

**Testimony to the House Committee on Government Reform and Oversight,  
Subcommittee on Human Resources**

**Hearing on  
“Early Childhood Interventions: Public-Private Partnerships”**

**Prevention of Child Abuse, Use of Welfare, and Crime with Preventive  
Interventions  
Early in the Life Cycle**

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Mr. Chairman, members of the Committee, thank you for the opportunity to testify on this important topic.

For over 20 years, my colleagues and I have been developing and studying a program of prenatal and early childhood home visitation by nurses that reduces child abuse and neglect, use of welfare, and crime in low-income families. The program serves low-income mothers who have had no previous live births, many of whom are unmarried adolescents.

The nurses visit pregnant women in their homes during pregnancy and the first two years of children's lives. In those visits:

- they help women reduce prenatal cigarette smoking, and use of alcohol and drugs;
- they help women improve their diets, and identify emerging complications of pregnancy that can be treated before they compromise the health of the mother and fetus;
- they help parents provide more responsible care for their children; and
- they help parents develop a vision for their future and plan subsequent pregnancies, complete their educations, and eventually find work.

The program has been developed, refined, and tested over a 20-year period so that today the nurses have structured written protocols and intensive training to guide them in working with families who live in highly challenging and often dangerous situations.

Over the years, we have been encouraged to disseminate the program model, but we have waited to do so until now because we wanted to have sound scientific evidence of its effectiveness and thoroughly developed program protocols. In this way, we can now provide greater assurance to communities that replicate this program will reproduce the results achieved in the research.

We have examined the program in three separate, large scale randomized trials. Randomized trials are the most scientifically credible method of determining the effectiveness of health, social service, and medical interventions.

The first study was carried out in Elmira, New York with Caucasian families.

The second was conducted in Memphis Tennessee, with African American families.

The third is being completed in Denver with a large portion of Mexican-American families.

We have found that the program can reduce some of the most intractable health and social problems facing at-risk families in our society and a recent report by the Rand Corporation shows that the program can more than pay for itself in reduced government expenditures, when it is focused on unmarried, low-income parents.

A recent report on the Elmira study shows that by the first child's 15th birthday, nurse-visited low-income unmarried mothers had:

- 33% fewer subsequent births;
- 30 months greater spacing between first and second births;
- 30 fewer months on welfare;
- 81% fewer arrests and convictions; and
- 79% fewer verified reports of child abuse and neglect;

Compared to their counterparts who had been assigned to comparison services, the 15-year old children born to nurse-visited, low-income, unmarried mothers had:

- 60% fewer instances of running away;
- 56% fewer arrests;
- 81% fewer convictions and violations of probation; and

- 56% fewer days of alcohol consumption.

There were very few benefits for higher income, married women and their children.

One of the hallmarks of good evidence is being able to reproduce it. The major findings from the Elmira trial in the early years of the child's life have now been reproduced in an urban replication conducted in Memphis.

For example, by the children's second birthdays, compared to women and children randomly assigned to comparison services, those who were nurse-visited had:

- 30% fewer hypertensive disorders of pregnancy;
- 50% more frequent breast feeding;
- 81% fewer days that children were hospitalized with injuries or ingestions;
- fewer conditions in the children's hospital records indicative of neglectful or abusive care;
- 30% fewer subsequent births.

During the past decade, the findings from this program of research have been used to promote a wide variety of home-visitation programs for pregnant women and parents of young children. Unless programs share the essential elements of the program tested in these trials, however, those other programs are not likely to produce the same results.

Even when communities choose to develop programs based on models with good scientific evidence, all too often the programs are watered down and compromised in the process of being scaled up. We have begun some work to address this problem.

We have been invited by the Justice Department to disseminate this program in high-crime neighborhoods in different parts of the country. We are using this initiative to learn more about what it will take, in new communities, to develop the program with fidelity to its essential elements. We have established the program in 14 communities and are studying what it will take to successfully develop the program on a much larger scale.

In this initiative, state and local governments are securing financial support for the program out of existing funds, such as TANF, Medicaid, child-abuse, and crime-prevention dollars. The program itself requires no new appropriation. Communities are making these investments in part because the evidence indicates that expenditures in these budgets will be reduced later on. This means that the cost of this program, which in 1998 dollars is about \$7,000 per family for two and a half years of service, can be shared by a variety of government agencies. This reduces the strain on any one budget.

We have recently been invited by a major philanthropy to develop a system of regional replication centers based in schools of nursing and public health to develop this program on a national scale. We have estimated that it will take 20 additional years to develop this program for all low-income women in our society, if we wish to preserve those elements of program quality necessary to reproduce the results I have just summarized on a national scale. This is because quality programming requires recruiting qualified staff, intensive training, and excellent supervisors – capacities that require development over time.

In general, we believe that policies and practices for assisting young children and their families ought to be based upon the best scientific evidence available. Given the recent emphasis on brain development in the first three years of life, there is a lot of enthusiasm these days about the promise of early preventive intervention.

We know that brain development is rapid during the first three years of life and that many neuronal pathways are established during this time. There are very few programs that have been scientifically proven to improve parents' care of their children, however, and I see almost no evidence that programs have been able to improve children's neurological development. At this point, we have lots of theory but not much proven to work.

The few well conducted studies of programs designed to promote early parental care should give us pause, given that almost all of those tested have failed to achieve the kinds of results we so desperately need.

I am particularly concerned about the expansion of Early Head Start before research on its effectiveness is completed. I am deeply concerned that the programs in place have not been sufficiently well developed clinically to produce meaningful results. I have similar concerns about the federal Healthy Start program.

To fund such programs before they have been developed clinically and carefully tested is likely to put in place a system of services for young families that is deficient and not reflective of what our evidence indicates that we, as a society, could achieve.

Public hope and confidence in the promise of such programs is a scarce commodity that we dare not squander on approaches that are not likely to succeed. As health and social welfare policy is redesigned in the near future, I believe that it makes sense to begin with programs that have been tested, replicated, and found to work.

In the next century, we have a unique opportunity to guide policies for children and families with solid scientific evidence. I hope we do not miss the opportunity.

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**IN PRESS - THE FUTURE OF CHILDREN**

**Prenatal and Infancy Home Visitation by Nurses:**

**Recent Findings**

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## I. INTRODUCTION

Many of the most pervasive and intractable problems faced by young children and parents in our society today can be traced to adverse maternal health-related behaviors during pregnancy, compromised care of the child, and stressful conditions in families' homes that interfere with parental and family functioning. These problems include infant mortality, pre-term delivery, low birthweight, and neurodevelopmental impairments in young children resulting from poor prenatal health;<sup>1,2,3</sup> child abuse and neglect, and accidental childhood injuries resulting from dysfunctional caregiving;<sup>4</sup> youth violence resulting from a combination of neurodevelopmental impairment and harsh and neglectful caregiving;<sup>5,6,7</sup> and diminished economic self-sufficiency of parents resulting from closely spaced pregnancy, educational failure, and sporadic workforce participation.<sup>8</sup>

Through 1993, we published a series of papers on a randomized trial of prenatal and infancy home visitation by nurses in Elmira, New York (N=400) that was designed to reduce these problems through the improvement of maternal health and behavior. The program was focused on women who were either unmarried, adolescents, or poor. Early results showed significant promise for the program, and were reviewed in an article on the effects of prenatal, infancy and early childhood home visitation published in 1993.<sup>9</sup>

At the time the 1993 review article was written, some of the program effects evaluated through the child's fourth year of life had been published. Compared to counterparts randomly assigned to receive comparison services, women who were nurse-visited experienced greater informal and formal social support, smoked fewer cigarettes, had better diets, and exhibited fewer kidney infections by the end of pregnancy. (There also was a non-significant decrease in the number of hypertensive disorders of pregnancy.) Babies born to nurse-visited women

identified as smokers were 75% less likely to be born prematurely, that is, before 37 weeks of gestation.<sup>10</sup>

From birth through the child's second birthday, nurse-visited children born to women with all three risk characteristics used for sample recruitment (poor, unmarried, or teen-aged) were 80% less likely to have been identified through state Child Protective Service Records as a victim of child abuse or neglect than were their counterparts in the comparison group. Moreover, nurse-visited children were seen in the emergency department 56% fewer times than were children in the comparison condition during the second year of their lives – that is, when children are more likely to be injured because of their increased mobility but immature motor development. These findings were corroborated by observations of the children's homes and parents' reports of their care of their children.<sup>11</sup>

During the first four years after delivery of the first child, nurse-visited women who were low-income and unmarried at registration were found to have 42% fewer subsequent pregnancies and 84% greater participation in the work force.<sup>12</sup> An economic evaluation of the program from the standpoint of savings to government showed that for low-income women the discounted cost savings to government exceeded the cost of the program before the children were four years of age.<sup>13</sup>

Given these encouraging results, beginning in the late 1980's many groups urged us to develop the program in new communities on a much wider scale. They reasoned that the program worked and that at-risk families in our society deserved the program. We chose not to replicate the program outside of research contexts, however, for three reasons.

