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14 OUNCES OF PREVENTION

A Casebook for Practitioners

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BACKGROUND OF
AMERICAN PSYCHOLOGICAL
ASSOCIATION REVIEW

Introduction

This book is dedicated to the idea that good psychological science is a critical ingredient in programmatic efforts to prevent human suffering, maladaptation, and illness. With this book, we intend to provide psychologists, and indeed citizens at large, with examples of successful prevention programs that can be adopted in local communities and be made part of the practice of psychologists nationwide.

In 1984, the National Institute of Mental Health (NIMH) reported that 43 million people in the United States, 19% of the nation's population, were suffering from some form of psychological disorder or distress. There will never be enough mental health professionals to provide help for such widespread distress. For that reason, prevention advocates have argued that we must mount large-scale preventive efforts, as public health pioneers did in dealing with diseases such as polio, smallpox, and measles.

Although a growing number of psychologists agree that a wide range of psychological and health problems are preventable, the logic of prevention must be turned into concrete reality. To do that, we must identify model programs that work. Identifying effective programs has two aspects. First, research evidence for claims of program effectiveness must be examined carefully. Many preventive measures that look as if they should work actually may not. Second, once identified, model programs can serve as examples to be repeated in other settings such as schools, communities, or work organizations. This idea led the American Psychological Association's (APA) Task Force on Prevention, Promotion, and Intervention Alternatives in Psychology to launch a major effort to search for effective model prevention programs.¹ This book represents the end product of the Task Force's efforts.

In this introduction, we describe the activities of the Task Force in searching for model prevention programs in the context of a larger history of resurgent interest in prevention and the criteria the Task Force used to select model programs. Brief previews of the programs described in the volume are also included here.

The Task Force: Mandate and History

In winter 1978, the APA's Policy and Planning Board appointed an ad hoc Task Force chaired by Edward S. Bordin to consider the emerging roles and activities for psychologists which, in the light of changing times and problem definitions, might help to balance the practices of current delivery systems. The Task Force held two meetings in early 1979, solicited the views of experts, and established a set of criteria to be used in evaluating alternative models. The Task Force's first and strongest recommendation was that APA establish a Continuing Committee on Promotion, Prevention, and Alternative Interventions in Psychology. The Task Force also proposed eight specific activities for the new committee to undertake.

Based on those recommendations, the APA's Board of Directors appointed a Task Force on Promotion, Prevention, and Intervention Alternatives in 1981 to report through the Committee on Professional Practice of the Board of Professional Affairs. The Board of Directors instructed the

¹The Task Force included psychologists Emory L. Cowen, Raymond P. Lorion, Richard H. Price, and Julia Ramos-McKay, as well as Beverly Hitchins of the American Psychological Association.

new task force to focus specifically on psychological approaches to the promotion of health and prevention of the range of physical and mental health problems such as those associated with coping skills, stress reduction, and acquisition of healthy behaviors and life-styles.

The mission statement of the new task force included specific recommendations that (a) the delivery settings and agencies of programs be studied, and proposals be made for developing and evaluating new approaches in settings with diverse characteristics; (b) legislation and other initiatives affecting these new approaches be monitored and assessed at the federal, state, and local levels; and (c) liaison be maintained with other professional and scientific organizations interested in prevention and promotion.

Although the Task Force had its first meeting in November, 1981, personnel changes limited its early operation and planning efforts. By September, 1982, however, the four-member Task Force was reconstituted. The first agenda item was to identify those elements in its broad, complex charge that could be realistically addressed within the constraints of limited resources. An early decision was made to focus on what was seen as the Task Force's single most central charge, that is to identify and support the development of newly evolving and needed approaches in psychology including the promotion of health, the prevention of disorder, and emergent intervention alternatives that maximize growth and minimize dysfunction.

The key words *identify* and *support* implied two distinct but important processes: (1) to identify innovative, well-documented "model" programs, exemplifying the categories of promotion, prevention, and emergent intervention alternatives; and (2) to spearhead the preparation of a volume describing these models in practitioner-oriented ways. The longer-term benefit that the Task Force hoped would accrue from these steps was to facilitate more widespread field applications of demonstrably effective preventive programs as alternatives to traditional, after-the-fact repair services.

The Emergence of Prevention as a National Priority

APA's appointment of the original Task Force on emerging roles in 1978 took place shortly after the submittal of the Final Report of the 1978 U.S. President's Commission on Mental Health. Among that report's distinguishing features were

its strong emphases on the concept of prevention, including the recommendation that NIMH be designated as a lead agency in furthering prevention; and the need for effective new service-delivery models for the unserved and underserved. Those conclusions put into bold relief a set of views that had been slowly gaining momentum over a long time period which were in response to perceived insufficiencies in the existing mental health and other service delivery systems.

