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Improving the Life Chances of Vulnerable Children and Families with Prenatal and Infancy Support of Parents: The Nurse-Family Partnership*

Un Programa de Apoyo Parental Prenatal e Infantil para Mejorar las Oportunidades Vitales de Niños y Niñas de Familias Vulnerables: El Nurse-Family Partnership

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Abstract. Pregnancy and the early years of the child's life offer an opportune time to prevent a host of adverse maternal and child outcomes that are important in their own right, but that also have significant implications for the development of criminal behavior. This paper summarizes a three-decade program of research that has attempted to improve the health and development of mothers and infants and their future life prospects with prenatal and infancy home visiting by nurses. The program, known as the Nurse-Family Partnership, is designed for low-income mothers who have had no previous live births. The home visiting 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 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, where careful attention is being given to ensuring that the program is being conducted in accordance with the program model tested in the randomized trials. The program also is being adapted, developed, and tested in countries outside of the US: the Netherlands, England, Scotland, Northern Ireland, Australia, and Canada, as well as Native American and Alaskan Native populations in the US, where programmatic adjustments are being made to accommodate different populations served and health and human service contexts. We believe it is important to test this program in randomized controlled trials in these new settings before it is offered for public investment.
Keywords: crime, development, health, home visiting, nurses, prevention.

Resumen. El embarazo y los primeros años de vida ofrecen un momento oportuno para prevenir una serie de situaciones adversas para la madre y el niño que son relevantes en sí mismas, pero que también tienen importantes implicaciones en el desarrollo de conductas desadaptativas posteriores. En este artículo se resumen tres décadas de un programa de investigación que ha intentado mejorar la salud y el desarrollo de madres e hijos y sus perspectivas vitales futuras con una intervención llevada a cabo por enfermeras en el domicilio familiar durante el embarazo y los primeros años de vida del niño. El programa, conocido como Nurse-Family Partnership, fue diseñado para madres primíparas de bajos ingresos. Las enfermeras que trabajan en el domicilio materno tienen tres metas principales: mejorar los resultados del embarazo ayudando a las madres a mejorar su salud prenatal; mejorar la salud del niño y su desarrollo ayudando a los padres a proporcionarle un cuidado más sensible y competente; y mejorar el futuro desarrollo vital de la madre ayudando a los padres a planificar futuros embarazos, completar su educación y encontrar trabajo. El programa ha demostrado efectos consistentes en la salud prenatal materna, en el cuidado parental, en el maltrato y negligencia infantil, en la salud del niño y su desarrollo, en la calidad de vida posterior de la madre, y en la implicación en delitos de las madres y sus hijos. Por ello, el programa se está ofreciendo en la actualidad en el ámbito público de los Estados Unidos de América con especial atención en asegurar que el programa se lleve a cabo de acuerdo con el modelo original evaluado en diferentes ensayos experimentales.

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El programa está siendo adaptado, desarrollado y evaluado en otros países: Holanda, Inglaterra, Escocia, Irlanda del Norte, Australia y Canadá, así como con poblaciones nativas de Norteamérica y de Alaska. En todos estos casos se han hecho algunos ajustes para adaptar el programa a las poblaciones a las que se dirige y al contexto específico de los servicios sociales y de salud. Creemos que es importante evaluar este programa a través de ensayos experimentales controlados en aquellos lugares en los que se considere oportuno aplicarlo.
Palabras clave: delito, desarrollo, enfermeras, intervención en el domicilio, prevención, salud.

Pregnancy and the early years of children's lives offer an opportune time to prevent a host of adverse maternal and child outcomes that are important in their own right, but that also have significant implications for the development and prevention of criminal behavior. Over the past 30 years, our team of investigators has been involved in developing and testing a program of prenatal and infancy home visiting by nurses aimed at improving the health of mothers and children and their future life prospects. Known as the Nurse-Family Partnership (NFP), this program 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 neuro-developmental and behavioral dysregulation; 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 (Olds, 2007). The program is designed to alter those influences early in life that contribute to early onset conduct disorder (Moffitt, 1993).

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, and 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; Bronfenbrenner, 1995, pp. 619-647), 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, and 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.

Parents help select and shape the settings in which they find themselves, however (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

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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, and Cassidy, 1985).

The program therefore explicitly promotes sensitive, responsive, and engaged care-giving in the early years of the child's life (Dolezol and Butterfield, 1994). 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.