First, we did not know whether the findings produced early in the life of the child would endure. Other preventive interventions had produced effects that washed out after the program



ended. We needed to see enduring benefit before we could justify a public investment in this service.

Second, we did not know whether the findings from the Elmira program were limited to the population studied (primarily whites living in a Central New York county) or whether they might apply to a wider range of communities and populations. In particular, we needed to be sure that this was a program that would work with minorities living in urban areas.

Third, we needed to develop the program protocols and methods of training nurse home visitors to the point that new programs based upon this model would reliably reproduce the essential elements of the program tested in the randomized trials. Many programs examined in research settings are subsequently altered or watered down in the process of being scaled up, often leading to reduced effectiveness. We wanted to avoid that fate for the current program and needed to be able to provide clear guidance for new communities about what, exactly, they should do to replicate the program.

In the meantime, several national groups used the findings from the Elmira trial to promote a variety of home-visitation models in spite of the fact that the promoted programs bore little resemblance to the program tested in Elmira. Some programs employed paraprofessional visitors who began during pregnancy but had little follow-up during infancy. Others began after delivery and employed paraprofessionals as home visitors. Rarely were such programs designed explicitly to promote maternal life course (plan future pregnancies, stay in school, find work, etc.). We did not discourage organizations using data from the Elmira trial to promote such a wide variety of program types because, for all we knew at the time, the Elmira findings might be reasonably applied to a many types of programs. We chose, instead, to focus our efforts on conducting a follow-up of the Elmira study to examine the durability of the early effects,

replicating the program in a major urban area (Memphis, Tennessee) and refining the program protocols and training. If the program were truly effective, we then could help new communities develop the program in accordance with the proven model so that they could be reasonably sure of achieving the effects observed in the randomized trials.

As the results of new randomized trials of other home visitation programs became available, however, we grew increasingly concerned that the findings from Elmira did not have broad applicability to all types of home visitation programs. Two reviews of randomized trials of prenatal and early childhood home visitation programs showed that such programs needed to adhere to certain standards to produce desired effects on maternal and child health.<sup>14,9</sup>

More recently, in light of the considerable proliferation of programs of home visitation by lay community health visitors, without solid evidence that such visitors could achieve the same results as has been found with nurses, we developed a third trial in Denver (N=735) in which nurse home visitors were contrasted with trained lay community health visitors when both visitor types were provided the same protocols developed in the Elmira and Memphis trials. This study was designed to determine the extent to which absence of effects for programs delivered by paraprofessionals is due to the background of the visitors or to the program protocols typically followed by paraprofessional visitors.

In this paper, we summarize findings from the Elmira trial that have been published since 1993 – the point at which we published the most recent review of this evidence<sup>9</sup> – and summarize findings from the Memphis replication study. Outcomes from the Denver trial are not yet available, although data on differences between the nurse and paraprofessional home visitors in implementation of the program are briefly summarized here. Before we summarize these findings, we outline the epidemiological and theoretical foundations of the program and its

content and methods. It is important to understand these features of the program in order to interpret its effects.

## II. DEVELOPMENTAL EPIDEMIOLOGY

The program tested in this series of randomized trials has been firmly grounded in epidemiology and theories of child development. Kellam has referred to the integration of these disciplines in guiding prevention science as *developmental epidemiology*.<sup>15</sup> In planning the original Elmira trial, we noted that although the problems identified above cut across all segments of U.S. society, they were more common among children born to poor, adolescent, and single parents. This observation led to our decision to focus recruitment on women bearing first children who were either adolescent, unmarried, or from low-income families. Any pregnant woman bearing a first child was accepted into the study, irrespective of her age, marital status or income, however, in order to avoid creating a program stigmatized because it served only the poor or people with problems. Given that the beneficial effects of the Elmira program (described below) were concentrated on women who were unmarried and from low-income families, we modified the sampling designs in Memphis and Denver to focus more exclusively on low-income women, the vast majority of whom were unmarried and adolescent.

All three of the trials focused on women who had no previous live births because we reasoned that offering them services during the transition to parenthood would increase their receptivity to offers of help. Moreover, from the standpoint of a public health strategy, this approach held the promise of improving the life chances of subsequent children because parents who received these services were hypothesized to have better skills for managing the demands of pregnancy and early care of subsequent children after they had been helped with their first child. In addition, to the extent that the rates of rapid successive births were reduced, parents would be

able to focus their caregiving resources on a smaller number of children. The program was directed toward improving the outcomes of pregnancy, parents' caregiving skills (and the corresponding health and development of the child), and the early life course of the mothers.

In designing the program, we reviewed the literature to determine behavioral and contextual conditions that were consistently and uniquely associated with the adverse maternal and child outcomes that we wished to affect. We analyzed the literature to determine the extent to which these risk factors were likely to be causally related to the outcomes of interest and which were simply markers for maladaptive functioning. Those thought to be causally related to the outcome of interest and that were potentially modifiable with social and behavioral interventions became the primary candidates for targeted interventions to reduce the adverse maternal and child outcomes identified for prevention. Theory played an important role in helping us integrate the epidemiologic data into a coherent developmental framework regarding the proximity of risk to adverse outcome, the developmental progression of maladaptive functioning, and how clinical interventions might be applied to reduce risk. It is important to note that the epidemiologic evidence indicated that some of the problems targeted for prevention early in the program were also risks for later antisocial behavior. This is best illustrated by reference to Figure 1.

#### **A. Modifiable Risks for Low Birthweight, Preterm Delivery, and Fetal Neurodevelopmental Impairment**

Epidemiologic evidence on risks for low birthweight indicates that prenatal exposure to tobacco, alcohol, and illegal drugs are established risks for compromised fetal growth<sup>1</sup> and, to a lesser extent, shortened length of gestation.<sup>1</sup> Similarly, prenatal exposure to these substances increases the likelihood of compromised neurodevelopmental impairment.<sup>2,3,16-21</sup> While the

evidence on these risks was not as coherent at the start of this series of trials 20 years ago as it is today, we chose to promote a reduction in use of all of these substances as a precaution.

Evidence also indicated that other prenatal behaviors, such as inadequate weight gain,<sup>22</sup> inadequate diet,<sup>22</sup> inadequate use of office-based prenatal care,<sup>23</sup> and unattended obstetric complications, such as genitourinary tract infections and hypertensive disorders<sup>23</sup> increased the risk for low birthweight, preterm delivery, and compromised neurologic development.

These observations guided the development of the content covered in the prenatal program protocols.

#### **B. Modifiable Risks for Child Abuse and Neglect and Injuries to Children**

We made an explicit inventory of risks for child abuse and neglect and organized them according to their levels of immediate proximity to parental behavior. At a proximal level, risk assessment focused on the mother's psychological immaturity and mental health problems that affect parents' competencies in caring for their infants.<sup>24,25</sup> At a more distal level, risks focused on those environmental conditions that create stressful conditions in the household that interfere with parents' care of their children, such as unemployment,<sup>26</sup> poor housing and household conditions,<sup>27</sup> marital discord,<sup>28</sup> and isolation from supportive family members and friends.<sup>29,30</sup> A history of punitive, rejecting, abusive, or neglectful caregiving on the parent's own part was considered a risk factor, especially if it occurred in the presence of other risks.<sup>31,4</sup>

#### **C. Modifiable Risks for Welfare Dependence and Compromised Maternal Life-Course Development**

One of the major risks for compromised maternal educational achievement and workforce participation is rapid, successive pregnancies, particularly among unmarried women. Proximal risks for rapid successive pregnancies include women's having limited visions for their futures in

the areas of education and work,<sup>8</sup> as well as a limited sense of control over their life circumstances and over contraceptive practices in particular.<sup>32,33,34</sup>

#### **D. Modifiable Risks for Early-Onset Antisocial Behavior**

More recently, we have analyzed risks for early-onset antisocial behavior<sup>7,35,36</sup> and determined that the impact of the program on maternal and child health early in the life cycle reduces risks for these problems. Children who exhibit early-onset antisocial behavior are more likely to develop violent behavior during adolescence and are hypothesized to become chronic offenders.<sup>5</sup> Figure 1 provides a framework for integrating our thinking about how these diverse influences converge in producing childhood-onset conduct disorder and how this program of prenatal and early childhood home visitation by nurses reduces its risks. Children who develop early-onset disorder are more likely to have subtle neurodevelopmental deficits (such as compromised intellectual or language functioning and attention deficit disorder) combined with harsh, punitive, and rejecting parenting.<sup>6,7</sup> Maternal life-course factors also predict the development of antisocial behavior, in that children with these behaviors are more likely to come from large families, with closely spaced children, where parents themselves are involved in substance abuse and criminal behavior.<sup>37</sup>

### **III. THEORETICAL FOUNDATIONS**

The program has been grounded in theories of human ecology,<sup>38,39</sup> self-efficacy,<sup>40</sup> and human attachment.<sup>41</sup> The earliest formulations of the program gave greatest emphasis to human ecology, but as the program has evolved, it has been grounded more explicitly in theories of self-efficacy and attachment.<sup>11</sup>

#### **A. Human Ecology Theory**

Human ecology theory emphasizes the importance of social contexts as influences on human development.<sup>38</sup> Parents' care of their infants, from this perspective, is influenced by characteristics of their families, social networks, neighborhoods, communities, and the interrelations among these structures. This theory focuses the home visitors' attention on the systematic evaluation and enhancement of the material and social environment of the family.

