

The Prevention of Child Maltreatment Through the Nurse Family Partnership Program: Mediating Effects in a Long-Term Follow-Up Study

Child Maltreatment
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Abstract

We examine maternal life-course mediators of the impact of a nurse home visitation program on reducing child maltreatment among participants in the Elmira trial of the Nurse Family Partnership program from the first child's birth through age 15. For women having experienced low to moderate levels of domestic violence, program effects on the number of confirmed maltreatment reports were mediated by reductions in numbers of subsequent children born to mothers and their reported use of public assistance. Together, the two mediators explained nearly one half of the total effect of nurse home visiting on child maltreatment. The long-term success of this program on reducing child maltreatment can be explained, at least in part, by its positive effect on pregnancy planning and economic self-sufficiency.

Keywords

child maltreatment, home visiting, evidence-based treatment, intervention, prevention

Annually, about 1 million children or 1 of every 1,000 children are maltreated in the United States (Gilbert et al., 2009; Institute of Medicine and National Research Council, 2014; Sedlak et al., 2010). Perinatal home visiting has received much attention as a strategy for the primary prevention of child maltreatment (Bilukha, Hahn, & Task Force on Community Preventive Services, 2005; Howard & Brooks-Gunn, 2009; MacMillan et al., 2009). However, the evidence supporting the effectiveness of home visitation in preventing child maltreatment and promoting child development has been mixed, reflecting differences in program models, populations served, and contextual factors (Chaffin, 2004; Gomby, 2005; Sweet & Applebaum, 2004). Even in home-visiting programs where evidence exists for a reduction of child maltreatment, much remains to be learned about the mechanisms that explain those intervention effects and how they are sustained over time. The purpose of this article is to examine the mediating mechanisms underlying the demonstrated long-term effects of the Nurse Family Partnership (NFP) program in reducing child maltreatment among first-time mothers and their children.

Many home visitation efforts are supported by states with federal funds from the Maternal, Infant, and Early Childhood Home Visiting program that targets at-risk pregnant women or at-risk families with children between the ages of 0 and 5 (<http://mchb.hrsa.gov/programs/homevisiting/homevisiting.pdf>). Several states have adopted the NFP program,

as well as other home-visiting models, such as Healthy Families America or Parents as Teachers (PAT), that have been approved for funding as evidence based under the program's criteria. A reduction in child maltreatment incidents is one of the eight outcomes used to judge program effectiveness. Few randomized controlled trials of perinatal home visiting have found reductions in official state-verified reports of maltreatment or in objective proxies for maltreatment, such as child injuries found in medical records (Olds et al., 1997; Olds, Sadler, & Kitzman, 2007), although some have found reductions in parents' self-reports of specific abusive or neglectful parenting behaviors (Duggan et al., 2004; Dumont et al., 2008) or observations of harsh parenting

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(Rodriquez, Dumont, Mitchell-Herzfeld, Walden, & Greene, 2010).

The most consistent evidence for the efficacy of perinatal home visiting in preventing child maltreatment has been from the NFP program (MacMillan et al., 2009). Initial evaluation of the Elmira trial of the program reported a reduced rate of verified cases of child maltreatment during the first 2 years of their children's lives among women who had all three risk factors used for sample recruitment, that is, poor, unmarried women under age 19 (Olds, Henderson, Chamberlin, & Tatelbaum, 1986). By the time the children reached age 4, however, the treatment effect on child maltreatment had attenuated, although there were enduring effects on children's health-care encounters for injuries (Olds, Henderson, & Kitzman, 1994). In a follow-up study of the Elmira NFP families when the children were 15 years old, the early effects of the program in reducing maltreatment were not only sustained but became stronger over time, with families in the treatment condition having significantly fewer official child maltreatment reports over that 15-year period (Olds et al., 1997; Zielinski, Eckenrode, & Olds, 2009). The intervention effect was concentrated in the subsample of women reporting low to moderate levels of domestic violence (80% of the overall sample; Eckenrode et al., 2000).