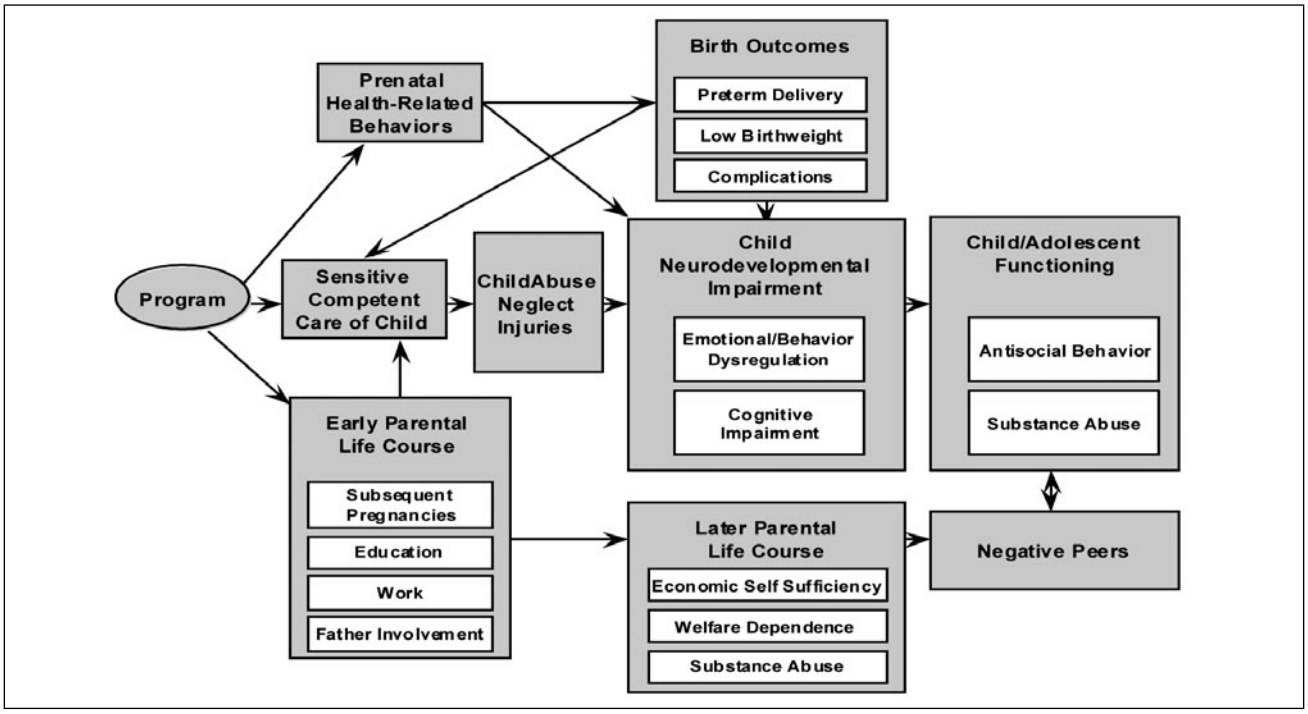
Epidemiologic Foundations

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 and McAnarney, 1980; Overpeck, Brenner, Trumble, Trifiletti, and 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; Olds, 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.

Prenatal Health Behaviors. Prenatal tobacco and alcohol exposure increase the risk for fetal growth restriction (Kramer, 1987), preterm birth (Kramer, 1987), and neurodevelopmental impairment (e.g., attention-deficit disorder, cognitive and language delays) (Fried, Watkinson, Dillon, and Dulberg, 1987; Mayes, 1994; Milberger, Biederman, Faraone, Chen, and Jones, 1996; Olds, Henderson, and Tatelbaum, 1994a; Olds, Henderson, and Tatelbaum, 1994b; Olds, 1997; Streissguth, Sampson, Barr, Bookstein, and Olson, 1994, pp. 148-183; Sood et al.,

Figure 1. General Conceptual Model of Program Influences on Maternal and Child Health and Development



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2001). Children born with subtle neurological perturbations resulting from prenatal exposure to stress and substances are more likely to be irritable and inconsolable (Clark, Soto, and Bergholz, 1996; Saxon, 1978; Streissguth et al., 1994, pp. 148-183), making it more difficult for parents to enjoy their care. Improved prenatal health thus helps parents become competent caregivers.

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, Henderson, Kitzman, Anson, Eckenrode, and Sidora, 2004; Peterson and Gable, 1998, pp. 291-318). Competent early parenting is associated with better child behavioral regulation, language, and cognition (Hart and Risley, 1995). Later demanding, responsive, and positive parenting can provide some protection from the damaging effects of stressful environments and negative peers (Bremner, 1999; Field et al., 1998) on externalizing symptoms and substance use (Baumrind, 1987; Biglan, Duncan, Ary, and Smolkowski, 1995; Cohen, Navaline, and Metzger, 1994; Field et al., 1998; Grant et al., 2000; Johnson and Pandina, 1991). In general, poor parenting is correlated with low child serotonin levels (Pine, 2001; Pine, 2003) which, in turn, are implicated in stress-induced delays in neurodevelopment (Bremner and Vermetten, 2004).