While this theory provides an elaborated conception of the environment, the original formulation of the theory tended to treat the immediate settings in which children and families find themselves as shaped by cultural and structural characteristics of the society, with little consideration given to the role that adults (in particular, parents) can play in selecting and shaping the settings in which they find themselves.<sup>39</sup> Consequently, self-efficacy and attachment theories were integrated into the model to provide a broader conception of the parent–setting relationship.

#### **B. Self-Efficacy Theory**

Self-efficacy theory provides a useful framework for understanding and promoting women's health-related behavior during pregnancy, their care of their children, and their own personal development. This theory distinguishes two cognitive influences on motivation: efficacy expectations and outcome expectations.<sup>40</sup> Outcome expectations are individuals' estimates that a given behavior will lead to a given outcome. Efficacy expectations are individuals' beliefs that they can successfully carry out the behavior required to produce the outcome. Individuals' perceptions of self-efficacy can influence their choice of activities and settings and can determine how much effort they put forth in the face of obstacles.

Self-efficacy theory influenced the design of the program by focusing the nurses' attention on both the mothers' beliefs about the consequences of their behavior and on building

their confidence for behavioral change. Much of the educational content of the program was focused on helping women understand what is known (or thought about) the influence of particular behaviors on the health and growth of the fetus, on women's own health, and on the subsequent health and development of the child. This represented an effort to bring women's outcome expectations into alignment with the best evidence available. Improvements in individuals' behavior depends upon their confidence in their ability to change. Because individuals gain confidence if they actually observe their accomplishments, the home visitors emphasize methods of enhancing self-efficacy that rely on women actually carrying out parts of the desired behavior. The visitors help parents establish realistic goals and small achievable objectives that, once accomplished, will increase parents' reservoir of successful experiences, and in turn will increase their confidence in taking on larger challenges.

While self-efficacy theory provides powerful insights into human motivation and behavior, it is limited in several respects. First, it is primarily a cognitive-behavioral theory. It attends to the emotional life of the mother and other family members only through the impact of behavior on women's beliefs or expectations, which, in turn, affect emotions. It also attends to environmental influences in only a cursory way. These shortcomings of self-efficacy theory have been addressed in the program with attachment and human ecology theories.

### **C. Attachment Theory**

Attachment theory posits that infants are biologically predisposed to seek proximity to specific caregivers in times of stress, illness, or fatigue in order to promote survival.<sup>41</sup> This organization of behavior directed toward the caregiver is called "attachment." Stated simply, a growing body of evidence indicates that children's trust in the world and their later capacity for empathy and responsiveness to their own children once they become parents can be traced to the



degree to which their needs were responded to sensitively and competently as they were growing up.<sup>42</sup>

Attachment theory has affected the design of the home-visitation programs in three fundamental ways. The first has to do with its emphasis on the visitors' developing an empathic relationship with the mother and other family members. The establishment of a relationship based on empathy and respect was expected to help women eventually trust others and to promote more sensitive, empathic care of their children. The second has to do with an emphasis in the program on helping 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. And third, attachment theory has led to the explicit promotion of sensitive, responsive, and engaged caregiving in the early years of the child's life.<sup>43,44</sup>

While attachment theory provides a rich set of insights into the origins of dysfunctional caregiving and possible preventive interventions focused on parent-visitor and parent-child relationships, it gives scant attention to the role of infants' constitutional differences as independent influences on parental behavior, and it provides inadequate attention to issues of parental motivation for change in caregiving. It also minimizes the importance of the current social and material environment in which the family is functioning as influences on parents' capacities to care for their children. For more systematic treatments of these issues, we turned to self-efficacy and human ecology theories.

The nurses thus have been equipped with a set of theory-driven program protocols that guide their efforts to help women improve their health-related behaviors, their care of their children, their planning of subsequent pregnancies, the completion of their education, and participation in the work force.

#### IV. PROGRAM DESIGN

##### A. Frequency of Visitation

The frequency of home visits changes with the stages of pregnancy and can be adapted to the mother's needs. Mothers typically are enrolled through the end of the second trimester of pregnancy. Visits are scheduled once a week during the first month after enrollment, which assists the new mother and the home visitor to establish a trusting relationship. Thereafter, visits are scheduled every other week until the birth of the baby. Nurses again visit weekly for 6 weeks after the baby is born, helping the new mother and newborn adjust. From the child's 2nd to 21st postnatal month, visits are scheduled twice a week. From the 21st to 24th postnatal month, visits are scheduled once a month. In Elmira and Memphis the nurses completed an average of 9 (range 0-16) and 7 (range 0-18) visits during pregnancy respectively; and 23 (range 0-59) and 26 (range 0-71) visits from birth to the child's second birthday. In calculating these rates of completed visits, all cases assigned to the nurse-visited conditions were included in the denominator, irrespective of the families' dropping from the program for any reason. Each visit lasted approximately 75-90 minutes.

##### B. Nurses as Home Visitors

This program calls for nurses to be the home visitors. We have chosen nurses because of their formal training in women's and children's health and because of their competence in managing the complex clinical situations often presented by at-risk families. We have hypothesized that nurses' abilities to address effectively mothers' and family members' concerns about the complications of pregnancy, labor, and delivery, and the physical health of the infant provide nurses with increased credibility and persuasive power in the eyes of family members. Moreover, through their ability to teach mothers and other family members to identify emerging

health problems and to use the health-care system to address those problems, they enhance their clinical effect through the early detection and treatment of disorders. Each nurse carried a caseload of 20-25 families and received regular clinical supervision.

### **C. Program Content**

During the home visits, the nurses carry out three major activities. They promote adaptive change in women's behavior thought to affect the outcomes of pregnancy, the health and development of the child, and maternal life course; they help women build supportive relationships with family members and friends; and they link women and their family members with other health and human services. The nurses follow detailed visit-by-visit program protocols. The content of the protocols is organized developmentally to reflect challenges that women are likely to confront at different stages of pregnancy and during the first 2 years of the child's life. Specific assessments are made of maternal, child, and family functioning, and specific educational content and psychosocial interventions are prescribed, depending upon the nature and degree of vulnerability revealed in the assessments.

## **V. OVERVIEW OF RESEARCH DESIGNS, METHODS AND FINDINGS**

In each of the three studies of the program described above, women were randomized to receive either home visitation services during pregnancy and the first two years of the children's lives or comparison services. While the nature of the home-visitation services was essentially the same in each of the trials, the comparison services were slightly different. The designs and methods employed in each of the trials are outlined below.

### **A. Elmira Design and Methods**

The first study was conducted in a small, semi-rural county of approximately 100,000 residents in the Appalachian region of New York State. The program was conducted through

Comprehensive Interdisciplinary Developmental Services, Inc.

Pregnant women were actively recruited for the study through their sources of prenatal care if, at intake, they had no previous live births, they were at less than 26 weeks of gestation, and they had any one of the following characteristics that predispose to infant health and developmental problems: (i) young age (<19 years); (ii) single parent status; and (iii) low socioeconomic status. Any woman who asked to participate was enrolled, however, regardless of her age, marital status, or income, if she had no previous live birth. This approach avoided creating a program that was stigmatized as being exclusively for the poor and created sample heterogeneity, enabling us to determine if the effects of the program were greater for families at higher risk. Five hundred women were invited to participate and 400 enrolled, 85% of whom were either low-income, unmarried, or <19 years of age at registration; none had a previous live birth. Eighty-nine percent of the sample was Caucasian. There were no sociodemographic differences between those who enrolled and those who declined, although participation was higher among African-Americans. We stratified the sample on a number of demographic factors and then randomly assigned participating women to one of four treatment groups.