The growing clarity of these problems and the heavy human and social costs of health and mental health problems for vulnerable populations stimulated consideration of conceptual alternatives. If even the best and most sophisticated attempts to cure psychological or physical illness can account for only a minor fraction of the prevalence of illness, might it not be easier, farther reaching, more humane, and more effective to seek prevention strategies from the start? That very real question stimulated a search for viable alternatives.

Prevention is one such option and is a sweeping alternative, which challenges pivotal assumptions of the health and mental health systems, not simply their practices. Rather than trying to undo established pathology, the goal of prevention orientation is to develop initiatives to forestall problems in people at risk and to build strengths and competencies to advance their well-being.

Primary prevention efforts cluster around two broad strategies: (1) system-directed approaches such as social policy development and modification of social environments designed to reduce sources of stress and to enhance life opportunities; and (2) person-centered strategies such as educational programs to impart adaptive skills and competencies as well as preventive interventions for risk groups such as divorcing parents and children of divorce. These two strategies have produced programs that reflect a healthy diversity. A core quality that links prevention efforts and sets them apart from past practice is their intentional targeting to well people. In that regard, these prevention efforts reflect the popular wisdom that an ounce of prevention is worth a pound of cure.

There have been important signposts of the growth, vitality, and promise of the prevention movement beyond the President's Commission Report. Although these developments have been energetic and well motivated, they have also been somewhat uncritical. The question, Which of many preferred prevention contributions are enduring rather than ephemeral?, guided the Task

Force's interpretation of its mandate and subsequent activities. From its inception, the overarching goal of the Task Force was to identify a diverse range of documented, effective prevention programs—the best our field can offer at this time—and to build bridges around those programs to span the sometimes wide gulf between theory and research on the one side and application and dissemination on the other. How might the potential benefits of these special prevention programs best be harnessed to affect not just the lives of the few people who were part of them, but the large unidentified masses who stand to benefit from exemplary model programs? To Task Force members, an answer to this question was a way of bringing the goal of prevention closer to fruition.

The Need for a Practitioner Focus

In the past, most mental health practitioners who saw themselves as working “in the trenches” tended to ignore prevention because they viewed it, in part, as a luxury for those with surplus time and money. Because of the pressure to meet the great need for psychological services, many providers, who otherwise might have worked in prevention programs, attached a low priority to prevention programs and research within their own work settings. In their experience, the number of people needing services continued to grow while resources for providing such services diminished. Moreover, prevention programs being developed by researchers did not necessarily address the needs of service providers. More recently, however, progress in the field of prevention research and a clamor by providers for usable prevention programs has led to the development of programs that can be applied in a variety of settings.

The recent expansion of work sites in which psychologists practice, including industrial settings, employee assistance programs, law enforcement agencies, and sports programs, requires providers of psychological services to be knowledgeable about appropriate ameliorative interventions and appropriate prevention techniques. For example, a police psychologist may develop programs to prevent or minimize stress and negative reactions in police officers, in addition to treating officers who are experiencing symptoms of psychological distress. A sports team that employs a psychologist may be interested not only in treatment for team members but also in ways to prevent such problems as substance abuse and

physical injuries. Prevention research and programming can no longer be seen as a luxury to be carried out by others; employers of psychological-service providers have begun to see prevention programming as a critical skill.

The recent proliferation of prevention programs is a response to real and urgent needs. Programs to provide specific interventions for children who are at risk for particular problems, programs to teach children interpersonal skills, and programs to teach children to say “No” to drugs and to recognize and react to “good touches” and “bad touches” are now available. Many of these programs appear to be designed for easy use and require little training on the part of the practitioner. The busy practitioner, pressed for time because of service provision needs, takes these programs at face value and assumes that they have been developed through the appropriate research.

Unfortunately, all “prevention” programs are not *real* prevention programs. Practitioners must know how to evaluate each program. To do so, they must consider not only its appropriateness and ease of application but also the quality of the research upon which a program stands, how well specified its target groups are, the actual nature of the intervention, and whether expected outcomes have been demonstrated. For those reasons, the Task Force concluded that it could best contribute to the field by conducting a search for model preventive programs with well-documented program features and solid, supporting program-outcome findings.

The Task Force's Search for Model Programs

Before beginning our search for model programs, the Task Force identified several benchmarks to be used in its search. First, we hoped to find programs relevant to all stages of the life span. Prevention is important not only for children but for adults and the elderly as well. In addition, we hoped to find programs that could be delivered in many different community settings including hospitals, schools, service agencies, and the workplace. Finally, we hoped that the exemplary prevention programs identified would be aimed at a wide range of different health, mental health, and criminal justice outcomes.