Early Parental Life Course. Closely spaced subsequent births undermine unmarried women's educational achievement and workforce participation (Furstenberg, Brooks-Gunn, and 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 and Carlson, 2002). Nurses therefore promote fathers' involvement and help women make appropriate 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 (Olds, Sadler, and Kitzman, 2007; Olds et al., 1997; Greene, 2001; Olds, 2002; Hawkins, Catalano, and Miller, 1992; Clark and Cornelius, 2004). Children with early-onset conduct problems are more likely to have subtle neurodevelopmental deficits (Arseneault, Tremblay, Boulerice, and Saucier, 2002; Milberger et al., 1996; Olds et al., 1997; Streissguth et al., 1994, pp. 148-183) that may contribute to, be caused by, or be exacerbated by abusive and rejecting care early in life (Moffitt, 1993; Raine, Brennan, and Mednick, 1994). Aggressive and disinhibited behaviors that emerge prior to puberty are risks for adolescent SUD (Tarter et al., 2003; Clark, Cornelius, Kirisci, and Tarter, 2005) antisocial behavior, and risky sexual behavior, such as unprotected sex with multiple partners. 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 medical complications, motor skill deficits, behavioral and emotional problems (Jaffee et al., 2002), especially impulsivity, risky decision making, and problems with verbal recognition memory and inattention (Aytaclar, Tarter, Kirisci, and 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 et al., 2005; Clark and Cornelius, 2004; Clark et al., 1997; 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). The reductions in prenatal risks, dysfunctional care of the infant, and improvements in family context are 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 pre-

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sented 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. In the Denver trial, we compared the relative impact of the program when delivered by nurses compared to paraprofessional visitors who shared many of the social characteristics of the families they served.

Program Content

The nurses had 3 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 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 2 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 parent's understanding of their infants' and toddlers' communicative signals, 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 = 1138 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 2-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 34 week of pregnancy (Olds, Henderson, Tatelbaum, and 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, and among women who smoked, those who were nurse-visited had 75% fewer pre-term deliveries, and 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, and 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, and 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

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and that were safer (Olds, Henderson, and 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, $p = .07$). Figure 2 shows how the treatment-control differences were greater among families where there was more concentrated social disadvantage. While these effects were only a trend, the effects among the poor, unmarried teens were corroborated by observations of mothers' treatment of their children in their homes and injuries detected in the children's medical records. 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.

As shown in Figures 3 and 4, 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 pregnancy. This set of findings deepened our conviction that the nurses' emphasis on supporting women's development of self-efficacy was a crucial element of 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 et al., 1994). The impact of the program on state-verified cases of child abuse and neglect, on the other hand, disappeared during that 2-year period (Olds et al., 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 (Greene, 2001).

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, and 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

Figure 2. Rates of verified cases of child abuse and neglect by treatment condition, and socio-demographic characteristics of sample

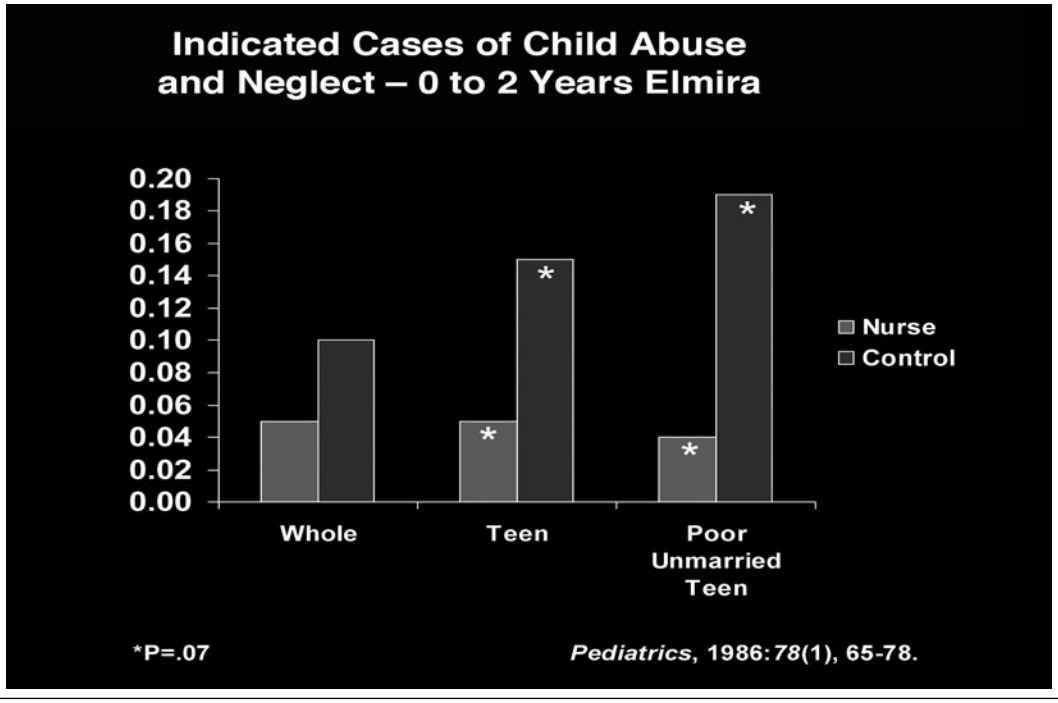

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Figure 3. Rates of verified cases of child abuse and neglect (birth – age 2) by treatment condition and maternal sense of control measured at registration during pregnancy (Elmira)

