

This article was downloaded by:[Olds, David L.]  
[Olds, David L.]

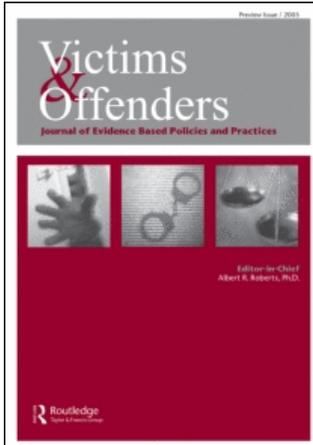
On: 25 April 2007

Access Details: [subscription number 777194905]

Publisher: Routledge

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Victims & Offenders

Publication details, including instructions for authors and subscription information:  
<http://www.informaworld.com/smpp/title-content=t716100771>

### Preventing Crime with Prenatal and Infancy Support of Parents: The Nurse-Family Partnership

To cite this Article: , 'Preventing Crime with Prenatal and Infancy Support of Parents: The Nurse-Family Partnership', *Victims & Offenders*, 2:2, 205 - 225

To link to this article: DOI: 10.1080/15564880701263569

URL: <http://dx.doi.org/10.1080/15564880701263569>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

© Taylor and Francis 2007

# Preventing Crime with Prenatal and Infancy Support of Parents: The Nurse-Family Partnership

David L. Olds

Department of Pediatrics, University of Colorado, Denver, Colorado, USA

**Abstract:** Pregnancy and the early years of a child's life offer an opportune time to prevent a host of adverse outcomes that are important in their own right, but that also have significant implications for the development of criminal behavior. This paper summarizes a 27-year program of research that has attempted to improve early maternal and child health and future life prospects with prenatal and infancy home visiting by nurses. The program, known today as the Nurse-Family Partnership (NFP), is designed for low-income mothers who have had no previous live births. The home visit-

The work reported here was made possible by support from many different sources. These include the Administration for Children and Families (90PD0215/01 and 90PJ0003), Biomedical Research Support (PHS S7RR05403-25), Bureau of Community Health Services, Maternal and Child Health Research Grants Division (MCR-360403-07-0), Carnegie Corporation (B-5492), Colorado Trust (93059), Commonwealth Fund (10443), David and Lucile Packard Foundation (95-1842), Ford Foundation (840-0545, 845-0031, and 875-0559), Maternal and Child Health, Department of Health and Human Services (MCJ-363378-01-0), National Center for Nursing Research (NR01-01691-05), National Institute of Mental Health (1-K05-MH01382-01 and 1-R01-MH49381-01A1), Pew Charitable Trusts (88-0211-000), Robert Wood Johnson Foundation (179-34, 5263, 6729, 9677, and 35369), U.S. Department of Justice (95-DD-BX-0181), and the W. T. Grant Foundation (80072380, 84072380, 86108086, and 88124688).

I thank John Shannon for his support of the program and data gathering through Comprehensive Interdisciplinary Developmental Services, Elmira, New York; Robert Chamberlin and Robert Tatelbaum for their contributions to the early phases of this research; Jackie Roberts, Liz Chilson, Lyn Scazafabo, Georgie McGrady, and Diane Farr for their home-visitation work with the Elmira families; Geraldine Smith, for her supervision of the nurses in Memphis; Jann Belton and Carol Ballard for integrating the program into the Memphis/Shelby County Health Department; Kim Arcoleo and Jane Powers for their work on the Elmira and Memphis trials; Pilar Baca, Ruth O'Brien, JoAnn Robinson, and Susan Hiatt, the many home visiting nurses in Memphis and Denver; and the participating families who have made this program of research possible.

Address correspondence to David L. Olds, Prevention Research Center for Family and Child Health, University of Colorado, 1825 Marion Street, Denver, CO 80218. E-mail: olds.david@tchden.org

ing nurses have three major goals: to improve the outcomes of pregnancy by helping women improve their prenatal health; to improve the child's health and development by helping parents provide more sensitive and competent care of the child; and to improve the parental life course by helping parents plan future pregnancies, complete their educations, and find work. Given consistent effects on prenatal health behaviors, parental care of the child, child abuse and neglect, child health and development, maternal life course, and criminal involvement of the mothers and children, the program is now being offered for public investment throughout the United States. Careful attention is being given to ensuring that the program is being conducted in accordance with the program model tested in the randomized trials.

**Keywords:** prevention, home visits, pregnancy, infancy

The Nurse-Family Partnership (NFP) is different from most mental-health, substance-abuse, and crime-prevention interventions tested to date in that it focuses on improving neuro-developmental, cognitive, and behavioral functioning of the child by improving prenatal health, reducing child abuse and neglect, and enhancing family functioning and economic self-sufficiency in the first two years of the child's life. These early alterations in biology, behavior, and family context are expected to shift the life-course trajectories of children living in highly disadvantaged families and neighborhoods away from psychopathology, substance use disorders, and risky sexual behaviors. Part of the program effect is now thought to be accomplished by moderating environmental risks that interact with genetic variations to increase the risk for poor child health and development. Most preventive interventions have focused on school-aged children in the pre-adolescent or adolescent age range, but recent evidence suggests that neuro-cognitive and socio-emotional risks rooted in early experience and biology can undermine the extent to which adolescents make use of some preventive interventions (Fishbein et al., 2006).

Noting that adolescent substance-use disorders (SUDs) are associated with childhood psychopathology, Kendall and Kessler (2002) have recommended public investments in earlier treatment of childhood mental disorders, rather than preventive interventions, as a way of reducing the rates of psychopathology and SUDs. They question the value of preventive interventions on the grounds that many who need such interventions fail to participate because they have no sense of vulnerability to motivate participation. Women who qualify for the NFP (low-income pregnant women bearing first babies), however, have profound senses of vulnerability that increase their participation in the NFP (Olds, 2002). Moreover, today the program is being integrated into obstetric and pediatric primary care services in hundreds of communities throughout the United States with essential fidelity to the model tested in randomized controlled trials (Olds, Hill, O'Brien, Racine, & Moritz, 2003). The NFP is thus a potentially important intervention to complement existing mental health prevention and treatment efforts, given its success in

engaging vulnerable pregnant women and its impact on a wide range of much earlier risks for compromised adolescent mental health and behavior. In evaluating this program, it is important to understand its theoretical and empirical foundations.

### Theory-Driven

The NFP also is grounded in theories of human ecology (Bronfenbrenner, 1979, 1995), self-efficacy (Bandura, 1977), and human attachment (Bowlby, 1969). Together, these theories emphasize the importance of families' social context and individuals' beliefs, motivations, emotions, and internal representations of their experience in explaining development.

