discussion, the mother, with coach assistance, identified specific concerns related to play time and created an individualized PAT checklist based on the 10 PAT strategies. The family coach modeled the use of PAT strategies with the child in the play activity, and the mother was then asked to practice them. After the activity, the coach provided positive and corrective feedback on the mother's use of the strategies. The mother engaged in additional practice as needed to reach an 80% correct mastery criterion on the strategies on the PAT checklist. To promote generalization of strategies across activities, PAT was taught in a similar manner within 2 or 3 additional mother-selected daily routines in subsequent sessions. In the final session, mothers engaged in additional practice, a progress review, and a plan for future application of PAT to new situations. Additional detail concerning the PAT curriculum and training of the interventionists can be found in the PAT manual.¹¹

Cell-Phone Enhanced PAT

Mothers in the CPAT condition also were provided with the PAT training delivered through home visits but also received a cellular phone and cellular phone service throughout the intervention phase. The cellular phone enhancement consisted of text messages and phone

calls that occurred between mothers and Family Coaches between PAT sessions. Text messages were sent twice per day, with 1 message prompting mothers to use a specific PAT strategy or to engage in positive interactions with their child, and a second text inquiring about mothers' use of PAT, their implementation of a planned activity or interactions with their child, or their child's behavior. Text message content was individualized for each mother 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 mother that did not directly pertain to the intervention (eg, providing resources or praising mothers' efforts). Family coaches called mothers once per week between home visits to engage mothers in talking about their use of PAT or their interactions with their child. Mothers directed the content of the calls, which occurred at times convenient for the mother.

Wait-List Control

Mothers assigned to the WLC condition participated in all assessments and observations but did not receive the PAT intervention or cellular phone contact with a family coach. They were offered the opportunity to receive training in the PAT program after completing all assessments.

Outcome Measures

PAT Checklist

At each of the assessment points, mothers' use of the PAT strategies was assessed by using the PAT Checklist.¹¹ Examples of strategies included: prepare child in advance of activity, explain the rules, give choices, and talk about what you are doing. Assessors observed each activity for 20 minutes and recorded mother's use of the PAT strategies

on the 10-item checklist. A summary score was created by calculating the percentage of applicable PAT strategies used correctly in that activity. Assessors were trained to meet an 80% interobserver agreement criterion with the assessment supervisor at the study's onset, and reliability was monitored every 6 months.

Keys to Interactive Parenting Scale

The quality of interactions between mothers and the target children was rated by using the Keys to Interactive Parenting Scale (KIPS¹²) at all assessment points. Parenting behaviors were rated on a 5-point scale along 12 dimensions (eg, sensitivity, reasonable expectations) and mean scores were calculated by summing over all items rated and dividing by the number of items scored. Inter-rater reliability coefficients ranged from 0.90 to 0.96 and the items have a high internal consistency reliability ($\alpha = 0.89$).¹²

Beck Depression Inventory-II

The Beck Depression Inventory-II¹³ was used to assess depressive mood and somatic complaints at pre-test, post-test, and 6-month follow-up using both total scores and clinical ratings; internal consistency coefficients ranged from 0.92 to 0.93.

Parenting Stress Index-Short Form

The Parenting Stress Index-Short Form¹⁴ was used to assess maternal parenting stress at pre-test and post-test. Internal consistencies were very good to excellent and study results support its use with low-income, African American mothers.¹⁵

Behavior Assessment Scale for Children-2-Parent Report Scale

The Behavior Assessment Scale for Children-2-Parent Report Scale (BASC-2-PRS)¹⁶ is a parent report measure used to assess child adaptive and

externalizing and internalizing problem behaviors at pre-test and 6-month follow-up. Internal consistency reliability coefficients for the age of interest ranged from 0.85 to 0.93. Test-retest reliability ratings ranged from 0.81 to 0.86.

Child Behavior Rating Scale

The Child Behavior Rating Scale (CBRS¹⁷) was a 5-point scale used to rate 5 dimensions of children's positive engagement and responsiveness during parent-child interactions at pre-test and 6-month follow-up assessments (with scores of 5 indicating most engaged). Internal consistency for this measure was high ($\alpha = 0.81$).