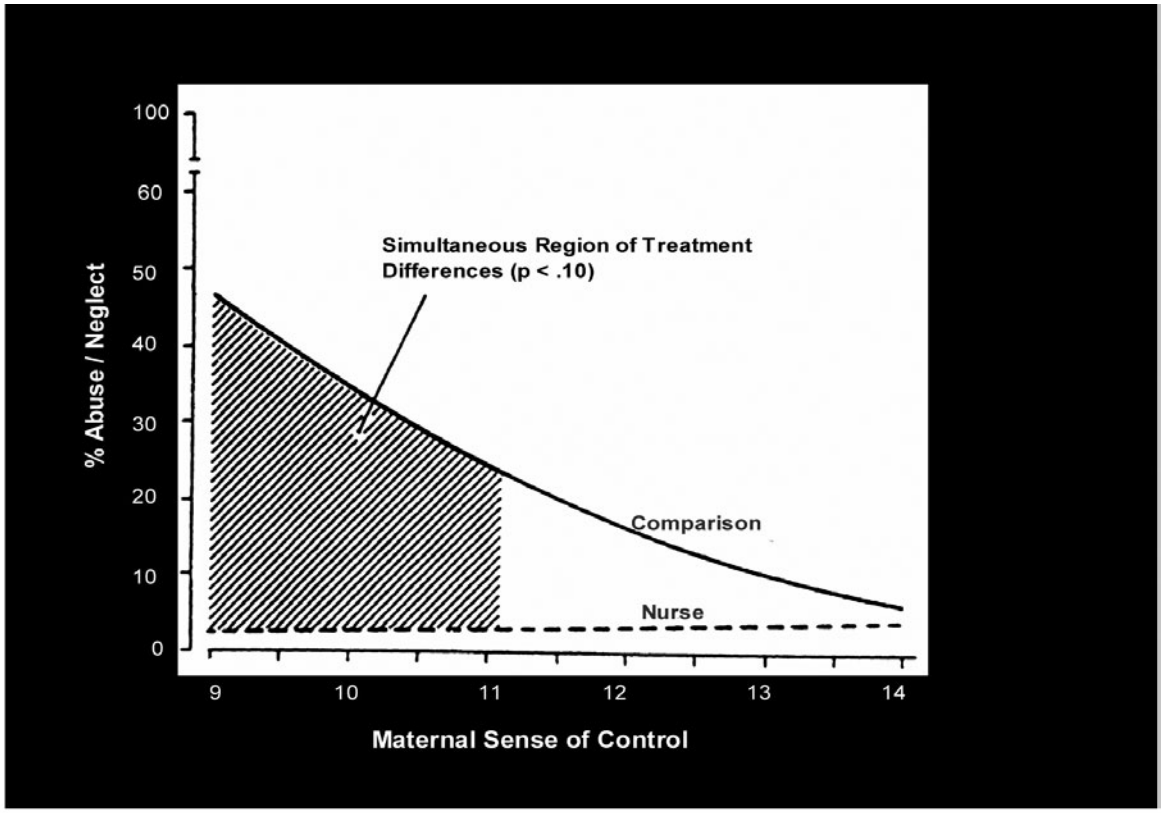
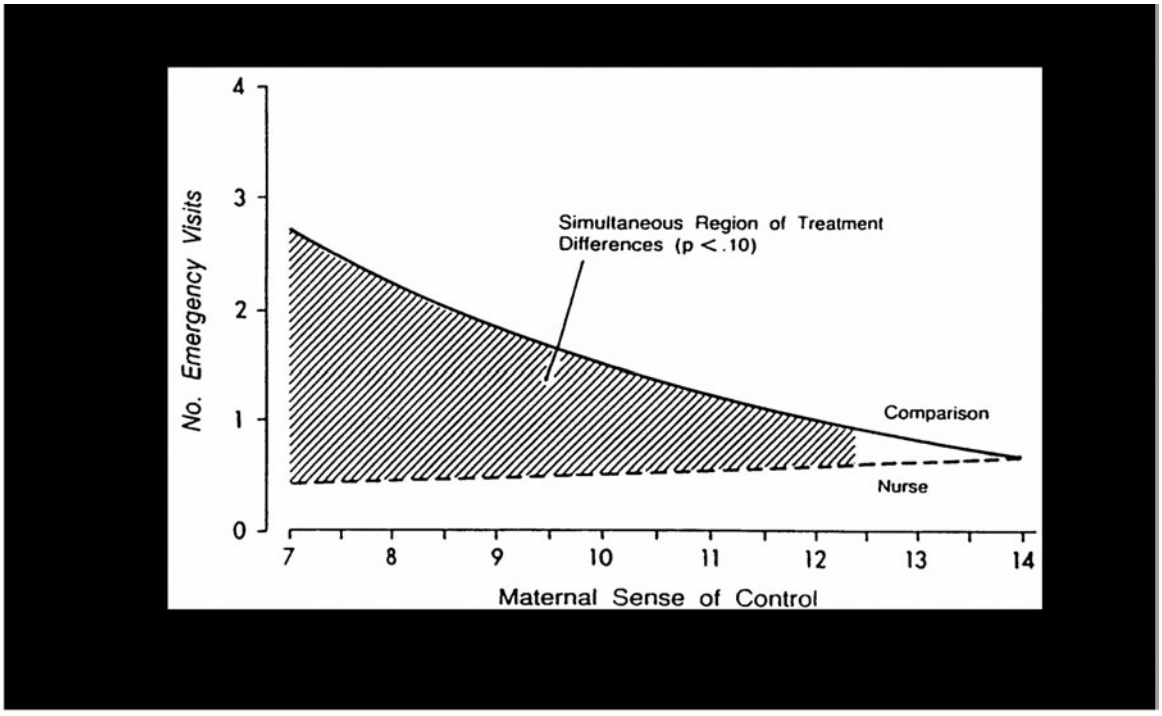