Human ecology theory, for example, emphasizes that children's development is influenced by how their parents care for them; that, in turn, is influenced by characteristics of their families, social networks, neighborhoods, communities, and the interrelations among them (Bronfenbrenner, 1979). Drawing from this theory, nurses attempt to enhance the material and social environment of the family by involving other family members, especially fathers, in the home visits, and by linking families with needed health and human services.

However, parents help select and shape the settings in which they find themselves (Plomin, 1986). Self-efficacy theory provides a useful framework for understanding how women make decisions about their health-related behaviors during pregnancy, their care of their children, and their own personal development. This theory suggests that individuals choose those behaviors that they believe (1) will lead to a given outcome, and (2) they themselves can successfully carry out (Bandura, 1977). In other words, individuals' perceptions of self-efficacy influence their choices and determine how much effort they put forth to get what they want in the face of obstacles.

The program therefore is designed to help women understand what is known about the influence of their behaviors on their health and on the health and development of their babies. The home visitors help parents establish realistic goals and small achievable objectives that, once accomplished, increase parents' reservoir of successful experiences. These successes, in turn, increase women's confidence in taking on larger challenges.

Finally, the program is based on attachment theory, which posits that infants are biologically predisposed to seek proximity to specific caregivers in times of stress, illness, or fatigue in order to promote survival (Bowlby, 1969). Attachment theory hypothesizes that children's trust in the world and their later capacity for empathy and responsiveness to their own children once they become parents is influenced by the degree to which they formed an attachment with a caring, responsive, and sensitive adult when they were growing

up, which affects their internal representations of themselves and their relationships with others (Main, Kaplan, & Cassidy, 1985).

The program therefore explicitly promotes sensitive, responsive, and engaged caregiving in the early years of the child's life. To accomplish this, the nurses try to help mothers and other caregivers review their own childrearing histories and make decisions about how they wish to care for their children in light of the way they were cared for as children. Finally, the visitors seek to develop an empathic and trusting relationship with the mother and other family members because experience in such a relationship is expected to help women eventually trust others and to promote more sensitive, empathic care of their children.

## **Epidemiologic Foundations**

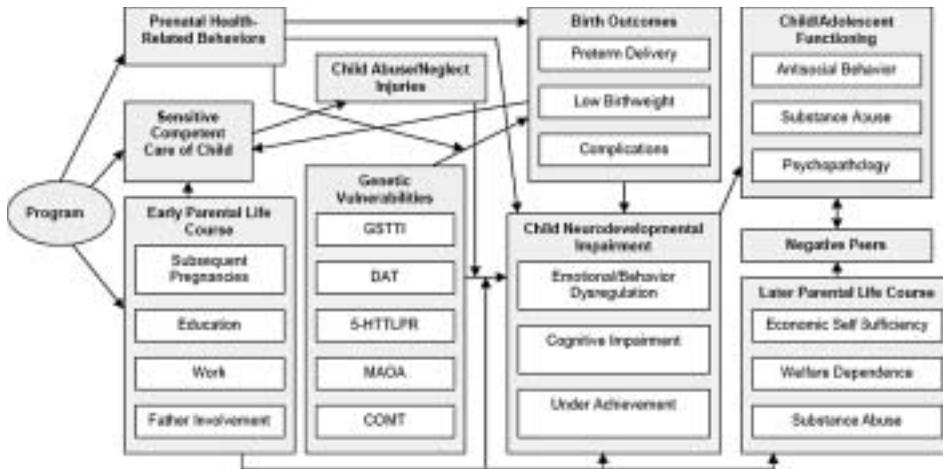
### *Focus on Low-Income, Unmarried, and Teen Parents*

The NFP registers low-income women having first births, and thus enrolls large portions of unmarried and adolescent mothers. These populations have higher rates of the problems the program was designed originally to address (e.g., poor birth outcomes, child abuse and neglect, and diminished parental economic self-sufficiency) (Elster & McAnarney, 1980; Overpeck, Brenner, Trumble, Trifiletti, & Berendes, 1998). Women bearing first children are particularly receptive to this service, and to the extent that they improve their prenatal health, care of their firstborns, and life course they are likely to apply those skills to subsequent children they choose to have (Olds, 2002, 2006).

### *Program Content*

The NFP seeks to reduce specific risks and promote protective factors for poor birth outcomes, neuro-cognitive impairments, child abuse and neglect, injuries, and compromised parental life course (Figure 1). These reduced exposures to prenatal toxicants, child abuse and neglect, and untoward family environments are expected to shift the child's health and development toward greater behavioral regulation and interpersonal and cognitive competence, eventually leading to reduced exposure to and engagement with antisocial, deviant peers.

Given recent interest in the interplay between genes and environments (Rutter, Moffitt, & Caspi, 2006), we have broadened our conceptual model of the program to acknowledge that the NFP probably produces part of its effects by interrupting gene X environment interactions that have been found to increase the risk for low birthweight; impulsive, oppositional, and violent behavior; depression; and psychosis (Caspi et al., 2002; Rutter et al., 2006). Environmental adversities increase the risk for poor outcomes in the presence



**Figure 1:** General conceptual model of program influences on maternal and child health and development.

of particular genetic polymorphisms, which are termed genetic vulnerabilities in Figure 1.

### *Prenatal Health Behaviors*

Prenatal tobacco and alcohol exposure increase the risk for fetal growth restriction (Kramer, 1987), preterm birth (Kramer, 1987), and neuro-developmental impairment (e.g., attention-deficit disorder, cognitive and language delays) (Milberger, Biederman, Faraone, Chen, & Jones, 1996; Olds, 1997; Sood et al., 2001; Streissguth, Sampson, Barr, Bookstein, & Olson, 1994). Children born with subtle neurological perturbations resulting from prenatal exposure to stress and substances are more likely to be irritable and inconsolable (Clark, Soto, & Bergholz, 1996; Saxon, 1978; Streissguth et al., 1994), making it more difficult for parents to enjoy their care. Improved prenatal health thus helps parents become competent caregivers.

The impacts of tobacco and alcohol exposure on birthweight and dysregulated behavior are increased in the presence of genetic vulnerabilities. Polymorphisms in the *GSTT1* gene, for example, increases the risk for low birthweight in the presence of maternal prenatal smoking (Wang et al., 2002). Similarly, polymorphisms in the dopamine transporter gene (DAT) have been found to increase the risk for preschoolers' impulsive and oppositional behavior when women smoke during pregnancy (Kahn, Khoury, Nichols, & Lanphear, 2003) and to increase children's ADHD when they have prenatal alcohol exposure (Brookes et al., 2006; Kahn et al., 2003). Program impacts on children with behavioral dysregulation are thus likely to be greatest among those who are both genetically vulnerable and at risk for exposure to these substances during

pregnancy, given nurses' reduction in women's prenatal substance use. Given consistent program effects on prenatal tobacco exposure (Olds, Henderson, Tatelbaum, & Chamberlin, 1986; Olds, Hill, Robinson, Song, & Little, 2000), it is likely that the reduction in prenatal tobacco use will have its greatest impact on those who are genetically vulnerable.