Analytic Approach

Analyses of covariance were used to assess the effects of the intervention on parenting, maternal stress, depression, and children's outcomes with separate models created for each construct at the post-test and 6-month follow-up, controlling for pre-test level of functioning on each measure. Planned comparisons were conducted to determine the direction of group differences and to test whether cellular phones offered additional benefits above and beyond the standard intervention. Finally, to explore relationships between changes in parenting

behaviors and child behaviors, multiple linear regression analyses were used; changes in parenting and maternal outcomes between pre-test and post-test were related to changes in children's behaviors from the pre-test to 6-month follow-up. IBM SPSS Missing Values software¹⁸ was used to estimate missing data and to analyze the 40 imputed data sets.

RESULTS

Intervention Effects on Parenting Outcomes

Table 1 contains the post-intervention means (M) and standard deviations (SD) for all measures across conditions; differences between the group means (ΔM) for each of the planned contrasts; and confidence intervals (CI) for each of the mean differences. At the post-test, each group was significantly different from the others in the percentage of parenting strategies properly used as measured on the PAT Checklist. The CPAT mothers showed the greatest use of parenting strategies taught as part of the intervention. The average difference between the CPAT and the WLC condition was ~ 2 strategies (0.18); the difference between the PAT and the WLC was just over 1 parenting strategy (0.13). These differences were associated with large effect sizes between both interventions

and the WLC group ($d = 1.13$ for CPAT versus WLC, and $d = 0.81$ for PAT versus WLC) and these advantages for the treatment groups continued at the 6-month follow-up ($d = 0.56$ for CPAT versus WLC, and $d = 0.44$ for PAT versus WLC). The difference between the CPAT and PAT group was < 1 strategy (0.06) ($d = 0.38$).

Group differences were also observed in general parenting interaction behaviors (KIPS). At post-test, both CPAT and PAT groups were significantly different from the WLC group with large effect sizes indicated at post-test for the differences between CPAT and WLC ($d = 0.78$), and PAT and WLC ($d = 0.62$). At the 6-month follow-up, both intervention groups continued to show greater sensitivity and more responsiveness in their parenting on the KIPS when compared with WLC, with moderate effect sizes ($d = 0.46$ for CPAT versus WLC and $d = 0.34$ for PAT versus WLC).

Maternal Stress and Depression

None of the groups was significantly different at the post-test in terms of maternal depression. At 6-month follow-up, however, CPAT mothers showed significantly lower rates of depression than WLC mothers ($d = 0.31$). At the post-test, rates of mild to severe depression within both intervention groups dropped markedly from pre-test levels (16%

TABLE 1 Post-Intervention Means, Mean Differences, and Confidence Intervals for Parenting Behavior, Maternal Functioning, and Child Behavior Between Intervention Conditions

Construct	Time	CPAT	PAT	WLC	CPAT versus WLC		PAT versus WLC		CPAT versus PAT	
		M (SD)	M (SD)	M (SD)	ΔM	CI	ΔM	CI	ΔM	CI
Positive behavior support (PAT checklist)	Post	0.55 (0.22)	0.51 (0.20)	0.37 (0.17)	0.18	0.13 to 0.23	0.13	0.07 to 0.18	0.06	0.01 to 0.11
	6-mo	0.47 (0.21)	0.45 (0.19)	0.38 (0.17)	0.09	0.04 to 0.14	0.07	0.02 to 0.12	0.02	-0.02 to 0.07
Parent interactions (KIPS)	Post	3.99 (0.66)	3.97 (0.65)	3.48 (0.71)	0.51	0.34 to 0.68	0.40	0.24 to 0.56	0.10	-0.06 to 0.27
	6-mo	3.83 (0.72)	3.82 (0.72)	3.54 (0.72)	0.30	0.11 to 0.48	0.22	0.03 to 0.41	0.08	-0.11 to 0.27
Depression (BDI-II)	Post	7.52 (6.32)	7.88 (7.06)	8.70 (7.69)	-1.59	-3.46 to 0.27	-1.27	-2.89 to 0.36	-0.33	-2.04 to 1.39
	6-mo	6.12 (6.68)	8.37 (8.81)	8.25 (8.16)	-2.52	-4.86 to -0.19	-0.50	-2.68 to 1.70	-2.03	-4.22 to 0.16
Parenting stress (PSI)	Post	68.91 (18.68)	72.30 (21.05)	73.33 (19.32)	-5.61	-11.16 to 0.05	-2.78	-8.18 to 2.62	-2.83	-7.67 to 2.01
Child behavior (CBRS)	6-mo	4.45 (0.51)	4.33 (0.64)	4.23 (0.64)	0.27	0.11 to 0.42	0.18	0.02 to 0.32	0.09	-0.06 to 0.25
Adaptive (BASC-2)	6-mo	53.59 (11.38)	50.27 (11.21)	48.28 (11.36)	2.95	0.52 to 5.38	0.77	-1.52 to 3.07	2.18	-0.24 to 4.59
Externalizing (BASC-2)	6-mo	47.73 (9.84)	48.96 (9.81)	49.85 (10.22)	-2.17	-4.49 to 0.15	-1.44	-3.63 to 0.74	-0.77	-2.96 to 1.43
Internalizing (BASC-2)	6-mo	48.48 (10.84)	50.60 (11.74)	49.21 (10.35)	-2.27	-4.87 to 0.34	-0.55	-2.96 to 1.87	-1.70	-4.14 to 0.74