Families in Treatment 1 (n=94) were provided sensory and developmental screening for the child at 12 and 24 months of age. Based upon these screenings, the children were referred for further clinical evaluation and treatment when needed. Families in Treatment 2 (n=90) were provided the screening services offered those in Treatment 1 plus free transportation for prenatal and well-child care through the child's 2nd birthday. There were no differences between Treatments 1 and 2 in their use of prenatal and well-child care (both groups had a high rate of completed appointments). Therefore, these two groups were combined to form a single comparison group. Families in Treatment 3 (n=100) were provided the screening and

transportation services offered Treatment 2 but in addition were provided a nurse who visited them at home during pregnancy. Families in Treatment 4 ( $n=1116$ ) were provided the same services as those in Treatment 3, except that the nurse continued to visit through the child's 2nd birthday. For assessment of the prenatal phase of the program, Treatments 1 and 2 were combined and compared to the combination of Treatments 3 and 4.

Assessments of outcomes were made by interviews, observations of mother-child interaction, observations of conditions in the home, and reviews of medical and social service records by individuals who were not aware of the women's and children's treatment assignment. Details of the research design and methods can be found in our earlier reports.<sup>11,12,35</sup>

#### **B. Elmira Results**

At the stage of randomization, the treatment conditions were essentially equivalent on all background characteristics examined. Moreover, at the 15-year follow-up, assessments were completed on over 90% of the women and children originally randomized who did not die or where there was no adoption. Low attrition and no treatment-control differences in background characteristics on those assessed after enrollment means that the estimates of program effects were not biased by loss of families. All analyses of program effects were based upon an intention-to-treat approach, that is data were employed for outcome analyses irrespective of the degree of program participation.

It is important to note that we hypothesized that the effects of the program would be greater for families who experienced greater stress and had fewer resources to cope. We tested this hypothesis by focusing the analysis on low-income unmarried women.

**1. Caregiving and Child Development Results.** With few exceptions, the beneficial effects of the program on caregiving outcomes were not present for the sample overall. Nurse-

visited at-risk women and their children, on the other hand, consistently exhibited lower rates of adverse outcomes indicative of grossly deficient care of the child.

As noted in our earlier reports, nurse-visited children born to low-income, unmarried teens had 80% fewer verified cases of child abuse and neglect during the first two years of the child's life. Moreover nurse-visited children, irrespective of risk, were seen in the emergency department 56% fewer times for injuries during the second year of the child's life. As indicated in Figures 2 and 3, the effect of the program on child abuse and neglect and emergency-department encounters was greater among children whose mothers had little sense of control over their lives (measured at registration during pregnancy).

The impact of the program on health-care encounters for injuries endured during the two-year period after the end of the program: irrespective of risk, children of nurse-visited women were less likely to receive emergency room treatment (1.00 vs 1.53 visits,  $p < .001$ ) and to visit a physician (0.34 vs 0.57,  $p = .03$ ) for injuries and ingestions than were their comparison-group counterparts.<sup>44</sup> The impact of the program on state-verified cases of child abuse and neglect, on the other hand, was attenuated during the 2-year period following the end of the program.<sup>45</sup>

We hypothesized that this pattern of results was probably due to increased surveillance for child abuse and neglect in the nurse-visited group, given that nurses were mandated to report suspected maltreatment and that they linked families with needed community services -- where their parenting needs were likely to be more completely assessed by other service providers.<sup>45</sup>

An examination of the living conditions and emergency-department encounters for the "maltreated" children showed that nurse-visited "maltreated" children lived in homes that were more conducive to children's development, as indicated by higher HOME scores; their homes were substantially safer; and the children themselves had far fewer emergency-room encounters

and physician visits in which injuries were detected. We have interpreted these differences as a reflection of greater surveillance for child abuse and neglect, leading to more frequent identification of less serious forms of maltreatment in the nurse-visited condition.<sup>16</sup>

This interpretation has been reinforced with results from a 15-year follow-up of the Elmira sample<sup>32</sup> in that the program-control differences in rates of state-verified reports of child abuse and neglect grew between the children's fourth and fifteenth 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 0.21 versus 0.46 verified reports ( $p < .001$ ). This effect was greater for women who were unmarried and from low-SES households at registration ( $p < .001$ ).<sup>32</sup>

**2. Prenatal Tobacco Exposure, Prenatal Home Visitation, and Development in the First 4 Years of the Child's Life.** While there were no overall program effects on children's mental development, children born to women who smoked a moderate to heavy amount when they registered in the program during pregnancy and who received prenatal home visitation had significantly higher IQ scores at 3 and 4 years of age than did their counterparts in the comparison group.<sup>16,17</sup> As shown in Figure 4, control-group children born to women who smoked 10 or more cigarettes per day during pregnancy had mental development scores that declined over the first 4 years of the child's life, in contrast to their counterparts in the comparison group whose mothers did not smoke during pregnancy.<sup>16</sup> In the nurse-visited condition, children born to women who smoked 10 or more cigarettes at registration during pregnancy had mental development scores in infancy, toddlerhood, and the preschool period that were the same as those who did not smoke at all or who smoked only a few cigarettes per day.<sup>17</sup> These beneficial effects of prenatal home visitation held for the group visited only during

pregnancy and were not explained by differences in measured aspects of the postnatal environment.

In light of this, it is important to note that we reported earlier that control-group mothers reported that their six-month old infants were more irritable than did those visited by nurses.<sup>11</sup> We have now conducted analyses that show that these effects were concentrated exclusively in infants born to women who smoked during pregnancy and that the positive program effects held for children whose mothers were visited only during pregnancy, as well as those visited in pregnancy and infancy. These findings have led us to focus greater attention on the role that an improvement in prenatal health can play in reducing subtle neurodevelopmental impairment in children.

**3. Maternal Life Course 15 Years after Delivery of First Child.** During the 15-year period after delivery of their first child, unmarried women from low socioeconomic (SES) households showed a number of enduring benefits. In contrast to their counterparts in the comparison condition, those visited by nurses during pregnancy and infancy had 1.1 versus 1.6 subsequent births ( $p = .02$ ), 65 versus 37 months between the birth of their first and 2nd children ( $p = .001$ ), 60 versus 90 months on welfare ( $p = .005$ ), 0.41 versus 0.73 behavioral problems due to substance abuse ( $p = .03$ ), and 0.18 versus 0.58 arrests by self-report ( $p < .001$ ). New York State records revealed that they had 0.16 versus 0.90 arrests ( $p < .001$ ).<sup>35</sup>

**4. Antisocial Behavior Among the Fifteen-Year-Old Adolescents.** In contrast to adolescents born to poor, unmarried women in the comparison group, those visited by nurses during pregnancy and the first two years of the child's life reported fewer instances of running away (0.60 vs. 0.24,  $p = .003$ ), fewer arrests (0.45 vs. 0.20,  $p = .03$ ), fewer convictions/violations of probation (0.47 vs. 0.09,  $p < .001$ ), fewer life-time sex partners (2.48 vs. 0.92,  $p = .003$ ), fewer



cigarettes smoked per day (2.50 vs. 1.50,  $p=.10$ ), and fewer days having consumed alcohol in the last six months (2.49 vs. 1.09,  $p=.03$ ). Parents of nurse-visited children reported that their children had fewer behavioral problems related to use of drugs and alcohol (0.34 vs. 0.15,  $p=.08$ ). There were no program effects on other behavioral problems.

**5. Cost Analysis.** The Rand Corporation has recently conducted an economic evaluation of the program that extends the estimate of cost savings beyond those reported in our earlier report.<sup>5,47</sup> While there were no net savings to government or society for serving families in which mothers were married and of higher social class, as indicated in Figure 5, the savings to government and society for serving families in which the mother was low-income and unmarried at registration exceeded the cost of the program by a factor of 4 over the life of the child. This figure shows, moreover, that the return on the investment was realized well before the child's fourth birthday. The primary cost savings were found in reduced welfare and criminal-justice expenditures, and increases in tax revenues.

**6. Conclusion.** In general, as expected, the beneficial effects of the program were greater for families at greater risk as defined by women's being unmarried or from lower-SES households. These findings were encouraging, but by themselves insufficient to form a foundation for policy and practice. In order for scientific findings to serve as a guide in this regard, they must first be replicated. The scientific credibility of such findings increases if they can be reproduced with different populations living in different contexts and in different times.