### *Sensitive, Competent Care of the Child*

Parents who empathize with and respond sensitively to their infants' cues are more likely to understand their children's competencies, leading to less maltreatment and unintentional injuries (Cole et al., 2004; Peterson & Gable, 1998). Competent early parenting is associated with better child behavioral regulation, language, and cognition (Hart & Risley, 1995). Later demanding, responsive, and positive parenting can provide some protection from the damaging effects of stressful environments and negative peers (Bremner, 1999) and on externalizing symptoms and substance use (Baumrind, 1987; Grant et al., 2000). In general, poor parenting is correlated with low child serotonin levels (Pine, 2001, 2003), which, in turn, are implicated in stress-induced delays in neurodevelopment (Bremner & Vermetten, 2004). Child abuse and neglect can lead to different behavioral phenotypes depending upon specific polymorphisms.

There is now consistent evidence that the 5HTTLPR polymorphism in the gene encoding for the serotonin transporter interacts with maltreatment and life stress to increase risk for major depression in humans (Caspi et al., 2003; Eley et al., 2004; Taylor et al., 2006; Wilhelm et al., 2006) and alcohol consumption in primates (Barr et al., 2003). Moreover, social support may moderate the interacting influence of the 5HTTLPR polymorphism and child maltreatment (Kaufman et al., 2006). While not as consistent as the evidence for 5HTTLPR, most studies indicate that a polymorphism in the gene that encodes monoamine oxidase A (MAOA) interacts with child abuse to increase severe antisocial, violent behavior in adolescent males (Caspi et al., 2002; Kim-Cohen et al., 2006).

The NFP has reduced child maltreatment and dysfunctional care of the child; environmental conditions that interact with these genotypes (which lends additional biological plausibility to the long-term effects of this program on SUDs); psychopathology; risks for HIV; and violent crime among those who are genetically vulnerable. We are beginning to conduct genotyping of the mothers and children in our samples in order to understand more precisely those groups who benefit from the intervention, those who do not, and why.

### *Early Parental Life Course*

Closely spaced subsequent births undermine unmarried women's educational achievement and workforce participation (Furstenberg, Brooks-Gunn, & Morgan, 1987) and limit their time to protect their children. Married couples are

more likely to achieve economic self-sufficiency, and their children are at lower risk for a host of problems (McLanahan & Carlson, 2002). Nurses therefore promote fathers' involvement and help women make smart choices about the timing of subsequent pregnancies and the kinds of men they allow into their lives.

*Modifiable Risks for Early Onset Antisocial Behavior,  
Substance-Use Disorders, and Depression*

Many of the prenatal and infancy risks addressed by this program are risks for early onset antisocial behavior, depression, and substance use (Clark & Cornelius, 2004; Hawkins, Catalano, & Miller, 1992; Olds, 2002). Children with early onset conduct problems are more likely to have subtle neurodevelopmental deficits (Arseneault, Tremblay, Boulerice, & Saucier, 2002) that may contribute to, be caused by, or be exacerbated by abusive and rejecting care early in life (Moffitt, 1993; Raine, Brennan, & Mednick, 1994). Aggressive and disinhibited behaviors that emerge prior to puberty are risks for adolescent SUD (Clark, Cornelius, Kirisci, & Tarter, 2005; Tarter, et al., 2003), antisocial behavior, and risky sexual behavior. Early onset antisocial behavior leads to more serious and violent offending that is different from normative acting out in mid-adolescence (Loeber, 1982).

A similar configuration of risks is associated with early onset Major Depressive Disorder (MDD). Children who develop MDD in childhood (compared to those who develop MDD as adults) are more likely to have perinatal insults, motor skill deficits, and behavioral and emotional problems (Jaffee et al., 2002)—especially impulsivity, risky decision making, problems with verbal recognition memory and inattention (Aytaclar, Tarter, Kirisci, & Lu, 1999), as well as caretaker instability, criminality, and psychopathology in their family of origin.

Both conduct disorder and early substance use increase the risk for later SUDs and chronic antisocial behavior (Boyle et al., 1992; Clark & Cornelius, 2004; Clark et al., 1997, 2005; Lynskey et al., 2003; Moffitt, 1993; Raine et al., 1994). Children who begin using cannabis in adolescence (<17 years) are at greater risk for developing SUDs (Lynskey et al., 2003) and, in the presence of a variant in the COMT gene, are at greater risk for later psychosis. Adolescent substance use also is implicated in the development of adult antisocial behavior (Ridenour et al., 2002) and depression. The reduction in prenatal risks, dysfunctional care of the infant, and improvement in family context is thus likely to have long-term effects on youth antisocial behavior that has its roots in early experience.

## **PROGRAM DESIGN**

The same basic program design has been used in Elmira, Memphis, and Denver.

## Frequency of Visitation

The recommended frequency of home visits changed with the stages of pregnancy and was adapted to parents' needs, with nurses visiting more frequently in times of family crisis. Mothers were enrolled through the end of the second trimester of pregnancy. In Elmira, Memphis, and Denver, the nurses completed an average of 9 (range 0–16), 7 (range 0–18), and 6.5 (range 0–17) visits during pregnancy, respectively; and 23 (range 0–59), 26 (range 0–71), and 21 (range 0–71) visits from birth to the child's second birthday. Paraprofessionals in Denver completed an average of 6 (range 0–21) prenatal visits and 16 (range 0–78) during infancy. Each visit lasted approximately 75–90 minutes.

## Nurses as Home Visitors

Nurses were selected as home visitors in the Elmira and Memphis trials because of their formal training in women's and children's health and their competence in managing the complex clinical situations often presented by at-risk families. Nurses' abilities to competently address mothers' and family members' concerns about the complications of pregnancy, labor, and delivery, and the physical health of the infant are thought to provide nurses with increased credibility and persuasive power in the eyes of family members.

## Program Content

The nurses had three major goals: (1) to improve the outcomes of pregnancy by helping women improve their prenatal health; (2) to improve the child's subsequent health and development by helping parents provide more competent care; and (3) to improve the parents' life course by helping them develop visions for their futures and then make smart choices about planning future pregnancies, completing their educations, and finding work. In the service of these goals, the nurses helped women build supportive relationships with family members and friends, and linked families with other services.