In a more recent replication of NFP in Memphis, consistent with the Elmira trial, nurse-visited mothers had fewer health-care encounters for injuries and ingestions consistent with inadequate parenting as well as more positive ratings of the home environment and parent's reports of caregiving (Kitzman et al., 1997). To date, the NFP is the only home-visiting intervention to have statistically significant, enduring effects on substantiated cases of child maltreatment.

An important next step in evaluating the long-term effects on reducing child maltreatment reported by the NFP program is to examine mechanisms that might explain why this program reduced the incidence of child maltreatment well beyond the end of the intervention period. Within the field of prevention research, there have been numerous calls for more analyses of the mediating mechanisms underlying treatment effects (MacKinnon & Dwyer, 1993; Reynolds, 2004). There are two major advantages of examining mediators in the context of an intervention. First, mediation analyses can elucidate the most likely pathways through which the intervention effects have occurred and can also confirm that the intervention had the intended effect on proposed intermediate outcomes. Second, analyses of mediation can illuminate areas where programs could be modified to improve subsequent intervention efforts. For example, findings that indicate nurse home visitation had its positive effects on child maltreatment as a result of changing maternal life-course outcomes would point to the importance of targeting such processes in similar interventions.

Like many home-visiting programs, the NFP program in Elmira was multifaceted, with nurses focusing on several domains of maternal and child health in their home visits. Specifically, the nurses promoted three aspects of family functioning: (1) health-related behaviors during pregnancy and the early years of the child's life, (2) the care parents provided to

their children, and (3) maternal life-course development (family planning, educational progress, and employment). In the service of these goals, the nurses linked families with needed health and human services and attempted to involve other family members and friends in the pregnancy, birth, and early care of the child. The program is based on theories of self-efficacy, human ecology, and attachment (Olds, Kitzman, Cole, & Robinson, 1997). Given this broad range of goals and outcomes, program effects on child maltreatment may have occurred through one or more mechanisms.

We considered as potential mediators outcomes that were the focus of the nurses' interaction with the families and where data were collected in various stages of the trial. We were particularly interested in a set of variables that reflected maternal life-course development. We hypothesized that, in order to sustain the program's effect on child maltreatment over a long period of time, the program would have to alter significant aspects of mothers' life course, such as their fertility patterns and levels of economic self-sufficiency, for which there was evidence of a program effect in the 15-year follow-up study (Olds, Eckenrode et al., 1997). These changes, in turn, may affect the ecology of the family in a way that would influence parenting and parents' abilities to establish an orderly, safe, and responsive home environment (e.g., Thornberry et al., 2013). Our hypotheses were informed broadly by developmental-ecological models of parenting and child maltreatment (Belsky, 1984, 1993; Cicchetti & Lynch, 1993). Other possible mediators, such as the mother's educational achievement, drug use, levels of depression, and ratings of early home environment, were not included in our analyses because there were no program effects on these outcomes. We hypothesized that child maltreatment was reduced among the nurse-visited women and children in part because the intervention led to fewer subsequent births and reductions in public assistance.

Method

Details of the study's design can be found in earlier articles (Olds et al., 1997; Olds, Henderson, et al. 1998); a summary of the design is given here. Data collection reported here was approved by the institutional review boards of Cornell University and the University of Rochester.

Setting and Participants

The study was originally conducted in Elmira, a small city in central New York State. Pregnant women were recruited from a free county health clinic and the offices of private obstetricians. From April 1978 through September 1980, 500 consecutive eligible women were invited to participate. Women were actively recruited for the study if they had no previous live births, could be registered in the study prior to the 25th week of gestation, and had at least one of the following characteristics: (a) under age 19, (b) unmarried, or (c) low socioeconomic status (Medicaid status or no private insurance). Additionally, any woman who asked to participate and had no previous live

birth was accepted into the study. Eighty-five percent of the sample originally recruited had at least one of the target characteristics at registration (47% were under age 19, 62% were unmarried, and 61% classified as low socioeconomic status).

Exactly 400 of the 500 women enrolled in the study. There were no differences in the age, education, or marital status of those women who chose to enroll and those who declined, except that 80% of the Caucasians agreed to participate versus 96% of the non-Caucasians (almost all African Americans). After completing informed consent and baseline interviews, women were stratified by sociodemographic characteristics and randomized to one of the four conditions in a randomized control trial (RCT).