Figure 4. Rates of emergency department encounters in children's second years of life by treatment condition and maternal sense of control measured at registration during pregnancy



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babies born to women who smoked 10 or more cigarettes per day in the comparison group (Conrad, 2006). 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 et al., 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 3 and 4 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+ cigarettes per day at registration (Olds et al., 1994b).

Early Parental Life-Course. By the time the first child was four year of age, nurse visited women low-income, unmarried women, in contrast to their counterparts in the control group had fewer subsequent pregnancies, longer intervals between births of first and 2nd children, and greater participation in the work force than did their comparison-group counterparts (Olds, Henderson, Tatelbaum, and 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 2nd 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, 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 percent 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 on 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, Injuries, and Death. 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 2 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 (Figure 5). 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 (Table 1).

We chose not to hypothesize that the program would affect the rates of mortality among nurse-visited children because death is too infrequently occurring to serve as a reliable outcome. Nevertheless, we (Olds, Kitzman et al., 2007) found that as a trend, by child age 9 nurse-visited children were less likely to have died than their control-group counterparts ($p = .08$). The rates of death were 4.5 times higher in the control group than in the group visited by nurses. Table 2 displays the rates and reasons for death among nurse-visited and control-group children.

Child Neuro-developmental Impairment. By child age 6, 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

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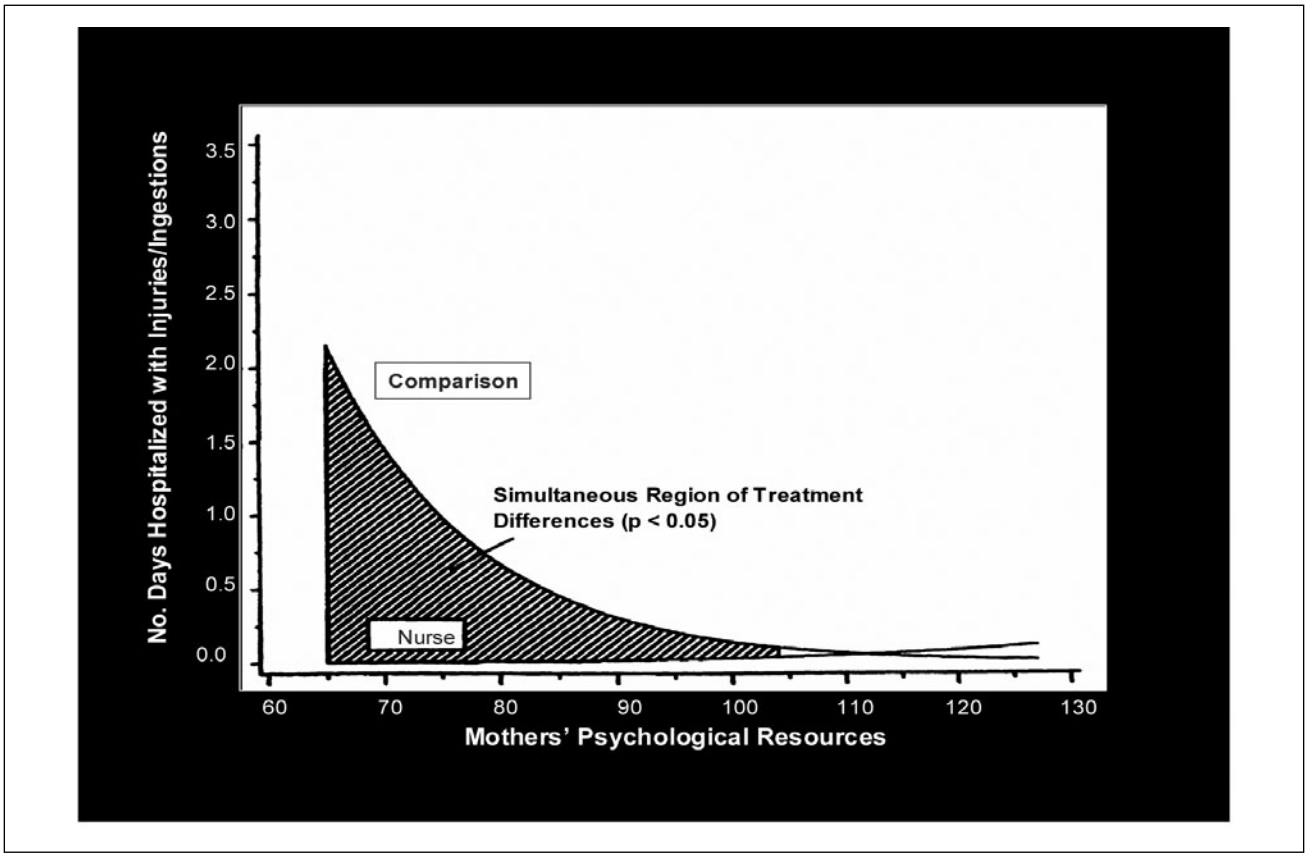
Figure 5. Regressions of number of days hospitalized on mothers' psychological resources fitted separately for nurse-visited and control group mothers (Memphis)