The nurses followed detailed visit-by-visit guidelines whose content reflects the challenges parents are likely to confront during specific stages of pregnancy and the first two years of the child's life. Specific assessments were made of maternal, child, and family functioning that correspond to those stages, and specific activities were recommended based upon problems and strengths identified through the assessments.

During pregnancy, the nurses helped women complete 24-hour diet histories on a regular basis and plot weight gains at every visit; they assessed the women's cigarette smoking and use of alcohol and illegal drugs and facilitated a reduction in the use of these substances through behavioral change strategies. They taught women to identify the signs and symptoms of pregnancy complications, encouraged women to inform the office-based staff about those conditions, and facilitated compliance with treatment. They gave particular

attention to urinary tract infections, sexually transmitted diseases, and hypertensive disorders of pregnancy (conditions associated with poor birth outcomes). They coordinated care with physicians and nurses in the office and measured blood pressure when needed.

After delivery, the nurses helped mothers and other caregivers improve the physical and emotional care of their children. They taught parents to observe the signs of illness, to take temperatures, and to communicate with office staff about their children's illnesses before seeking care. Curricula were employed to promote parent-child interaction by facilitating parents' understanding of their infants' and toddlers' communicative signals, and enhancing parents' interest in interacting with their children to promote and protect their health and development.

## OVERVIEW OF RESEARCH DESIGNS, METHODS, AND FINDINGS

In each of the three trials, women were randomized to receive either home visitation services or comparison services. While the nature of the home-visitation services was essentially the same in each of the trials as described above, the comparison services were slightly different. Both studies employed a variety of data sources. The Elmira sample ( $n=400$ ) was primarily white. The Memphis sample ( $n=1,138$  for pregnancy and 743 for the infancy phase) was primarily black. The Denver trial ( $n=735$ ) consisted of a large sample of Hispanics and systematically examined the impact of the program when delivered by paraprofessionals (individuals who shared many of the social characteristics of the families they served) and by nurses. We looked for consistency in program effect across those sources before assigning much importance to any one finding. Unless otherwise stated, all findings reported below were significant at the  $p \leq .05$  level using two-tailed tests.

### Elmira Results

#### *Prenatal Health Behaviors*

During pregnancy, compared to their counterparts in the control group, nurse-visited women improved the quality of their diets to a greater extent, and those identified as smokers smoked 25% fewer cigarettes by the 34th week of pregnancy (Olds, Henderson, Tatelbaum, & Chamberlin, 1986). By the end of pregnancy, nurse-visited women experienced greater informal social support and made better use of formal community services.

#### *Pregnancy and Birth Outcomes*

By the end of pregnancy, nurse-visited women had fewer kidney infections. Among women who smoked, those who were nurse-visited had 75%

fewer pre-term deliveries. Also, among very young adolescents (aged 14–16), those who were nurse-visited had babies who were 395 grams heavier than their counterparts assigned to the comparison group (Olds, Henderson, Tatelbaum, & Chamberlin, 1986).

#### *Sensitive, Competent Care of Child*

At 10 and 22 months of the child's life, nurse-visited poor, unmarried teens (in contrast to their counterparts in the control group) exhibited less punishment and restriction of their infants and provided more appropriate play materials than did their counterparts in the control group (Olds, Henderson, Chamberlin, & Tatelbaum, 1986). At 34 and 46 months of life, nurse-visited mothers provided home environments that were more conducive to their children's emotional and cognitive development and that were safer (Olds, Henderson, & Kitzman, 1994).

#### *Child Abuse, Neglect, and Injuries*

During the first two years of the child's life, nurse-visited children born to low-income, unmarried teens had 80% fewer verified cases of child abuse and neglect than did their counterparts in the control group (1 case or 4% of the nurse-visited teens, versus 8 cases or 19% of the control group,  $p=.07$ ). During the second year of life, nurse-visited children were seen in the emergency department 32% fewer times, a difference that was explained in part by a 56% reduction in visits for injuries and ingestions.

The effect of the program on child abuse and neglect in the first two years of life and on emergency department encounters in the second year of life was greatest among children whose mothers had little belief in their control over their lives when they first registered for the program.

During the two years after the program ended, its impact on health-care encounters for injuries endured: irrespective of risk, children of nurse-visited women were less likely than their control group counterparts to receive emergency room treatment and to visit a physician for injuries and ingestions (Olds, Henderson, & Kitzman, 1994). The impact of the program on state-verified cases of child abuse and neglect, on the other hand, disappeared during that two-year period (Olds, Henderson, & Kitzman, 1994), probably because of increased detection of child abuse and neglect in nurse-visited families and nurses' linkage of families with needed services (including child protective services) at the end of the program (Olds, Henderson, Kitzman, & Cole, 1995).

Results from a 15-year follow-up of the Elmira sample (Olds et al., 1997) indicate that the Group 4 comparison differences in rates of state-verified reports of child abuse and neglect grew between the children's 4th and 15th birthdays. Overall, during the 15-year period after delivery of their first child, in contrast to women in the comparison group, those visited by nurses during pregnancy and infancy were identified as perpetrators of child abuse and

neglect in an average of 0.29 versus 0.54 verified reports per program participant, an effect that was greater for women who were poor and unmarried at registration (Olds et al., 1997).

### *Child Neuro-Developmental Impairment*

At six months of age, nurse-visited poor unmarried teens reported that their infants were less irritable and fussy than did their counterparts in the comparison group (Olds, Henderson, Chamberlin, & Tatelbaum, 1986). Subsequent analyses of these data indicated that these differences were really concentrated among infants born to nurse-visited women who smoked 10 or more cigarettes per day during pregnancy in contrast to babies born to women who smoked 10 or more cigarettes per day in the comparison group (Olds et al., 1998). Over the first four years of the child's life, children born to comparison-group women who smoked 10 or more cigarettes per day during pregnancy experienced a 4–5 point decline in intellectual functioning in contrast to comparison-group children whose mother smoked 0–9 cigarettes per day during pregnancy (Olds, Henderson, & Tatelbaum, 1994a). In the nurse-visited condition, children whose mothers smoked 0–9 cigarettes per day at registration did not experience this decline in intellectual functioning, so that at ages three and four their I.Q. scores on the Stanford Binet test were about 4–5 points higher than their counterparts in the comparison group whose mothers smoked 10 or more cigarettes per day at registration (Olds, Henderson, & Tatelbaum, 1994b).

### *Early Parental Life Course*

By the time the first child was four years of age, nurse visited, low-income, unmarried women, in contrast to their counterparts in the control group, had fewer subsequent pregnancies, longer intervals between births of first and second children, and greater participation in the work force (Olds, Henderson, Tatelbaum, & Chamberlin, 1988).