Treatment Conditions

Families in Treatment I ($n = 94$) were provided sensory and developmental screening for the child at 12 and 24 months of age. Based upon these screenings, the children were referred for further clinical evaluation and treatment when needed. Families in Treatment II ($n = 90$) were provided the services offered in Treatment I plus free transportation for prenatal and well-child care through the child's second birthday. There were no differences between Treatments I and II in their use of prenatal and well-child care (both groups had high rates of completed appointments). Therefore, these two groups were combined to form a single comparison group. Families in Treatment III ($n = 100$) were provided the services offered in Treatment II and in addition were provided a nurse who visited them during pregnancy. Families in Treatment IV ($n = 116$) were provided the same services as those in Treatment III, except that the nurse continued to visit through the child's second birthday. The nurses completed an average of 8.6 (range: 0–16) visits during pregnancy and 22.8 (range: 0–59) from birth to the child's second birthday (Olds et al., 1997).

Overview of the Follow-Up Study

Outcomes reported here are from a follow-up study completed 15 years after the original study. Of the 400 original mothers and their children, there were 43 cases where the child or mother had died, the mother declined further participation, or the child had been adopted, leaving 357 eligible cases for the follow-up study. Assessments were completed on 81% ($n = 324$) of the women originally randomized, 90% of those eligible for follow-up. There were no treatment group differences in the rates of completed assessments at the 15-year follow-up. Interviews were conducted with the mothers, their adolescent children, and custodial parents if the biological mother no longer retained custody. For respondents living in the original study area, in-person interviews were conducted; otherwise, phone interviews were conducted. All data were gathered by staff members who had no access to the families' treatment assignments, except in a few cases where the mothers inadvertently revealed that they were visited by a nurse. The principal investigators and statisticians had access to the families'

treatment assignments, although the operationalization of variables was made explicitly without reference to this information.

Sample Restrictions

The current analysis is restricted to mothers and children who experienced low to moderate levels of domestic violence (i.e., reported fewer than 28 incidences of partner-perpetrated violence since the birth of the study child on the violence subscales of the Conflict Tactics Scale; Straus, 1979). Given earlier findings that the program effects on child maltreatment were concentrated among this group (80% of the available sample; Eckenrode et al., 2000), we reasoned that the identification of potential mediators should also be focused on this group. In addition, although alternative approaches exist for testing moderated mediation, where the mediated effects are conditional on a third variable (Preacher, Rucker, & Hayes, 2007), and mediated moderation, where a differential effect (i.e., moderation) is explained (i.e., mediated) by a third variable (Baron & Kenny, 1986), neither of these apply in this case. Instead, this mediation analysis is conducted in the context of an intervention effect on maltreatment that is moderated by domestic violence. There were no program effects on maternal reports of domestic violence over the 15-year period covered by this analysis (Eckenrode et al., 2000). Across all treatment groups, the available sample of families who experienced low-to-moderate domestic violence was 251.

Measures

Assessments conducted at earlier phases are specified in previous publications (Olds, Henderson, Chamberlin, et al., 1986; Olds, Henderson, Kitzman, 1994; Olds, Henderson, Tatelbaum, & Chamberlin, 1988). At the 15-year follow-up, mothers were given a life history interview to help them recall major life events (such as births of additional children, marriages, employment, and moves and total number of months that they used the federal public assistance program [Aid to Families with Dependent Children], Medicaid, and Food Stamps). Number of months on public assistance (an indicator of economic self-sufficiency) and number of subsequent children were examined as potential mediators.

Mothers provided consent for the research staff to review Child Protective Service (CPS) records from states, in which they resided during the interval from the birth of the study child to that child's fifteenth birthday. All substantiated reports (where a caseworker confirmed abuse or neglect allegations) involving either the mother as a perpetrator or the study child as a victim were abstracted to ascertain key features of the maltreatment incident. All New York State records were searched as well as most of the other states in which families resided over the 15-year period. In some states, data were not available over part of the 15-year period. A few other states prohibited the release of case-level information. Nevertheless, our search covered an average of 13.4 years of the 15-year period, and

Table 1. Descriptive Statistics for Control and Treatment Groups at Program Entry and 15-Year Follow-Up Among Those With Low-to-Moderate Domestic Violence.