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. Though child age 9, nurse-visited children born to mothers with low psychological resources had higher grade point averages in reading and math than did their counterparts in the control group (Olds, Kitzman et al., 2007). By child age 12, nurse-visited children born to low-resource mothers had higher rates of reading and math achievement and overall, nurse-visited children reported lower use of substances and internalizing disorders (depression and anxiety) (Kitzman et al., 2010).

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 2nd 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 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 (Kitzman et al., 2000). By child 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%) (Olds, Kitzman et al., 2004). By the time the firstborn child was nine years of age, nurse-visited women continued to have longer intervals between the births of first and second children, fewer cumulative subsequent births, and longer relationships with their current partners. From birth through child age 9, nurse-visited women continued to use welfare and food stamps for fewer months (Olds, Kitzman et al., 2007). Over the first 12 years following birth of the first child, nurse-visited relied upon welfare related services less frequently, costing government (Olds et al., 2010). This led to $12,300 discounted savings to government (expressed in 2006 dollars), which is compared to a cor-

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Table 1. Diagnoses for hospitalizations for injuries or ingestions among nurse-visited and control group children in the first two years of life (Memphis)

Diagnosis	Age, mo	Sex	Length of Stay, d
Nurse-Visited (Treatment Group 4)			
Burns	12.0	M	2
Coin ingestion	12.1	M	1
Ingestion of Iron medication	20.4	F	4
Comparison (Treatment Group 2)			
Head trauma	2.4	M	1
Fractured fibula/congenital syphillis	2.4	M	12
Strangulated hernia with delay in seeking care/burns (1st degree to lips)	3.5	M	15
Bilateral subdural hematoma*	4.9	F	19
Fractured skull	7.8	F	3
Bilateral subdural hematoma (unresolved)/ aspetic meningitis–2nd hospitalization*	5.3	F	4
Fractured skull	7.8	F	3
Coin ingestion	10.9	M	2
Child abuse/neglect suspected	14.6	M	2
Fractured tibia	14.8	M	2
Burns (2nd degree to face/neck)	15.1	M	5
Bruns /2nd and 3rd degree to bilateral leg)†	19.6	M	4
Gastroenteritis/head trauma	20.0	F	3
Burns /splinting/grafting(–2nd hospitalization †	20.1	M	6
Finger injury/osteomyelitis	23.0	M	6

*One child was hospitalized twice with a single bilateral subdural hematoma.
†One child was hospitalized twice for burns resulting from a single incident.

responding program cost of $11,500, also expressed in 2006 dollars (Olds et al., 2010).

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 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 (Olds et al., 2002). By child age 4, 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 (Olds, Robinson et al., 2004).

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 (Olds et al., 2002).