### *Later Parental Life Course*

At the 15-year follow-up, no differences were reported for the full sample on measures of maternal life course such as subsequent pregnancies or subsequent births, the number of months between first and second births, receipt of welfare, or months of employment. Poor unmarried women, however, showed a number of enduring benefits. In contrast to their counterparts in the comparison condition, those visited by nurses both during pregnancy and infancy averaged fewer subsequent pregnancies, fewer subsequent births, longer intervals between the birth of their first and second children, fewer months on welfare, fewer months receiving food stamps, fewer behavioral problems due to substance abuse, and fewer arrests (Olds et al., 1997).

*Child/Adolescent Functioning*

Among the 15-year-old children of study participants, those visited by nurses had fewer arrests and adjudications as Persons in Need of Supervision (PINS). These effects were greater for children born to mothers who were poor and unmarried at registration. Nurse-visited children, as trends, reported fewer sexual partners and fewer convictions and violations of probation.

**Memphis Results***Prenatal Health Behaviors*

There were no program effects on women's use of standard prenatal care or obstetrical emergency services after registration in the study. By the 36th week of pregnancy, nurse-visited women were more likely to use other community services than were women in the control group. There were no program effects on women's cigarette smoking, probably because the rate of cigarette use was only 9% in this sample.

*Pregnancy and Birth Outcomes*

In contrast to women in the comparison group, nurse-visited women had fewer instances of pregnancy-induced hypertension and among those with the diagnosis, nurse-visited cases were less serious (Kitzman et al., 1997).

*Sensitive, Competent Care of Child*

Nurse-visited mothers reported that they attempted breast-feeding more frequently than did women in the comparison group, although there were no differences in duration of breast-feeding. By the 24th month of the child's life, in contrast to their comparison-group counterparts, nurse-visited women held fewer beliefs about child-rearing associated with child abuse and neglect. Moreover, the homes of nurse-visited women were rated as more conducive to children's development. While there was no program effect on observed maternal teaching behavior, children born to nurse-visited mothers with low levels of psychological resources were observed to be more communicative and responsive toward their mothers than were their comparison-group counterparts (Kitzman et al., 1997).

*Child Abuse, Neglect, and Injuries*

The rate of substantiated child abuse and neglect in the population of two-year-old, low-income children in Memphis was too low (3–4%) to serve as a valid indicator of child maltreatment in this study. We therefore hypothesized that we would see a pattern of program effects on childhood injuries similar to that observed in Elmira. During their first two years, compared to children in the comparison group, nurse-visited children had 23% fewer health-care

encounters for injuries and ingestions and were hospitalized for 79% fewer days with injuries and/or ingestions, effects that were more pronounced for children born to mothers with few psychological resources. Nurse-visited children tended to be older when hospitalized and to have less severe conditions. The reasons for hospitalizations suggest that many of the comparison-group children suffered from more seriously deficient care than children visited by nurses.

#### *Child Neuro-Developmental Impairment*

By age six, compared to their counterparts in the control group, children visited by nurses had higher intellectual functioning and receptive vocabulary scores and fewer behavior problems in the borderline or clinical range. Nurse-visited children born to mothers with low psychological resources had higher arithmetic achievement test scores and expressed less aggression and incoherence in response to story stems.

#### *Early Parental Life Course*

At the 24th month of the first child's life, nurse-visited women reported fewer second pregnancies and fewer subsequent live births than did women in the comparison group. Nurse-visited women and their first-born children relied upon welfare for slightly fewer months during the second year of the child's life than did comparison-group women and their children (Kitzman et al., 1997).

#### *Later Parental Life Course*

During the 4.5-year period following the birth of the first child, in contrast to control-group counterparts, women visited by nurses had fewer subsequent pregnancies; fewer therapeutic abortions; and longer durations between the birth of the first and second child; fewer total person-months (based upon administrative data) that the mother and child used Aid to Families with Dependent Children (AFDC) and food stamps; higher rates of living with a partner and living with the biological father of the child; and partners who had been employed for longer durations. By age 6, women visited by nurses continued to have fewer subsequent pregnancies and births; longer intervals between births of first and second children; longer relationships with current partners; and since last follow-up at 4.5 years, fewer months of using welfare and food stamps. They also were more likely to register their children in formal out-of-home care between age 2 and 4.5 years (82.0% versus 74.9%).

### **Denver Results**

In the Denver trial, we were unable to use the women's or children's medical records to assess their health because the health-care delivery system was too complex to reliably abstract all of their health-care encounters as we had

done in Elmira and Memphis. Moreover, as in Memphis, the rate of state-verified reports of child abuse and neglect was too low in this population (3–4% for low-income children from birth to two years of age) to allow us to use Child Protective Service records to assess the impact of the program on child maltreatment. We therefore focused more of our measurement resources on the early emotional development of the infants and toddlers.

### **Denver Results for Paraprofessionals**

There were no paraprofessional effects on women's prenatal health behavior (use of tobacco), maternal life course, or child development—although at 24 months, paraprofessional-visited mother-child pairs in which the mother had low psychological resources interacted more responsively than did control-group counterparts. Moreover, while paraprofessional-visited women did not have statistically significant reductions in the rates of subsequent pregnancy, the reductions observed were clinically significant. By age four, mothers and children visited by paraprofessionals, compared to controls, displayed greater sensitivity and responsiveness toward one another and, in those cases in which the mothers had low psychological resources at registration, had home environments that were more supportive of children's early learning. Children of low resource women visited by paraprofessionals had better behavioral adaptation during testing than their control-group counterparts.

### **Denver Results for Nurses**

The nurses produced effects consistent with those achieved in earlier trials of the program.

#### *Prenatal Health Behaviors*

In contrast to their control-group counterparts, nurse-visited smokers had greater reductions in urine cotinine (the major nicotine metabolite) from intake to the end of pregnancy.

#### *Sensitive, Competent Care of Child*

During the first 24 months of the child's life, nurse-visited mother-infant dyads interacted more responsively than did control pairs, an effect concentrated in the low-resource group. As trends, nurse-visited mothers provided home environments that were more supportive of children's early learning.

#### *Child Neuro-Developmental Impairment*

At 6 months of age, nurse-visited infants, in contrast to control-group counterparts, were less likely to exhibit emotional vulnerability in response to fear stimuli and those born to women with low psychological resources were less likely

to display low emotional vitality in response to joy and anger stimuli. At 21 months, nurse-visited children were less likely to exhibit language delays than were children in the control group, an effect again concentrated among children born to mothers with low psychological resources. Nurse-visited children born to women with low psychological resources also had superior language and mental development in contrast to control-group counterparts. At age four, nurse-visited children whose mothers had low psychological resources at registration, compared to control-group counterparts, had more advanced language, superior executive functioning, and better behavioral adaptation during testing.