Variable	Control (Treatment Groups I and II; <i>n</i> = 108)	Pregnancy Only (Treatment Group III; <i>n</i> = 66)	Home Visited (Treatment Group IV; <i>n</i> = 77)	<i>p</i> Value Control vs. Home Visited
Characteristics of mothers at program entry				
Education, mean (<i>SD</i>)	11.30 (1.49)	11.65 (1.49)	11.25 (1.59)	.83
Age, mean (<i>SD</i>)	19.44 (2.71)	19.62 (3.11)	19.57 (3.54)	.79
No. married (%)	46 (42.6)	29 (43.9)	30 (39.0)	.62
No. low income (%)	66 (61.1)	39 (59.1)	46 (59.7)	.85
No. non-White race (%)	10 (9.3)	6 (9.1)	12 (15.6)	.19
Characteristics of mothers at 15-year follow-up				
Education, mean (<i>SD</i>)	12.19 (1.52)	12.50 (1.38)	12.32 (1.43)	.58
No. married (%)	62 (57.4)	41 (62.1)	47 (61.0)	.62
Characteristics of families from program entry to 15-year follow-up				
No. maltreatment reports (<i>SD</i>)	0.81 (2.30)	0.50 (1.35)	0.21 (0.71)	.01
No. months CPS reports available (<i>SD</i>)	13.06 (3.58)	13.29 (3.02)	13.37 (3.33)	.60
No. months on public assistance (<i>SD</i>)	49.62 (60.19)	43.83 (55.34)	30.45 (47.20)	.02
No. subsequent children (<i>SD</i>)	1.70 (1.13)	1.30 (0.98)	1.30 (0.95)	.01

Note. *N* = 251. *SD* = standard deviation; CPS = Child Protective Service.

there were no treatment differences in the amount of time searched (see Table 1). The primary outcome variable reported here is the total number of substantiated reports over the entire 15-year period involving the study child as victim, regardless of the identity of the perpetrator. A similar set of analyses focusing on a measure of maltreatment reports involving the mother as perpetrator, regardless of the identity of the child, yielded results nearly identical to those reported below (the correlation between these outcome variables was .85).

Statistical Models and Analysis

We tested the hypothesized effect of number of subsequent children and time receiving public assistance in mediating the effect of nurse home visitation on child maltreatment by specifying a system of three simultaneous equations (see Figure 1 for a simplified view of the model). In addition, within this model, we calculated the indirect effect of nurse home visitation on child maltreatment through the mediating variables using product of coefficients tests with asymmetric confidence intervals (Preacher & Hayes, 2008; Tofighi & MacKinnon, 2011).

The equation for number of maltreatment reports included nurse home visiting, mother's education, age, low income, and marital status at intake and number of months on public assistance and number of subsequent children as mediating variables. The equation for public assistance included nurse home visiting, mother's education, age, low income, and marital status. The equation for number of subsequent children included the same five variables as the public assistance equation. Mother's characteristics at program entry were included to improve the precision of estimates of program effects and

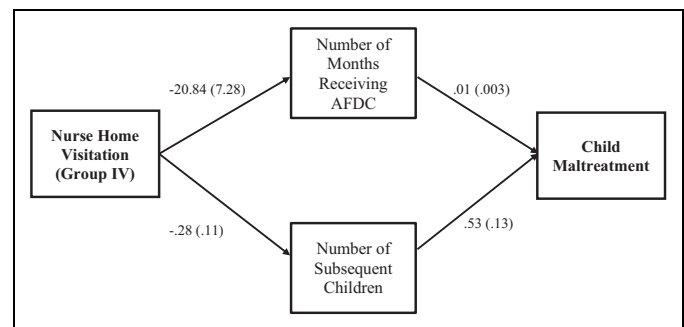


Figure 1. Mediation model of Nurse Family Partnership program's effect on incidence of child maltreatment via maternal life-course variables among families with low to moderate levels of domestic violence (*N* = 251).