### **C. Memphis Design and Methods**

The Memphis trial was designed to determine if the effects of the Elmira program could be replicated when it was conducted through an existing health department and when it served a large sample of low-income African-American women, children, and their families living in a

major urban area. We hypothesized that the effects of the program would be found in the same outcome domains as we observed in Elmira and that the same background variables would moderate the effect of the program. So, for example, we hypothesized explicitly that the effect of the program on birthweight and length of gestation would be greater for women who smoked cigarettes and were young teens (<16 years of age at registration). Even though the program effect on hypertensive disorders of pregnancy in Elmira was not statistically significant, we hypothesized that the program would reduce the rates of pregnancy-induced hypertension in Memphis, given high rates of this problem in African-American pregnant women bearing first children.

In planning this study, we conducted extensive pretest and pilot work in Memphis and learned, among other things, that the rate of state-verified cases of child abuse and neglect among low-income first-born children in Memphis was too low (3-4%) to serve as a viable outcome in this setting. We therefore chose not to hypothesize program effects on rates of state-verified cases of child abuse and neglect, but instead hypothesized that the program would produce effects on children's health-care encounters for injuries that would be like those observed in Elmira - i.e., greater for women with few psychological resources. In Memphis, we hypothesized that the effects would be greater for women with more mental-health symptoms and limited intellectual functioning in addition to limited sense of control, as observed in Elmira.<sup>48</sup> Finally, given that the effects of the Elmira program were greater for women who were unmarried and from low-income families, we focused recruitment in Memphis on this population.

The program was conducted through the Memphis/Shelby County Health Department. From June 1990 through August 1991, 1290 women were invited to participate and 1,139 enrolled through the obstetrical clinic at the Regional Medical Center in Memphis. Women were

recruited if they were less than 29 weeks of gestation, had no previous live births, no specific chronic illnesses thought to contribute to fetal growth retardation or preterm delivery, and at least two of the following sociodemographic risk conditions: (i) unmarried, (ii) less than 12 years of education, (iii) unemployed. There were no differences in the sociodemographic characteristics of those who enrolled and those who declined, except that African Americans were more likely to participate than were whites. At registration, 92% of the 1139 women registered were African-American, 98% were unmarried, 65% were aged 18 or younger, 85% came from households with incomes at or below the federal poverty guidelines, and 9% smoked cigarettes. The details of the research design and methods are described in greater detail in our original report.<sup>44</sup>

**1. Treatment Conditions.** After completion of informed consent and baseline interviews, identifying information on the participants was entered into a computer program that randomized women to one of four groups. Women in Treatment 1 (n = 166) were provided free transportation for scheduled prenatal care appointments; they did not receive any postpartum services or child development screenings. Women in Treatment 2 (n = 515) were provided the free transportation plus developmental screening and referral services for the child at 6, 12, and 24 months of age. Women in Treatment 3 (n = 230) were provided the free transportation and screening offered Treatment 2 plus intensive nurse home-visitation services during pregnancy, one postpartum visit in the hospital before discharge, and one postpartum visit in the home. Women in Treatment 4 (n = 228) were provided the same services as those in Treatment 3; in addition, they continued to be visited by nurses through the child's 2nd birthday.

For the evaluation of the prenatal phase of the program, Treatments 1 and 2 were combined to form a single comparison group, which was contrasted with combined Treatments 3

and 4 (nurse-visitation during pregnancy). For the postnatal phase of the study, Treatment 2 was contrasted with Treatment 4.

As in Elmira, outcome assessments were conducted by individuals who did not know the treatment assignment of the participating women and children. Data were derived from interviews, observations of mother-infant interaction, observations of conditions in the home, and reviews of mothers' and children's medical and social-service records.

In interpreting the findings from this trial, it is important to note that it was conducted during a nursing shortage, which led to fairly high rates of staff turn-over because nurses left their jobs with the health department to earn more in competing hospitals. Given that these kinds of factors are likely to buffet the program as it is administered in other community settings, the Memphis findings may provide a good estimate of what the program might be able to achieve if it were replicated on a large scale.

#### **D. Memphis Results**

At the stage of randomization, the nurse-visited and control groups were essentially equivalent on all background characteristics examined. For those individuals on whom subsequent assessments were conducted, these groups remained equivalent on background characteristics. Moreover, postnatal assessments were conducted on a large portion of the women originally assigned to Treatments 2 and 4. Office-based assessments were completed at 24 months postpartum, for example, on 96% of the cases for which there was no fetal or child death. Low attrition and no nurse-visited-control differences in background characteristics on those assessed after enrollment means that the analyses of program effects are not likely to have been biased by loss of participating families. All analyses of program effects were based upon an intention-to-treat approach, that is data were employed for outcome analyses irrespective of the

degree of program participation.

**1. Prenatal Findings.** There were no treatment main effects on birthweight, low birthweight, length of gestation, spontaneous preterm delivery, indicated preterm delivery, or Apgar scores. Nevertheless, by the 36th week of pregnancy, nurse-visited women were more likely to use other community services than were women in the control group ( $p = .01$ ). They also were more likely to be working ( $p = .06$ ), an effect that was particularly strong among women who were not in school when they were randomized (8% vs. 2%,  $p = .01$ ). There were no program effects on women's use of standard prenatal care or obstetrical emergency services after registration in the study, but nurse-visited women who were in school at the time of registration had twice as many pre-delivery hospitalizations as their counterparts in the comparison condition (0.18 versus 0.09,  $p = .003$ ). This difference was not explained by any coherent pattern of diagnoses associated with those hospitalizations.<sup>48</sup>

In contrast to women in the comparison group, nurse-visited women had fewer yeast infections after randomization and fewer instances of Pregnancy-Induced Hypertension (PIH) ( $p=.05$  and  $p=.02$ , respectively). Women with PIH who received a nurse home visitor had mean arterial blood pressures during labor that were 3.5 points lower ( $p=.05$ ) than those in the comparison group, an indication of less severe cases.<sup>48</sup>

**2. Dysfunctional Caregiving and Child Development.** During their first 2 years, nurse-visited children overall had fewer health-care encounters in which injuries and ingestions were detected than did children in the comparison condition ( $p = .05$ ), an effect that was accounted for primarily by a reduction in outpatient encounters ( $p = .02$ ). Nurse-visited children also were hospitalized for fewer days with injuries and/or ingestions than were children in the comparison condition ( $p < .001$ ). The program effects on both total health-care encounters and

number of days hospitalized with injuries and ingestions were greater for children born to women with few psychological resources (indicated by a combination of low intellectual functioning, high levels of mental-health symptoms, and limited sense of mastery/self efficacy). Figures 6 and 7 illustrate the concentration of positive program effects in women with few psychological resources. Note the similarity in pattern of results shown in these figures with the child-abuse-and-neglect and emergency-department visits findings in the Elmira study displayed in Figures 2 and 3.

An explanation for the difference in number of days children were hospitalized with injuries can be found in the nature of their problems. As can be seen in Table 1, nurse-visited children were hospitalized at older ages and for substantially less serious reasons. The three nurse-visited children who were hospitalized with injuries and ingestions were admitted when they were 12 months of age or older (and thus mobile), while six (43%) of the 14 comparison children were hospitalized when they were younger than 6 months of age (and thus immobile). Eight (57%) of the 14 comparison-group hospitalizations involved either fractures and/or head trauma, while none of the nurse-visited hospitalizations did. Two of the three nurse-visited children were hospitalized with ingestions. These profiles suggest that many of the comparison-group children were hospitalized for longer durations because of seriously deficient care. These differences in injuries were corroborated by maternal reports of breast-feeding and beliefs about caregiving, observations of the home environments, and the two-year olds' behavior towards their mothers.

Nurse-visited mothers reported that they attempted breast-feeding more frequently than did women in the comparison group ( $p = .006$ ), 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-lack of empathy, belief in physical punishment, unrealistic expectations for infants ( $p = .003$ ). Moreover, the homes of nurse-visited women were rated on the HOME scale as more conducive to children's development ( $p = .003$ ). There was no program effect on observed maternal teaching behavior, but 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 (17.9 versus 17.2;  $p = .03$ ). There were no program effects on the children's use of well-child care, immunization status, mental development, or reported behavioral problems.

**3. Maternal Life Course.** At the 24th month of the first child's life, nurse-visited women reported 23% fewer second pregnancies and 32% fewer subsequent live births than did women in the comparison group ( $p=.006$  and  $.01$ , respectively). Nurse-visited women and their first-born children relied upon welfare for slightly fewer months (.7) during the 2nd year of the child's life than did comparison-group women and their children ( $p=.07$ ). There were no program effects on reported educational achievement or length of employment.<sup>48</sup>

#### **E. Comment on Elmira and Memphis Results**

Many of the beneficial effects of the program found in the Elmira trial that were concentrated in higher risk groups, have been reproduced in the Memphis replication. Overall, these two trials indicate that the program has achieved two of its most important goals -- the reduction in dysfunctional care of children and the improvement of maternal life course. Its impact on the third goal -- the improvement of pregnancy outcomes (in particular, the reduction

of preterm delivery and low birthweight) -- was equivocal.