### *Early Maternal Life Course*

By 24 months after delivery, nurse-visited women, compared to controls, were less likely to have had a subsequent pregnancy and birth and had longer intervals until the next conception. Women visited by nurses were employed longer during the second year following the birth of their first child than were controls. By age four, nurse-visited women continued to have greater intervals between the birth of their first and second children, less domestic violence, and enrolled their children less frequently in either preschool, Head Start, or licensed day care than did controls.

## **Cost Savings**

The Washington State Institute for Public Policy has conducted a thorough economic analysis of prevention programs from the standpoint of their impact on crime, substance abuse, educational outcomes, teen pregnancy, suicide, child abuse and neglect, and domestic violence (Aos, Lieb, Mayfield, Miller, & Penucci, 2004). While this analysis does not cover all outcomes that have cost implications for the NFP (such as the rates and outcomes of subsequent pregnancies and the amount of maternal employment), it provides a consistent examination of all programs that have attempted to affect the listed outcomes. This report sums the findings across all three trials of the NFP and estimates that it saves \$17,000 per family. This estimate is consistent with a subsequent analysis produced by the Rand Corporation (Karozy, Kilburn, & Cannon, 2005).

## **SUMMARY OF RESULTS, POLICY IMPLICATIONS, AND PROGRAM REPLICATION**

### **Results and Policy Implications**

One of the clearest messages that has emerged from this program of research is that the functional and economic benefits of the nurse home-visitation program are greatest for families at greater risk. In Elmira, it was evident that most married women and those from higher socioeconomic households

managed the care of their children without serious problems and that they were able to avoid lives of welfare dependence, substance abuse, and crime without the assistance of the nurse home-visitors. Low-income, unmarried women and their children in the control group (on the other hand) were at much greater risk for these problems, and the program was able to avert many of these untoward outcomes for this at-risk population. This pattern of results challenges the position that these kinds of intensive programs for targeted at-risk groups ought to be made available on a universal basis. Not only is it likely to be wasteful from an economic standpoint, but it may lead to a dilution of services for those families who need them the most because of insufficient resources to serve everyone well.

During the past five years, new studies have been reported that have led us to doubt the effectiveness of home-visitation programs that do not adhere to the elements of the model studied in these trials (Gomby, Culross, & Behrman, 1999), including especially the hiring of nurses and the use of carefully constructed program protocols designed to promote adaptive behavior. These results should give policy makers and practitioners pause as they consider investments in home visitation programs without careful consideration of program structure, content, methods, and likelihood of success.

### **Replication and Scale-Up of the NFP**

Even when communities choose to develop programs based on models with good scientific evidence, such programs run the risk of being watered down in the process of being scaled up. So it was with some apprehension that our team began to make the program available for public investment in new communities (Olds, et al., 2003). Since 1996, the NFP national office has helped new communities develop the program outside of traditional research contexts so that today the program is operating in 250 counties nationally from 170 local operating sites. State and local governments are securing financial support for the NFP (about \$9,500 per family for 2.5 years of services) out of existing sources of funds, such as Temporary Assistance to Needy Families, Medicaid, the Maternal and Child Health Block-Grant, and child-abuse and crime-prevention dollars.

### **Capacities Necessary to Support Dissemination**

Each site choosing to implement the NFP needs certain capacities to operate and sustain the program with high quality. These capacities include having an organization and community that are fully knowledgeable and supportive of the program; a staff that is well trained and supported in the conduct of the program model; and real-time information on implementation of the program and its achievement of benchmarks to guide efforts in continuous quality improvement. Staff members at the NFP national service office are organized to help create these state and local capacities.

## REFERENCES

- Aos, S., Lieb, R., Mayfield, J., Miller, M., & Pennucci, A. (2004). *Benefits and costs of prevention and early intervention programs for youth*. Olympia: Washington State Institute for Public Policy.
- Arseneault, L., Tremblay, R. E., Boulerice, B., & Saucier, J. F. (2002). Obstetrical complications and violent delinquency: Testing two developmental pathways. *Child Development, 73*, 496–508.
- Aytaclar, S., Tarter, R. E., Kirisci, L., & Lu, S. (1999). Association between hyperactivity and executive cognitive functioning in childhood and substance use in early adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*, 172–178.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215.
- Barr, C. S., Newman, T. K., Becker, M.L., Champoux, M., Lesch, K. P., Suomi, S. J., Goldman, D., & Higley, J. D. (2003). Serotonin transporter gene variation is associated with alcohol sensitivity in rhesus macaques exposed to early-life stress. *Alcoholism: Clinical and Experimental Research, 27*, 812–817.
- Baumrind, D. (1987). *Familial antecedents of adolescent drug use: A developmental perspective*. Washington, DC: U.S. Government Printing Office.
- Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. New York: Basic Books.
- Boyle, M. H., Offord, D. R., Racine, Y. A., Szatmari, P., Fleming, J. E., & Links, P. S. (1992). Predicting substance use in late adolescence: Results from the Ontario Child Health Study follow-up. *American Journal of Psychiatry, 149*, 761–767.
- Bremner, J. D. (1999). Does stress damage the brain? *Biological Psychiatry, 45*, 797–805.
- Bremner, J. D., & Vermetten, E. (2004). Neuroanatomical changes associated with pharmacotherapy in posttraumatic stress disorder. *Annals of the New York Academy of Science, 1032*, 154–157.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective. In P. Moen, G. H. J. Elder, & K. Luscher (Eds.), *Examining lives in context* (pp. 619–647). Washington, DC: American Psychological Association.
- Brookes, K. J., Mill, J., Guindalini, C., Curran, S., Xu, X., Knight, J., Chen, C. K., Huang, Y. S., Sethna, V., Taylor, E., Chen, W., Breen, G., & Asherson, P. (2006). A common haplotype of the dopamine transporter gene associated with attention-deficit/hyperactivity disorder and interacting with maternal use of alcohol during pregnancy. *Archives of General Psychiatry, 63*, 74–81.
- Caspi, A., McClay, J., Moffitt, T. E., Mill, J., Martin, J., Craig, I. W., Taylor, A., & Poulton, R. (2002). Role of genotype in the cycle of violence in maltreated children. *Science, 297*, 851–854.
- Caspi, A., Sugden, K., Moffitt, T. E., Taylor, A., Craig, I. W., Harrington, H., McClay, J., Mill, J., Martin, J., Braithwaite, A., & Poulton, R. (2003). Influence of life stress on depression: Moderation by a polymorphism in the 5-HTT gene. *Science, 301*, 386–389.
- Clark, A. S., Soto, S., & Bergholz, T. S. M. (1996). Maternal gestational stress alters adaptive and social behavior in adolescent rhesus monkey offspring. *Infant Behavior and Development, 19*, 453–463.