reduce the likelihood of obtaining spurious relationships between the maternal life-course variables and child maltreatment. Since there were no treatment differences in the number of months of complete CPS data, we did not include this variable in the model; alternative specifications with the variable included did not change the results. All two-way interactions (e.g., Nurse Home-Visiting Status \times Education) were examined but were excluded from the final model because none predicted maternal life-course variables or maltreatment reports. The model involves simultaneous equations with two of the dependent variables (number of maltreatment reports and number of subsequent children) having assumed Poisson distributions. Ideally, we would use full information maximum likelihood (FIML) or other instrumental variables methods of estimation to account for endogeneity (correlated errors) together with generalized linear model estimation to account for nonnormal distributions. Software limitations precluded

Table 2. Regression Estimates From Baseline and Three-Equation Model of Nurse Home Visitation on Child Maltreatment Mediated by Maternal Life-Course Variables.

Independent Variables	Baseline		Equation 1		Equation 2		Equation 3	
	Child Maltreatment		Child Maltreatment		No. Subsequent Children		No. Months on Public Assistance	
	<i>B</i> (<i>SE</i>)	<i>p</i> Value	<i>B</i> (<i>SE</i>)	<i>p</i> Value	<i>B</i> (<i>SE</i>)	<i>p</i> Value	<i>B</i> (<i>SE</i>)	<i>p</i> Value
Control vs. pregnancy only	-.26 (.41)	.52	.04 (.36)	.92	-.25 (.11)	.03	-.097 (7.6)	.90
Control vs. home visited	-1.51 (.68)	.03	-.76 (.60)	.21	-.28 (.11)	.01	-20.84 (7.3)	.004
Mother's education (intake)	-.56 (.16)	.001	-.26 (.14)	.07	-.05 (.04)	.19	-13.68 (3.2)	.000
Mother's age (intake)	.21 (.09)	.03	.17 (.08)	.04	-.06 (.02)	.01	3.71 (1.7)	.03
Mother's low income (intake)	.40 (.52)	.94	.20 (.45)	.66	.07 (.10)	.47	-23.23 (5.9)	.000
Mother married (intake)	-.24 (.40)	.55	-.18 (.38)	.64	.01 (.01)	.95	-19.91 (6.2)	.001
No. subsequent children	—	—	.53 (.13)	.00	—	—	—	—
No. months on public assistance	—	—	.01 (.003)	.00	—	—	—	—

Note. *SE* = standard error.

this. We triangulated the estimation of the model by using ordinary least squares (OLS) in single equations, Poisson log-linear estimation in single equations, and FIML estimation assuming normality. The results do not differ substantively. For maximum comparability with our earlier papers, we choose to present Poisson estimation in single equations (the Poisson counterpart to OLS).

Within the group of mothers and children who experienced low to moderate levels of domestic violence, we focus presentation of results and discussion on the comparison between Treatment Groups I and II (combined into a single low-intensity control group) with Treatment Group IV, which received both prenatal and postnatal home visiting. Results from this RCT have consistently shown that prenatal home visiting alone (Treatment Group III) did not affect maternal self-sufficiency or child maltreatment outcomes. Furthermore, there is no version of the evidenced-based NFP program where implementation occurs prenatally only, so analysis from that group has limited practical value. Data were analyzed in Mplus (Version 7.4) using bootstrap resampling to estimate standard errors (Muthen & Muthen, 1998–2012). Given the distribution of the outcome variable, we were unable to calculate standard model fit statistics (Muthen & Muthen, 1998–2012).

Results

Descriptive statistics for the major study variables at program entry and the 15-year follow-up are shown in Table 1, along with the results of bivariate analyses to compare each variable among the pre- and postnatal home-visited and control groups. The χ^2 test is shown for categorical variables (i.e., low-income status at program entry and marital status at entry and follow-up) and the *t*-test for the remaining continuous variables.

As expected, there were no treatment group differences in mother's characteristics at program entry or the 15-year follow-up among mothers with low to moderate levels of domestic violence. There were, however, strong bivariate differences among treatment groups in substantiated maltreatment, number

of months on public assistance, and number of subsequent children. To confirm this effect remained significant when accounting for mother's baseline characteristics, a baseline model including these variables was estimated; the effect of home visiting on child maltreatment among families with low-to-moderate domestic violence remained significant. Results indicate that over their first 15 years of life, first-born children of mothers with low-to-moderate domestic violence who received prenatal and postpartum home visiting had 4.52 times fewer substantiated maltreatment reports as their counterparts from the control group (95% CI [1.90, 13.67]; see Table 2).