In the Elmira trial, the program produced the anticipated reduction in cigarette smoking, improvement in diet, and increases in women's use of needed social services and informal social support. There was an increase in the birthweight of infants born to women who were very young (i.e., less than 17 years of age at registration) and a reduction in the rates of preterm delivery from 10% to 2% among women identified as smokers (those who smoked five or more cigarettes per day at registration). It is important to note that 55% of the Caucasian women in the Elmira trial smoked cigarettes during pregnancy.

The program impact on preterm delivery and the birthweight of babies born to young adolescents and women identified as smokers in Elmira was not replicated in Memphis, although the program did produce the anticipated effects on women's use of other human services and on the rates of Pregnancy Induced Hypertension (PIH). The absence of corresponding effects on the rates of preterm delivery among smokers in Memphis is probably a reflection of the very low rates of cigarette smoking among African-Americans. Nine percent of the Memphis sample overall smoked cigarettes, and only 7% of the African-Americans smoked. Reproductive-tract infections (another major risk for preterm delivery), on the other hand, were much higher among African-Americans.<sup>48</sup>

This lack of correspondence between the results of the two trials emphasizes the importance of basing preventive interventions on sound epidemiologic evidence -- that is, a clear understanding of the modifiable risks for the disorder that one wishes to prevent. In this case, the pattern of risks was quite different for Caucasians in Central New York State than for African-Americans in Memphis. While the program can reduce cigarette smoking, it is more of a challenge to affect reproductive-tract infections, given that many infections begin prior to



pregnancy, are relatively asymptomatic, and are not easily detected outside of office-based medical settings after pregnancy has already progressed.<sup>49</sup>

The impact of the program on the rates of dysfunctional caregiving among higher risk families found in Elmira was substantially replicated in Memphis where the population served was at much higher risk overall. Recall that the beneficial effects of the program in Elmira on dysfunctional care during the child's first two years of life (reflected in rates of state-verified cases of child abuse and neglect and on emergency-department encounters) were concentrated on women who were unmarried and from low-SES households. In Memphis, (where 98% of the sample was unmarried, all were from low-SES families) we found corresponding effects for health-care encounters in which injuries were detected, for observations of the home environments, and for parents' reports of caregiving and childrearing beliefs. The beneficial effects of the program on caregiving-related outcomes, while strong enough to emerge as program "main effects," were concentrated among women with lower levels of psychological resources at the time of registration. The effect of the program on health-care encounters in which injuries were detected and on the number of days that children were hospitalized with injuries, for example, was limited to children born to women with few psychological resources.

Moreover, in contrast to children in the comparison group, children of nurse-visited mothers in Memphis who had few psychological resources were observed to be more responsive and communicative toward their mothers. Infant-attachment research suggests that toddlers' behavior toward their mothers reveals the extent to which their mothers are sensitive and responsive rather than hostile, intrusive, or neglectful toward them, with toddlers' behavior being a better indication of the quality of the parent-child relationship over time than currently observed behaviors of parents.<sup>50,51</sup>

The Elmira program produced important effects on a host of maternal life-course outcomes from the birth of the first child to that child's 15th birthday. Among women who were unmarried and from low-SES households at registration, those who were visited by nurses during pregnancy and infancy had fewer subsequent children, fewer months on welfare, fewer behavioral impairments from use of alcohol and drugs, fewer arrests and convictions, and fewer days jailed during the 15-year period after birth of their first child.

In Memphis, the program reproduced the most important outcome with respect to maternal life-course -- a reduction in the rate of subsequent pregnancy. This is important given that future maternal life course effects depend heavily upon the prevention of subsequent pregnancy and an increase in the interval of subsequent pregnancies. In the Elmira trial, the beneficial effects of the program on life-course outcomes for teens were not reflected in increased rates of employment, greater educational achievements, or in reduced welfare dependence while the program was in operation (i.e., 2 years postpartum). It was reflected instead in the reduced rate of subsequent pregnancy, which positioned the teen mothers to eventually find work,<sup>12</sup> become economically self-sufficient, and eventually avoid substance abuse and criminal behavior.<sup>35</sup>

There is some indication in the Elmira trial that the program reduced the rates of neurodevelopmental impairment associated with cigarette smoking during pregnancy.<sup>2,16,17</sup> Given the simultaneous impact of the program on the rates of dysfunctional care and compromised maternal life-course (major risks for early-onset conduct disorder),<sup>32,52,53,54</sup> it is not all that surprising that the 15-year-old children born to women who were unmarried and low SES exhibited fewer arrests and convictions, and lower rates of cigarette smoking, alcohol use, and promiscuous sexual activity.

## VI. PROGRAM IMPLEMENTATION IN DENVER TRIAL

The Denver trial was designed to gain insight into the reasons that previous trials of home-visitation programs that employed paraprofessionals either failed or produced very modest effects.<sup>9,55</sup> In the Denver trial, the paraprofessionals hired as home visitors were required to have a high school education, but no advanced training in the helping professions. We set this requirement because many programs employ paraprofessionals who come from the communities they serve on the premise that shared backgrounds and experiences will increase the visitors' ability to form effective relationships and promote adaptive functioning among the visited families. To further enhance the test of this theory, all of the paraprofessional visitors in Denver were required to be parents themselves. The nurses, on the other hand, all had bachelors degrees in nursing and were not required to be parents, although many were. Both groups were provided essentially the same training and program protocols, although, as one would expect, the nurses were provided more in-depth training regarding physical health and were expected to deal with health issues more extensively.<sup>55</sup>

### **Denver Design and Methods**

From March, 1994 through June, 1995, 1178 consecutive low-income pregnant women with no previous live births were invited to participate from 21 antepartum clinics in the Denver metropolitan area. Low-income status was operationalized by the women's having no private insurance or their qualifying for Medicaid. Medicaid status as the time extended to women at or below 133% of the federal poverty guidelines.

Compared to women who either actively refused (n=244) or were invited but not contacted before delivery (n=199), those who accepted (n=735) were more likely to be of Mexican-American descent and were less likely to smoke cigarettes. These groups were

equivalent on other major sociodemographic characteristics, such as maternal age, language preference (English versus Spanish), and marital status. The rates of acceptance into the research was lower than in Elmira and Memphis, probably because of the large number of prenatal clinics involved, which meant that many women were invited in writing but did not have the study explained to them in a face-to-face interview, where their questions about the study might be answered.

84% of those enrolled were unmarried, 45% Mexican American, 34% Anglo non-Mexican American, 16% African-American, and 5% American Indian/Asian. 87% of the women enrolled were unmarried. The average age at registration was 19.8 years. The women were randomly assigned to treatment and control conditions using a computer program that stratified women by sociodemographic characteristics prior to allocation.

Women in Treatment 1 (n = 255) were provided developmental screening and referral services for the child at 6, 12 and 24 months of age. Those in Treatment 2 (n = 236) were provided the free screening services offered Treatment 1 plus intensive nurse home-visitation during pregnancy and the first two years of the child's life. Women in Treatment 3 (n = 244) were provided the free screening services offered Treatments 1 and 2 plus intensive home-visitation during pregnancy and the first two years of the child's life delivered by well-trained and supervised paraprofessionals.

Both groups of visitors were provided extensive pre-service and on-going training in the program model and were provided updated visit-by-visit protocols previously tested in Elmira and Memphis. They also were provided excellent clinical supervision, with the 10 nurses having a single full-time supervisor (a 1:10 supervisor to staff ratio) and the paraprofessionals having two full-time licensed clinical social workers as supervisors (for a

1:5 ratio).

Although outcome data on the mothers and children are not yet available, differences between nurses and paraprofessionals in the nature and quantity of program implementation have been reported. Data on program implementation were derived from encounter forms that the nurses and paraprofessionals completed after every home visit, and from administrative records.<sup>55</sup>

#### **Differences between Nurses and Paraprofessionals in Program Implementation**

Nurses and paraprofessionals completed essentially the same number of visits during pregnancy (approximately 6.5 visits), but the nurses completed an average of 5 more visits from birth to the child's second birthday (22 versus 17). This may be accounted for by a higher rate of staff turn over among the paraprofessionals (17 paraprofessional visitors hired over the life of the study), compared to no staff turn-over among the 10 nurses. The average visit by the paraprofessionals was about 7 minutes longer (81 minutes compared to 74 minutes,  $p < .001$ ). The nurses spent a slightly larger portion of their time during the visits addressing the mothers' and children's physical health (23% versus 20%,  $p < .001$ ) while the paraprofessionals spent more time on the mothers' life course development (18% versus, 16%,  $p < .001$ ), their friend and family relationships (19% versus 15%,  $p < .001$ ), and on the health and safety of the environment (15% versus 8%,  $p < .001$ ). We did not expect to find that the nurses would spend more time on promoting parents' care of their children, but they did (39% versus 28%,  $p < .001$ ).<sup>55</sup>

We expect that these differences in program implementation will affect the visitors' influence on maternal and child functioning, which will be the subject of additional reports in the near future.