- Clark, D. B., & Cornelius, J. R. (2004). Childhood psychopathology and adolescent cigarette smoking: A prospective survival analysis in children at high risk for substance use disorders. *Addictive Behaviors, 29*, 837–841.
- Clark, D. B., Cornelius, J. R., Kirisci, L., & Tarter, R. E. (2005). Childhood risk categories for adolescent substance involvement: A general liability typology. *Drug and Alcohol Dependence, 77*, 13–21.
- Clark, D. B., Pollock, N., Bukstein, O. G., Mezzich, A. C., Bromberger, J. T., & Donovan, J. E. (1997). Gender and comorbid psychopathology in adolescents with alcohol dependence. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 1195–1203.
- Cole, R., Henderson, C. R. J., Kitzman, H., Anson, E., Eckenrode, J., & Sidora, K. (2004). *Long-term effects of nurse home visitation on maternal employment*. Unpublished manuscript.
- Eley, T. C., Sugden, K., Corsico, A., Gregory, A. M., Sham, P., McGuffin, P., Plomin, R., & Craig, I. W. (2004). Gene-environment interaction analysis of serotonin system markers with adolescent depression. *Molecular Psychiatry, 9*, 908–915.
- Elster, A. B., & McAnarney, E. R. (1980). Medical and psychosocial risks of pregnancy and childbearing during adolescence. *Pediatric Annals, 9*, 89–94.
- Fishbein, D. H., Hyde, C., Eldreth, D., Paschall, M. J., Hubal, R., Das, A., Tarter, R., Ialongo, N., Hubbard, S., & Yung, B. (2006). Neurocognitive skills moderate urban male adolescents' responses to preventive intervention materials. *Drug and Alcohol Dependence, 82*, 47–60.
- Furstenberg, F. F., Brooks-Gunn, J., & Morgan, S. P. (1987). *Adolescent mothers in later life*. New York: Cambridge University Press.
- Gomby, D. S., Culross, P. L., & Behrman, R. E. (1999). Home visiting: recent program evaluations—analysis and recommendations. *Future of Children, 9*(1), 4–26, 195–223.
- Grant, K. E., O'Koon, J. H., Davis, T. H., Roache, N. A., Poindexter, L. M., Armstrong, M. L., Minden, J. A., & McIntosh, J. M. (2000). Protective factors affecting low-income urban African American youth exposed to stress. *Journal of Early Adolescence, 20*, 388–417.
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul Brookes.
- Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin, 112*, 64–105.
- Jaffee, S. R., Moffitt, T. E., Caspi, A., Fombonne, E., Poulton, R., & Martin, J. (2002). Differences in early childhood risk factors for juvenile-onset and adult-onset depression. *Archives of General Psychiatry, 59*, 215–222.
- Kahn, R. S., Khoury, J., Nichols, W. C., & Lanphear, B. P. (2003). Role of dopamine transporter genotype and maternal prenatal smoking in childhood hyperactive-impulsive, inattentive, and oppositional behaviors. *Journal of Pediatrics, 143*, 104–110.
- Karoly, L. A., Kilburn, M. R., & Cannon, J. S. (2005). *Early childhood interventions: Proven results, future promise*. Santa Monica, CA: RAND.
- Kaufman, J., Yang, B. Z., Douglas-Palumberi, H., Grasso, D., Lipschitz, D., Houshyar, S., Krystal, J. H., & Gelernter, J. (2006). Brain-derived neurotrophic factor-5-HTTLPR gene interactions and environmental modifiers of depression in children. *Biological Psychiatry, 59*, 673–680.

- Kendall, P. C., & Kessler, R. C. (2002). The impact of childhood psychopathology interventions on subsequent substance abuse: Policy implications, comments, and recommendations. *Journal of Consulting and Clinical Psychology, 70*, 1303–1306.
- Kim-Cohen, J., Caspi, A., Taylor, A., Williams, B., Newcombe, R., Craig, I. W., & Moffitt, T. E. (2006). MAOA, maltreatment, and gene-environment interaction predicting children's mental health: New evidence and a meta-analysis. *Molecular Psychiatry, 11*, 903–913.
- Kitzman, H., Olds, D. L., Henderson, C. R., Jr, Hanks, C., Cole, R., Tatelbaum, R., McConnochie, K. M., Sidora, K., Luckey, D. W., Shaver, D., Engelhardt, K., James, D., & Barnard, K. (1997). Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing: A randomized controlled trial. *Journal of the American Medical Association, 278*, 644–652.
- Kramer, M. S. (1987). Intrauterine growth and gestational duration determinants. *Pediatrics, 80*, 502–511.
- Loeber, R. (1982). The stability of antisocial and delinquent child behavior: A review. *Child Development, 53*, 1431–1446.
- Lynskey, M. T., Heath, A. C., Bucholz, K. K., Slutske, W. S., Madden, P. A., Nelson, E. C., Statham, D. J., & Martin, N. G. (2003). Escalation of drug use in early-onset cannabis users vs co-twin controls. *Journal of the American Medical Association, 289*, 427–433.
- Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood, and adulthood: A move to the level of representation. *Monographs of the Society for Research in Child Development, 50*(1–2), 66–104.
- McLanahan, S. S., & Carlson, M. J. (2002). Welfare reform, fertility, and father involvement. *Future of Children, 12*(1), 146–165.
- Milberger, S., Biederman, J., Faraone, S. V., Chen, L., & Jones, J. (1996). Is maternal smoking during pregnancy a risk factor for attention deficit hyperactivity disorder in children? *American Journal of Psychiatry, 153*, 1138–1142.
- Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674–701.
- Olds, D. L. (1997). Tobacco exposure and impaired development: A review of the evidence. *Mental Retardation and Developmental Disabilities Research Reviews, 3*, 257–269.
- Olds, D. L. (2002). Prenatal and infancy home visiting by nurses: From randomized trials to community replication. *Prevention Science, 3*, 153–172.
- Olds, D. L. (2006). The Nurse-Family Partnership: An evidence-based preventive intervention. *Infant Mental Health Journal, 27*, 5–25.
- Olds, D. L., Eckenrode, J., Henderson, C. R., Jr., Kitzman, H., Powers, J., Cole, R., Sidora, K., Morris, P., Pettitt, L. M., & Luckey, D. (1997). Long-term effects of home visitation on maternal life course and child abuse and neglect: Fifteen-year follow-up of a randomized trial. *Journal of the American Medical Association, 278*, 637–643.
- Olds, D. L., Henderson, C. R., Jr., Chamberlin, R., & Tatelbaum, R. (1986). Preventing child abuse and neglect: A randomized trial of nurse home visitation. *Pediatrics, 78*, 65–78.
- Olds, D. L., Henderson, C. R., Jr, & Kitzman, H. (1994). Does prenatal and infancy nurse home visitation have enduring effects on qualities of parental caregiving and child health at 25 to 50 months of life? *Pediatrics, 93*, 89–98.