Results of the simultaneous equation analysis are presented in Table 2 and Figure 1. Consistent with earlier reports from this trial and the bivariate analysis, among those with low to moderate levels of domestic violence, home-visited mothers spent fewer months on public assistance and had fewer subsequent children compared to their counterparts in the control group. Both outcomes were also significant predictors of maltreatment. The indirect effect of nurse home visiting on maltreatment reports through number of subsequent children ($B = -0.148$, $SE = .07$, 95% CI [-0.303, -0.03]) and use of public assistance ($B = -0.208$, $SE = .098$, 95% CI [-0.429, -0.047]) were both significant. Together, the two mediators explained nearly one half (49.7%) of the total effect of pre- and postnatal nurse home visiting on child maltreatment among mothers with low-to-moderate domestic violence.

Discussion

In this study, we sought to determine the mechanisms by which a program of nurse home visitation led to reductions in substantiated child maltreatment reports over a 15-year period. Results of the mediation analyses with women reporting low to moderate levels of domestic violence revealed that maternal life-course variables, as represented by the number of subsequent children and months receiving public assistance, accounted for a substantial portion of the effect of nurse home visiting on maltreatment reports.

Overall, our findings provide support for the theoretical underpinnings of the NFP (Olds, Kitzman, et al., 1997). Human ecology theory (Bronfenbrenner, 1979) and self-efficacy theory (Bandura, 1997) served as the basis for the program's emphasis on the life-course development of the mothers as an important pathway in promoting the long-term improvements in parenting and child outcomes. Findings from a replication of the NFP in Memphis with a predominantly low-income, unmarried, African American sample also showed significant reductions in subsequent pregnancies and in use of public assistance (Kitzman, Olds, Henderson, et al., 1997; Kitzman, Olds, Sidora, et al., 2000). In a pooled analysis across the three NFP trials, Miller (2015) reports a 39.9% reduction in the risk of a second birth within 24 months ($p < .001$).

Although the Memphis trial did not report data on official child maltreatment reports, there was a significant reduction in health encounters by children for reasons typically associated with the quality of parenting behaviors (injuries, ingestions of poisonous substances, etc.). In the more recent Denver trial (Olds et al., 2006), 4 years after the birth of their first child, nurse-visited mothers did not have fewer children than control group mothers but did have a significantly longer interval between their first and second children. There was no treatment effect on the use of public assistance, perhaps reflecting the time period and place in which that trial took place, or differences in the populations served. Further follow-up studies with the Denver mothers will reveal if treatment effects on other indicators of economic self-sufficiency emerge.

Improving the life-course development of mothers has not typically been a primary focus of home-visiting programs designed to improve children's cognitive or social/emotional outcomes and reduce child maltreatment (Gomby, Culross, & Behrman, 1999; Olds et al., 2007; Paulsell, Avellar, Sama, & Del Grosso, 2010). The home-visiting programs that have been designed to impact maternal life-course outcomes have met with limited success. For example, the PAT program seeks to help parents promote growth and learning among their children and provides case management and referrals focused on promoting positive outcomes for mothers, such as postponing repeat pregnancies and completing their education (Wagner & Clayton, 1999). Home visits are conducted over the first 3 years of life by parent educators and supplemented by case management, group meetings, monitoring and treating child problems, and linking families with needed services. Two randomized trials of the PAT program in California, one focused on Latino families and other focused on teen mothers, showed no reductions in public assistance use or the number of subsequent pregnancies.