## VII. POLICY IMPLICATIONS AND PROGRAM REPLICATION

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 the Elmira study, 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. Similarly, their children on average avoided encounters with the criminal justice system, the use of cigarettes and alcohol and promiscuous sexual activity. Low-income, unmarried women and their children in the comparison group, on the other hand, were at substantial risk for these problems and the program of prenatal and infancy home visitation was able to avert many of these untoward outcomes for this at-risk population. This led to substantial cost-savings to government when the program was focused on this higher risk group. Among families at lower risk, on the other hand, the financial investment in the service was a loss. This suggests that this program will produce its greatest effects when it is focused on those in greatest need. This pattern of results challenges the position that these kinds of programs ought to be made available on a universal basis. Not only is the universal approach 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, including the hiring of nurses.<sup>56</sup> These results should give policy makers and practitioners pause as they consider investments in home visitation programs without careful

consideration of program structure, content, and methods. With the increased focus on brain development in the first three years of life,<sup>37</sup> there is increased pressure to fund programs at this stage in the life cycle. It would be a mistake to do so, however, without solid scientific evidence that the particular model promoted is able to achieve its intended effects, given the failure of most programs that have been carefully tested.

It is increasingly clear that the evidence from the Elmira and Memphis studies cannot be generalized to programs that do not conform to the model tested in those trials. Even if the results of the Denver trial show benefits for the paraprofessionals, the beneficial effects must be understood in the context of the thoroughly developed program protocols and excellent clinical supervision they were provided. The difficulties faced by other home visiting programs tested in the past may be due to the particular program models tested or to the background of the visitors employed (or both). The outcomes of the Denver trial and randomized trials of other model programs (e.g., Parents as Teachers, Healthy Families America, Comprehensive Child Development Program summarized in this issue) as well as the Early Head Start program currently under investigation in the Head Start Bureau should provide additional guidance to policy makers in the near future. Even when communities choose to develop programs based on models with good scientific evidence, all too often the programs are watered down and compromised in the process of being scaled up. We have recently begun work that addresses this problem.

In 1995, we were invited by the US Department of Justice to develop the program studied in Elmira and Memphis in several high-crime neighborhoods around the country. We accepted the invitation because the results from the Memphis replication study and the Elmira follow-up were promising. We intend to use the Justice Department initiative to learn more about what is

required to develop the program in new communities with fidelity to its essential elements.

Under the Justice Department initiative we are establishing the program in six communities in the country, including Los Angeles, Fresno, and Oakland California; Oklahoma City, Oklahoma; St. Louis, Missouri; and Clearwater, Florida.

In this program-replication phase (which will soon expand to include 15-20 additional sites beyond the Justice Department initiative), state and local governments are securing financial support for the program out of existing sources of funds, such as TANF (Temporary Assistance to Needy Families), Medicaid, Maternal and Child Health Block-Grant, child-abuse, and crime-prevention dollars. They are making this investment in part because the evidence indicates that the program will reduce future expenditures. This means that the cost of this program, which in 1998 dollars is about \$7,000 per family for 2½ years of service, can be shared by a variety of government agencies. This, in turn, reduces the strain on any one agency's budget.

We wish to emphasize that we do not believe we can replicate this program on a large scale in a short period of time without compromising its effectiveness. We believe that it makes sense to develop a larger number of demonstration sites only after we have learned from our first group of sites how to develop the program successfully in a variety of new contexts. In the next phase of this work, we are building in provisions for learning about new implementation efforts so that we can develop the program in an even larger number of sites as quickly as is possible without losing program effectiveness.



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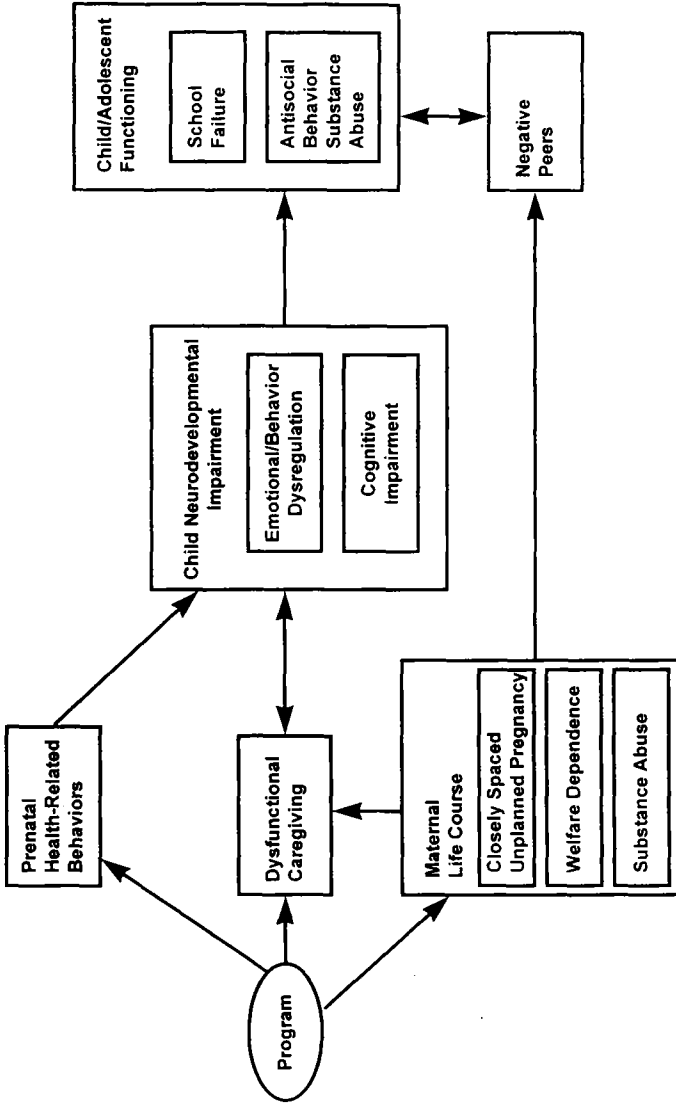


Figure 1. Conceptual model of risk domains to be affected by prenatal and infancy home visitation and influence on child and adolescent health and development

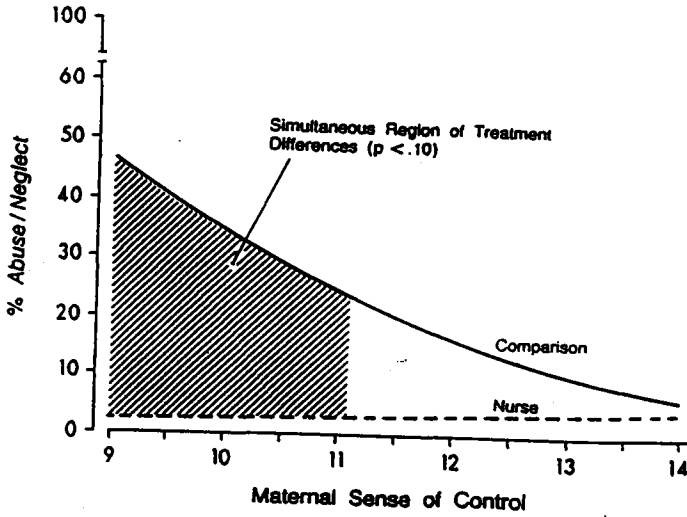


Figure 2. Estimated nurse-comparison differences in the rates of child abuse and neglect as a function of maternal sense of control - Elmira. (Reprinted with permission from Olds, D.L., Henderson, C.R., Chamberlin, R., Tatelbaum, R. Preventing child abuse and neglect: a randomized trial of nurse home visitation. *Pediatrics*. 1986;78(1):65-78.)