BDI-II, Beck Depression Inventory-II; CI, confidence interval; ΔM , mean difference between groups; PSI, Parenting Stress Index.

to 4% for CPAT and 13% to 5% for PAT), with a significant difference between the rates of depression for CPAT and WLC. The rate of depression for the CPAT group remained low (4%), and by the 6-month follow-up, significant differences were found between the CPAT and PAT groups (12%), and between the CPAT and WLC groups (13%). In addition, mothers in the CPAT intervention had significantly lower scores in their reports of parenting stress at post-test than WLC mothers ($d = 0.27$). The differences between the PAT and WLC and the CPAT and PAT groups were not statistically significant.

Children's Behavioral Outcomes

Group differences in children's behaviors were assessed at 6 months after the intervention using independent ratings of children's positive engagement (CBRS) as well as maternal ratings of adaptive skills, internalizing symptoms, and externalizing behaviors (BASC-2). Children of mothers in both intervention groups exhibited more positive engagement than children in the WLC group; effect sizes for these contrasts were small ($d = 0.29$ for PAT versus WLC) to moderate ($d = 0.43$ for CPAT versus WLC). There were no significant group differences in the maternal ratings of the children's internalizing or externalizing behaviors (BASC-2); however, children of mothers in the CPAT group had more mature adaptive behavior scores than children of mothers in the WLC. The effect size for this contrast was small ($d = 0.29$).

Changes in Parenting and Their Relationship to Child Outcomes

Beyond examinations of the effectiveness of the intervention in influencing mothers' use of parenting strategies, their responsivity, and their reported rates of stress and depression, we sought to explore whether these changes in parenting predicted changes in children's

behaviors. Multiple linear regression was used to relate changes in children's positive engagement (CBRS) from pre-test to 6-month follow-up to changes in parent positive behavior supports, quality of parent interactions (KIPS), maternal depression, and parenting stress from pre-test to post-test. Table 2 summarizes the results of this regression analysis. Only the KIPS score measuring changes in parenting interactions was a significant predictor: children demonstrating gains in positive engagement were most likely to have mothers who showed improvements in positive parenting interactions as measured by the KIPS ratings.

Next, a series of multiple linear regressions were used to predict changes in the BASC-2 subscales of adaptive skills, internalizing and externalizing behaviors from pre-test to 6-month follow-up, based on changes in parenting and maternal functioning (see Table 2). Parenting stress scores significantly predicted children's adaptive skills: decreases in parenting stress from pre-test to post-test were related to improvements in children's adaptive skills.

Finally, maternal depression significantly predicted children's internalizing behaviors, with decreases in depression from pre-test to post-test related to decreases in children's internalizing behaviors; there were no significant predictors for changes in children's externalizing behaviors.