The Healthy Families America program uses paraprofessional home visitors and has the improvement of maternal life-course outcomes as a goal. Results from randomized trials in Hawaii (Duggan et al., 2004), Alaska (Duggan et al., 2007), and New York (Dumont et al., 2008) found no effects of these interventions on maternal life-course variables such as repeat pregnancies, income, employment, or education. The Early Start Program (Fergusson, Grant, Horwood, & Ridder, 2005,

2006) involves postnatal home visits to at-risk families for 2 years by nurses or social workers. In addition to child outcomes, the program sought to improve maternal well-being and family social and economic circumstances. Child and maternal outcomes were assessed up to 36 months in an RCT in New Zealand. Significant treatment effects were reported for hospital visits for accidents and injuries and parental reports of severe physical abuse. No treatment effects were found for child maltreatment reports to agencies, maternal health (e.g., subsequent pregnancy, depression, or substance use), family functioning (e.g., partner changes), or family economic factors (e.g., welfare use, family income, and maternal employment).

Our findings suggest that large family size and poverty are risks for child maltreatment, and thus improving maternal life-course development represents a key pathway through which long-term improvements in parenting and reductions in the incidence of child maltreatment can be achieved. Given that this is only one study, confidence in these findings will be gained through replications of these results with the Memphis and Denver trials of the current program as well as with other home visitation programs evaluated in randomized controlled trials.

It is important to note that, consistent with other research, the mediators of treatment effects found in this study were correlated in this sample. We could not precisely identify the timing of the use of public assistance relative to the birth of subsequent children, so the temporal ordering of these processes could not be clearly determined. Our results, however, are consistent with other research that has shown that these processes are interrelated. For example, in a longitudinal study, Maynard and Rangarajan (1994) found that the experience of welfare increased the likelihood that adolescent mothers would have another pregnancy and birth. In another longitudinal study, rapid, successive pregnancies by young mothers were also linked to lower educational attainment and future welfare use (Furstenberg, Brooks-Gunn, & Morgan, 1987). One implication of such research, and the findings of our study, is that efforts to influence one of these mediators (e.g., reducing subsequent pregnancies and births) may be more successful if progress can also be made in promoting improvements in other domains as well (e.g., improving economic circumstances).

We also note some of the limitations of our study. Although the random assignment design of the current study allows for strong causal inferences about the effects of nurse home visitation on the maternal life-course outcomes and child maltreatment, we should be more cautious in the conclusions that are drawn about the pathways between the maternal life course and child maltreatment. This is because families were not randomly assigned based on public assistance status or whether they had subsequent children, rather these are responses, among many others, to the program. Therefore, the differences we observed in child maltreatment may have been caused by additional mediators that were not measured in this study and which may have been more proximal to the maltreatment incidents. For example, decreases in the number of children may have decreased the likelihood of maltreatment through its effects

on economic resources, family relationships, mother's psychological well-being, or patterns of parent-child interactions directly preceding maltreatment. Such processes are important in understanding the developmental-ecological antecedents of child maltreatment and may represent other important pathways in explaining the impact of this program on child maltreatment outcomes (Belsky, 1993; Simons, Lorenz, Wu, & Conger, 1993).

Second, the contemporaneous nature of the measurement of child maltreatment and maternal life-course outcomes does not allow us to conclude definitively the direction of the relation between these outcomes. However, we believe that there is a greater likelihood that public assistance use and subsequent child-bearing led to maltreatment reports rather than the reverse, and this is typically how researchers have modeled these relations.

Third, the subsample we employed was restricted to women reporting low to moderate levels of domestic violence, which was most of the women in the trial. Although this limits generalizability, we believe it more accurately targets the effects of the intervention on this particular outcome. Indeed, evolving standards of evidence for prevention programs encourage the exploration of subgroup effects in order to describe for whom and under what circumstances programs are effective (Flay et al., 2005; Reynolds & Ou, 2016).

Finally, the external validity of our findings may be affected by the fact that the intervention occurred over 30 years ago. Subsequent societal changes, such as welfare reform in the mid-1990s or the availability of contraception, may make some of the mechanisms we explored more or less important for NFP programs today. This again calls for replication of our findings with data from recent trials of home-visiting programs.

Conclusions

In summary, our findings suggest that long-term efforts to reduce child maltreatment through perinatal nurse home visitation programs will be more successful if they achieve improvements in maternal life-course outcomes as an intermediate step. Home-visiting programs in general might benefit from adopting such goals and training home visitors to work effectively with young mothers to increase their economic self-sufficiency and plan future pregnancies.

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