Sensitive, Competent Care of Child. During the first 24 months of the child's life, nurse visited moth-

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Table 2: Rates and causes of infant and child deaths (International Classification of Diseases) among first- born children through age 9

	Treatment Group		Treatment Comparisons	
	Comparison	Nurse-Visited	Comparison vs. Nurse	
	N = 498	N = 222	P Value	Odds Ratio (CI)
No. of Deaths (rate/1000)	10 (20.08)	1 (4.50)	.080[a]	0.22 (0.03, 1.74)

Cause of Death (ICD9 Code)	Age at Death (days)	Cause of Death (ICD9 Code)	Age at Death (days)
Extreme Prematurity (7650)	3	Chromosomal abnormalities (7589)	24
Sudden Infant Death Syndrome (7980)	20		
Sudden Infant Death Syndrome (7980)	35		
Ill Defined Intestinal Infections (90)	36		
Sudden Infant Death Syndrome (7980)	49		
Multiple Congenital Anomalies (7597)	152		
Chronic Respiratory Disease in Arising in Perinatal Period (7707)	549		
Homicide Assault by Firearm (9654)	1569		
Motor Vehicle Accident (8129)	2100		
Accident Caused by Firearm (9229)	2114		

[a] This is the likelihood ratio p-value. The Chi-Square test probability is .116

er-infant dyads interacted more responsively than did 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 (Olds et al., 2002).

Child Neurodevelopmental 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 (Olds et al., 2002). At child age 4, 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 (Olds, Robinson et al., 2004).

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 (Olds et al., 2002). By child age 4, 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 (Olds, Robinson et al., 2004).

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, and Pennucci, 2004). While this analysis does not cover all outcomes that have cost implications for the NFP (such as the

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rates and outcomes of subsequent pregnancies or 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 3 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 (Karoly, Kilburn, and Cannon, 2005).

Policy implications and program replication

One of the clearest messages 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.

Replication and Scale-Up of the Nurse Family Partnership

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 Nurse Family Partnership national office has helped new communities develop the program outside of traditional research contexts so that today the program is operating in 330 counties in the United States, serving over 14,400 families per day. State and local governments are securing financial support for the Nurse-Family Partnership (about $11,000 per family for 2½ years of services, in 2008 dollars) 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. In 2009, the US federal government passed the Affordable Care Act (healthcare reform), which included $1.5 billion for states who choose to invest in evidence-based home visiting programs. The NFP served as the primary evidentiary foundation for that legislation. That legislation has served as a primary foundation for continued expansion of the NFP in the US during the recent economic downturn.

Capacities Necessary to Support Dissemination. Each site choosing to implement the Nurse-Family Partnership 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.

International Replication. Our approach to international replication of the program is to make no assumptions about its possible benefits in societies that have different health and human service delivery systems and cultures than those in which the program was tested in the United States. Given this, our team has taken the position that the program ought to be adapted and tested in other societies before it is offered for public investment. We currently are working with partners in England, Scotland, Northern Ireland, Holland, Australia, and Canada to adapt and test the program with disadvantaged populations. While it is possible that the need and impact of this intervention may be diminished in societies with more extensive health and social welfare systems than are found in the United States, it is possible that the program may have comparable effects for subgroups that do not make good use of those other services and resources that are available to them.

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References

Aos, S., Lieb, R., Mayfield, J., Miller, M., & Pennucci, A. (2004). *Benefits and costs of prevention and early intervention programs for youth.* Olympia, WA: 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 & Adolescent Psychiatry, 38,* 172-178.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review 84,* 191-215.

Baumrind, D. (1987). *Familial antecedents of adolescent drug use: a developmental perspective.* National Institute of Drug Abuse Monograph 56 (DHHS Publication No. ADM 87-1335). Washington, DC: US Government Printing Office.

Biglan, A., Duncan, T. E., Ary, D. V., & Smolkowski, K. (1995). Peer and parental influences on adolescent tobacco use. *Journal of Behavioral Medicine, 18,* 315-330.

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.* Washington, DC: American Psychological Association.

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. (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 & Adolescent Psychiatry, 36,* 1195-1203.

Cohen, E., Navaline, H., & Metzger, D. (1994). High-risk behaviors for HIV: a comparison between crack-abusing and opioid-abusing African-American women. *Journal of Psychoactive Drugs, 26,* 233-241.

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.

Conrad, C. (2006). Measuring costs of child abuse and neglect: a mathematic model of specific cost estimations. *Journal of Health & Human Services Administration, 29,* 103-123.

Dolezol, S., & Butterfield, P. M. (1994). *Partners in parenting education.* Denver, CO: How to Read Your Baby.

Elster, A. B., & McAnarney, E. R. (1980). Medical and psychosocial risks of pregnancy and childbearing during adolescence. *Pediatric Annals, 9,* 89-94.

Field, T. M., Scafidi, F., Pickens, J., Prodromidis, M., Pelaez-Nogueras, M., Torquati, J., ... Kuhn, C. (1998). Polydrug-using adolescent mothers and their infants receiving early intervention. *Adolescence, 33,* 117-143.

Fried, P. A., Watkinson, B., Dillon, R. F., & Dulberg, C. S. (1987). Neonatal neurological status in a low-risk population after prenatal exposure to cigarettes, marijuana, and alcohol. *Journal of Developmental and Behavioral Pediatrics, 8,* 318-326.

Furstenberg, F. F., Brooks-Gunn, J., & Morgan, S. P. (1987). *Adolescent mothers in later life.* Cambridge: Cambridge University Press.