- Olds, D. L., Henderson, C. R., Jr., Kitzman, H., & Cole, R. (1995). Effects of prenatal and infancy nurse home visitation on surveillance of child maltreatment. *Pediatrics*, *95*, 365–372.
- Olds, D. L., Henderson, C. R., Jr., Kitzman, H., Eckenrode, J., Cole, R., Tatelbaum, R., Robinson, J., Pettitt, L. M., O'Brien, R., & Hill, P. (1998). Prenatal and infancy home visitation by nurses: A program of research. In C. Rovee-Collier, L. P. Lipsitt, & H. Hayne (Eds.), *Advances in infancy research*, (vol. 12, pp. 79–130). Stamford, CT: Ablex Publishing.
- Olds, D. L., Henderson, C. R., Jr., & Tatelbaum, R. (1994a). Intellectual impairment in children of women who smoke cigarettes during pregnancy. *Pediatrics*, *93*, 221–227.
- Olds, D. L., Henderson, C. R., Jr., & Tatelbaum, R. (1994b). Prevention of intellectual impairment in children of women who smoke cigarettes during pregnancy. *Pediatrics*, *93*, 228–233.
- Olds, D. L., Henderson, C. R., Jr., Tatelbaum, R., & Chamberlin, R. (1986). Improving the delivery of prenatal care and outcomes of pregnancy: A randomized trial of nurse home visitation. *Pediatrics*, *77*, 16–28.
- Olds, D. L., Henderson, C. R., Jr., Tatelbaum, R., & Chamberlin, R. (1988). Improving the life-course development of socially disadvantaged mothers: A randomized trial of nurse home visitation. *American Journal of Public Health*, *78*, 1436–1445.
- Olds, D. L., Hill, P. L., O'Brien, R., Racine, D., & Moritz, P. (2003). Taking preventive intervention to scale: The Nurse-Family Partnership. *Cognitive and Behavioral Practice*, *10*, 278–290.
- Olds, D. L., Hill, P. L., Robinson, J., Song, N., & Little, C. (2000). Update on home visiting for pregnant women and parents of young children. *Current Problems in Pediatrics*, *30*, 107–141.
- Overpeck, M. D., Brenner, R. A., Trumble, A. C., Trifiletti, L. B., & Berendes, H. W. (1998). Risk factors for infant homicide in the United States. *New England Journal of Medicine*, *339*, 1211–1216.
- Peterson, L., & Gable, S. (1998). Holistic injury prevention. In J. R. Lutzker (Ed.), *Handbook of child abuse research and treatment* (pp. 291–318). New York: Plenum Press.
- Pine, D. S. (2001). Affective neuroscience and the development of social anxiety disorder. *Psychiatric Clinics of North America*, *24*, 689–705.
- Pine, D. S. (2003). Developmental psychobiology and response to threats: Relevance to trauma in children and adolescents. *Biological Psychiatry*, *53*, 796–808.
- Plomin, R. (1986). *Development, genetics, and psychology*. Hillsdale, NJ: Erlbaum.
- Raine, A., Brennan, P., & Mednick, S. A. (1994). Birth complications combined with early maternal rejection at age 1 year predispose to violent crime at age 18 years. *Archives of General Psychiatry*, *51*, 984–988.
- Ridenour, T. A., Cottler, L. B., Robins, L. N., Compton, W. M., Spitznagel, E. L., & Cunningham-Williams, R. M. (2002). Test of the plausibility of adolescent substance use playing a causal role in developing adulthood antisocial behavior. *Journal of Abnormal Psychology*, *111*, 144–155.
- Rutter, M., Moffitt, T. E., & Caspi, A. (2006). Gene-environment interplay and psychopathology: Multiple varieties but real effects. *Journal of Child Psychology and Psychiatry*, *47*, 226–261.
- Saxon, D. W. (1978). The behavior of infants whose mothers smoke in pregnancy. *Early Human Development*, *2*, 363–369.

- Sood, B., Delaney-Black, V., Covington, C., Nordstrom-Klee, B., Ager, J., Templin, T., Janisse, J., Martier, S., & Sokol, R.J. (2001). Prenatal alcohol exposure and childhood behavior at age 6 to 7 years: I. dose-response effect [Electronic version]. *Pediatrics*, *108*(2), e34.
- Streissguth, A. P., Sampson, P. D., Barr, H. M., Bookstein, F. L., & Olson, H. C. (1994). The effects of prenatal exposure to alcohol and tobacco: Contributions from the Seattle longitudinal prospective study and implications for public policy. In H. L. Needleman & D. Bellinger (Eds.), *Prenatal exposure to toxicants: Developmental consequences* (pp. 148–183). Baltimore, MD: Johns Hopkins University Press.
- Tarter, R. E., Kirisci, L., Mezzich, A., Cornelius, J. R., Pajer, K., Vanyukov, M., Gardner, W., Blackson, T., & Clark, D. (2003). Neurobehavioral disinhibition in childhood predicts early age at onset of substance use disorder. *American Journal of Psychiatry*, *160*, 1078–1085.
- Taylor, S. E., Way, B. M., Welch, W. T., Hilmert, C. J., Lehman, B. J., & Eisenberger, N. I. (2006). Early family environment, current adversity, the serotonin transporter promoter polymorphism, and depressive symptomatology. *Biological Psychiatry*, *60*, 671–676.
- Wang, X., Zuckerman, B., Pearson, C., Kaufman, G., Chen, C., Wang, G., Niu, T., Wise, P. H., Bauchner, H., & Xu, X. (2002). Maternal cigarette smoking, metabolic gene polymorphism, and infant birth weight. *Journal of the American Medical Association*, *287*, 195–202.
- Wilhelm, K., Mitchell, P. B., Niven, H., Finch, A., Wedgwood, L., Scimone, A., Blair, I. P., Parker, G., & Schofield, P. R. (2006). Life events, first depression onset and the serotonin transporter gene. *British Journal of Psychiatry*, *188*, 210–215.