DISCUSSION

Maternal involvement in either CPAT or PAT produced significant and large changes in parenting practices immediately and 6 months after the intervention. At 6-month follow-up, there were moderate effects on children's positive engagement behavior for children in PAT and CPAT. Importantly, more favorable outcomes were noted for parents who received the CPAT intervention: parents in CPAT used more of the newly learned parenting strategies than mothers in either the PAT or the WLC conditions, and their children had higher rates of adaptive behavior. In addition, CPAT mothers showed greater reductions in parenting stress immediately after the intervention and lower rates of depression at the

TABLE 2 Summary of Linear Regression Analysis Using Changes in Parenting Behavior and Maternal Functioning to Predict Changes in Child Behavior

	B	SE B	β
Child behavior (CBRS) ($R^2 = 0.09$)			
Positive behavior support (PAT checklist)	0.49	0.26	0.14
Parent interactions (KIPS)	0.22**	0.08	0.21
Maternal depression (BDI-II)	0.002	0.008	0.03
Parenting stress (PSI)	<0.0001	0.003	-0.02
Adaptive skills (BASC-2) ($R^2 = 0.06$)			
Positive behavior support (PAT checklist)	-1.04	4.28	-0.02
Parent interactions (KIPS)	-0.12	1.37	-0.007
Maternal depression (BDI-II)	-0.10	0.12	-0.07
Parenting stress (PSI)	-0.10*	0.05	-0.19
Externalizing (BASC-2) ($R^2 = 0.02$)			
Positive behavior support (PAT Checklist)	-3.12	3.47	-0.07
Parent interactions (KIPS)	0.52	1.05	0.04
Maternal depression (BDI-II)	0.07	0.11	0.05
Parenting stress (PSI)	0.04	0.04	0.07
Internalizing (BASC-2) ($R^2 = 0.05$)			
Positive behavior support (PAT Checklist)	0.29	3.88	0.005
Parent interactions (KIPS)	-0.11	1.26	-0.007
Maternal depression (BDI-II)	0.29**	0.11	0.20
Parenting stress (PSI)	-0.06	0.04	-0.11

* $P \leq .05$; ** $p \leq .01$. B, unstandardized beta; β , standardized beta; BDI-II, Beck Depression Inventory-II; PSI, Parenting Stress Index; SE B, standard error of beta.

6-month follow-up. Relationships between changes in mothers and their children strengthened the internal validity of the curriculum: increases in responsive caregiving were related to improved children's positive engagement, and declines in parenting stress and depression were related to improvements in children's adaptive skills and internalizing behaviors, respectively.

Our findings added to the growing body of evidence indicating that relatively brief home visiting interventions that focus on teaching specific parenting strategies can be effective in improving parenting practices and can eventually result in improvements in children's behavior.^{3,19} The effect sizes we obtained for parenting and child behavior changes were larger than have been found for many other longer-term home visiting interventions that focus on broader outcomes, such as family well-being or

teaching general information about child development (eg, Early Start²⁰ or Healthy Steps²¹). The PAT curriculum is unique in that it focuses on routines that parents select as particularly challenging (eg, bedtime, dinner time) and teaches specific strategies parents can use to transform those stressful routines into more pleasant experiences.¹¹ The fact that families in CPAT demonstrated greater growth in parenting and child outcomes and also experienced greater reductions in maternal depression and parenting stress strengthens the evidence for the advantages of enhancing interventions with cellular phones. Such interventions have been shown to be effective when used in programs as widely varying as smoking cessation,²² diabetes management,²³ and adherence to HIV medication therapies.²⁴ Cellular phones offer particular advantages for maintaining communication with parents who are difficult to

reach owing to their high mobility, unpredictable schedules, and inconsistent land line phone service.²⁵

CONCLUSIONS

These findings indicate that PAT is an effective curriculum for changing specific parenting skills that persist 6 months post-intervention; the greater the changes in parenting, the more likely child behaviors improve and maternal stress and depression are reduced. The use of cellular phones augmented the effectiveness of the parenting intervention and reduced attrition.⁹ Although larger studies with more diverse samples and longer-term follow-up assessments are needed, this study provides strong evidence for the effectiveness of using this inexpensive technology for improving communication with high-risk families involved in home visiting interventions.

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