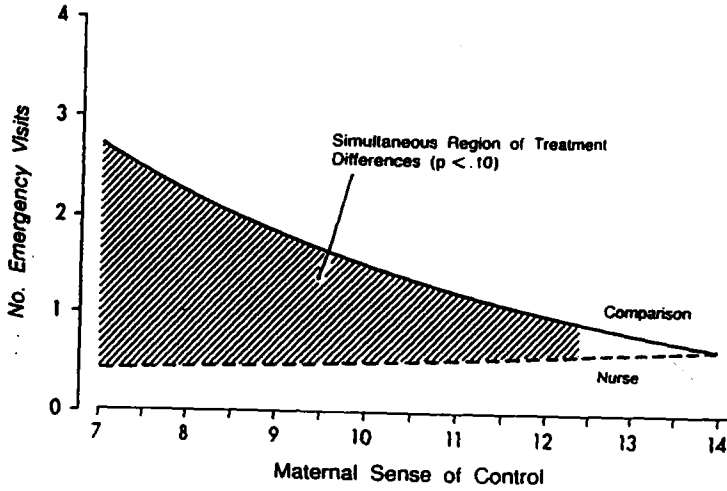


Figure 3. Estimated nurse-comparison differences in the number of children's emergency department visits during second year of child's life as a function of maternal sense of control - Elmira. (Reprinted with permission from Olds, D.L., Henderson, C.R., Chamberlin, R., Tatelbaum, R. Preventing child abuse and neglect: a randomized trial of nurse home visitation. *Pediatrics*. 1986;78(1):65-78.)

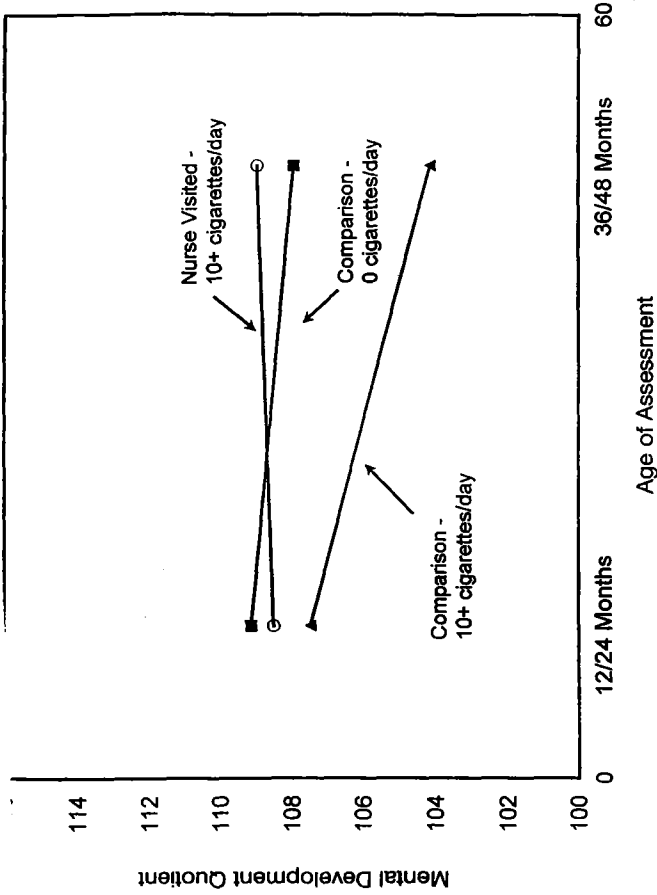


Figure 4. Mental development during first four years of life among children whose mothers smoked 10 or more cigarettes per day at registration during pregnancy and those whose mothers did not smoke

## Cumulative Cost Savings: Elmira Home Visits (High-Risk Families)

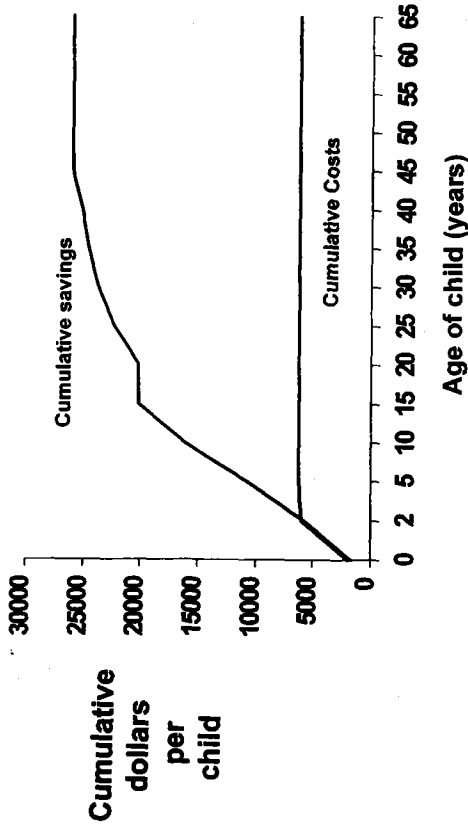


Figure 5. Cumulative costs and savings by age of child - high-risk families (headed by women who were low-income and unmarried at registration) - Elmira. (Reprinted with permission from Karoly, L.A., Greenwood, P.W., Everingham, S. S., Hoube, J., Kilburn, M.R., Rydell, C.F., Sanders, M., & Chitesa, J. *Investing in our Children. What We Know and Don't Know about the Costs and Benefits of Early Childhood Interventions*. 1998. Santa Monica, CA:RAND.)

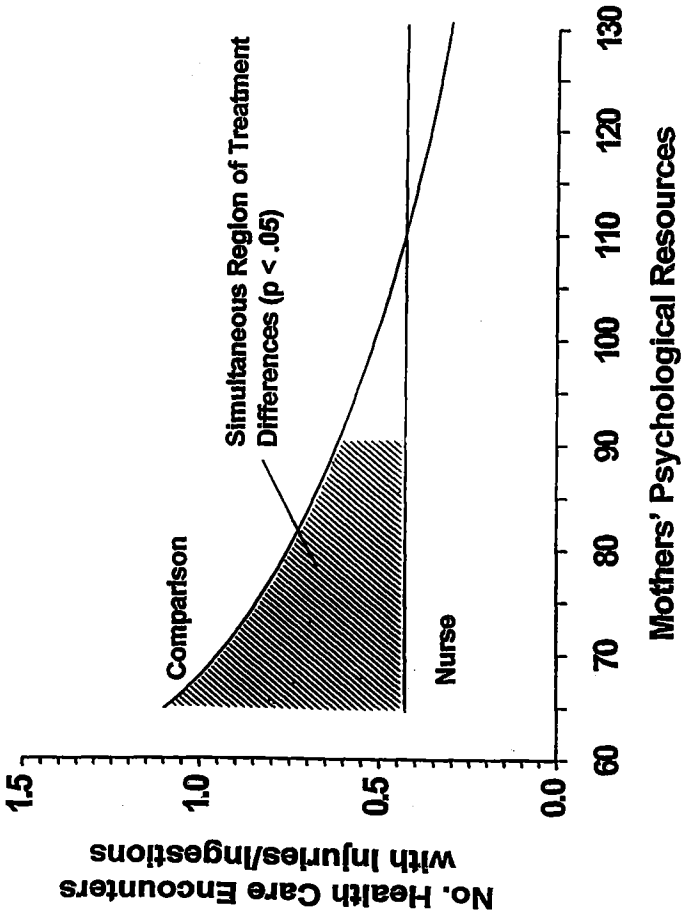
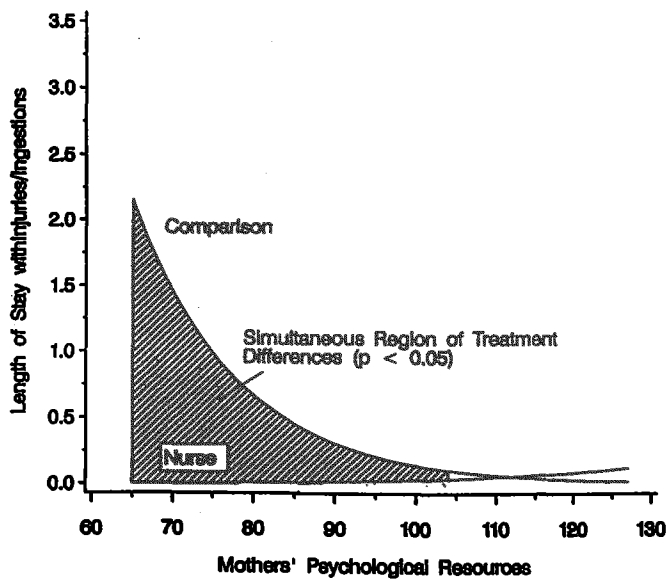


Figure 6. Estimated nurse-comparison differences in number of children's health-care encounters with injures/ingestions as a function of maternal psychological resources - Memphis.



**Figure 7.** Estimated nurse-comparison differences in number of days children were hospitalized with injuries/ingestions as a function of maternal psychological resources - Memphis.