Grant, K. E., O'Koon, J. H., Davis, T. H., Roache, N. A., Poindexter, L. M., Armstrong, M. L., ... McIntosh, J. M.

ISSN: 1132-0559 - http://dx.doi.org/10.5093/in2012a14

(2000). Protective factors affecting low-income urban African American youth exposed to stress. *Journal of Early Adolescence, 20,* 388-417.

Greene, J. P. (2001). *High school graduation rates in the United States: revised.* New York: Manhattan Institute for Policy Research.

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.

Johnson, V., & Pandina, R. J. (1991). Familial and personal drinking histories and measures of competence in youth. *Addictive Behaviors, 16,* 453-465.

Karoly, L. A., Kilburn, M. R., & Cannon, J. S. (2005). *Early childhood interventions: proven results, future promise.* Santa Monica, CA: RAND.

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.

Kitzman, H., Olds, D. L., Henderson, C. R. Jr., Hanks, C., Cole, R., Tatelbaum, R., ... 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.

Kitzman, H., Olds, D. L., Sidora, K., Henderson, C. R. Jr, Hanks, C., Cole, R., ... Glazner, J. (2000). Enduring effects of nurse home visitation on maternal life course: a 3-year follow-up of a randomized trial. *Journal of the American Medical Association, 283,* 1983-1989.

Kitzman, H., Olds, D. L., Cole, R., Hanks, C., Anson, E., Sidora-Arcoleo, K., ... Holmberg, J. (2010). Enduring effects of prenatal and infancy home visiting by nurses on children: Age-12 follow-up of a randomized trial. *Archives of Pediatric and Adolescent Medicine, 164,* 412-418.

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., ... 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,* 66-104.

Mayes, L. C. (1994). Neurobiology of prenatal cocaine exposure: effect on developing monoamine systems. *Infant Mental Health Journal, 15,* 121-133.

McLanahan, S. S., & Carlson, M. J. (2002). Welfare reform, fertility, and father involvement. *The Future of Children, 12,* 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 Reviews, 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. (2007). Preventing crime with prenatal and infancy support of parents: The Nurse-Family Partnership. *Victims and Offenders, 2,* 205-225.

Olds, D. L., Eckenrode, J., Henderson, C. R. Jr., Kitzman, H., Powers, J., Cole, R., ... 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., & 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,* 6-28.

Olds, D. L., Henderson, C. R. Jr., Tatelbaum, R., & Chamberlin, R. (1988). Improving the life-course development of socially disadvantaged mothers: a randomized

ISSN: 1132-0559 - http://dx.doi.org/10.5093/in2012a14

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., Kitzman, H., Cole, R., Hanks, C., Sidora-Arcoleo, K., Anson, ... Stevenson, A. (2010). Enduring effects of prenatal and infancy home visiting by nurses on maternal life-course and government spending: Age-12 follow-up of a randomized trial. *Archives of Pediatric and Adolescent Medicine, 164,* 419-424.

Olds, D., Kitzman, H., Cole, R., Robinson, J., Sidora, K., Luckey, D., ... Holmberg, J. (2004). Effects of nurse home visiting on maternal life-course and child development: age-six follow-up of a randomized trial. *Pediatrics, 114,* 1550-1559.

Olds, D. L., Kitzman, H., Hanks, C., Cole, R., Anson, E., Sidora-Arcoleo, K., ... Bondy, J. (2007). Effects of nurse home visiting on maternal and child functioning: Age-9 follow-up of a randomized trial. *Pediatrics 120,* 832-845.

Olds, D. L., Robinson, J., O'Brien, R., Luckey, D.W., Pettitt, L. M., Henderson, C. R. Jr., Ng, R. K., ... Talmi, A. (2002). Home visiting by paraprofessionals and by nurses: A randomized, controlled trial. *Pediatrics, 110,* 486-496.

Olds, D. L., Robinson, J., Pettitt, L., Luckey, D.W., Holmberg, J., Ng, R. K., Isacks, K., & Sheff K. (2004). Effects of home visits by paraprofessionals and by nurses: Age-four follow-up of a randomized trial. *Pediatrics 114,* 1560-1568.

Olds, D. L., Sadler, L., & Kitzman, H. (2007). Programs for parents of infants and toddlers: Recent evidence from randomized trials. *Journal of Child Psychology and Psychiatry, 48,* 355-391.

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.* 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.

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., ... Sokol, R. J. (2001). Prenatal alcohol exposure and childhood behavior at age 6 to 7 years: I. dose-response effect. *Pediatrics, 108,* 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.* Baltimore: Johns Hopkins University Press.

Tarter, R. E., Kirisci, L., Mezzich, A., Cornelius, J. R., Pajer, K., Vanyukov, M., ... Clark, D. (2003). Neurobehavioral disinhibition in childhood predicts early age at onset of substance use disorder. *American Journal of Psychiatry, 160,* 1078-1085.

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