The Task Force contacted over 900 experts throughout the country who we believed were knowledgeable about prevention programs. In response to our inquiries, we received nearly 300 replies describing a wide range of prevention ef-

forts. The Task Force then set about examining these programs and searching for evidence of effectiveness. In the end, we identified 14 programs that we believe can serve as models. There are surely many effective programs that we were unable to identify as our search was certainly not exhaustive. What follows is a brief sketch of the search itself, the criteria we developed, the procedures we used to evaluate candidates for model programs, and some information about the kinds of program submissions we received.

Criteria for the Selection of Model Programs

Task Force members discussed at length the diverse ways in which the concept of a model program could be realized. The prime concern was how to determine whether an intervention worked. At one extreme, we could rely entirely upon the availability of rigorous empirical data to decide this question. From this perspective, a model would represent an intervention strategy with irrefutable scientific evidence of its capacity to reduce the incidence of identifiable disorders.

At the other extreme, one might rely upon community acceptance. From this perspective, a model would represent an intervention strategy that appeared useful and adoptable across multiple settings. Evidence that the strategy worked would be reflected in the positive responses of those who provided and received the intervention. Less emphasis would be placed upon the outcomes of formal evaluations on the assumption that those charged with the allocation of scarce community resources would have examined program outcomes according to local norms.

Members of the Task Force concluded that the selection of model interventions should be based on quantitative outcomes. However, we felt that consideration must also be given to the diversity of targets, desired outcomes, and setting conditions for which preventive interventions are designed. To reflect that diversity, a three-dimensional matrix was created within which to locate identified interventions.

The first dimension related to the life stage of intervention recipients. Prevention strategies can be focused at all points across the life span from the prenatal period to old age. Thus, a life-span continuum was created which included the following major developmental periods: prenatal through preschool (0 to 4 years); elementary school (5 to 12 years); adolescence (13 to 21 years); adulthood (22 to 65 years); and retirement (65

and beyond). We also considered program outcome. Initially, this dimension focused on distinguishing among mental-health, substance-abuse, physical-health, criminal-justice and educational outcomes. We classified each program in terms of its specific preventive goals. We focused on the setting in which the program activities occurred. We considered (among others) educational, occupational, medical, social service, and home settings as well as a combination of these settings.

Within this three-dimensional framework, we classified interventions which successfully completed the initial program screening. Of the approximately 300 program descriptions received in response to more than 900 practitioner surveys distributed, 52 were considered sufficiently promising to warrant detailed examination of program materials and evaluation findings. Eventually, 14 of those 52 were selected as exemplary programs.

In screening, we considered program descriptions in terms of multiple criteria. Conceptually, these criteria addressed four aspects of the interventions: (a) the problem addressed, (b) the program's targeted goals, (c) the procedures followed in reaching those goals, and (d) the evidence documenting the successful attainment of program goals. Specifically, members of the Task Force examined program descriptions and sought information about the characteristics of the intervention. We used the following selection criteria for model prevention programs.

- Clear description of the emotional or behavioral condition to be prevented and the group at risk
- Description of the skills necessary to conduct the intervention
- Statement of a rationale for the intervention
- Description of the actual intervention
- Rationale for the timing of the delivery, duration, and chronology of intervention activities
- Specification of the program steps taken to recruit intervention recipients
- Specification of the observable and measurable program objectives
- Description of the evaluation, follow-up data, and program monitoring
- Description of how the program relates to other groups, organizations, and agencies in the community
- Recognition and resolution of ethical issues

- Transferability of the intervention to other settings
- Roles of psychologists and other professional and nonprofessional caregiver resources

As noted earlier, 52 of the approximately 300 program descriptions submitted provided sufficient information on issues to warrant further examination. Each of the 300 submissions was reviewed by two Task Force members and rated along a 5-point continuum in terms of overall promise for more detailed scrutiny, importance of the problem, and probable quality of the evaluation. Interrater agreements were examined for each program description. In cases of marked disagreement, a third or fourth rater was used.

The developers of these 52 programs submitted detailed program materials, manuals, research reports, and other indicators of effectiveness. Task Force members examined the informative and scientific quality of these materials and selected 14 model programs. Although these 14 programs varied in their reported evaluation findings, each had specifically documented the achievement of intended outcomes. Moreover, each was judged to be exportable, that is, a program that had a defined, replicable set of procedures that could be adopted by practitioners. Finally, in selecting the final set of programs, the Task Force attempted to provide at least reasonable coverage of the three-dimensional matrix of the life span, service settings, and prevention outcomes.

Characteristics of Programs Submitted

Examination of the initial pool of submitted programs provides useful insight into the profile of preventive interventions at the time of the Task Force's survey (1983–1984). In general, these preventive interventions were targeted predominantly to children and adolescents. Less than 20% of the programs submitted focused on adults or the elderly. Demographically, recipients of preventive interventions tended to be disproportionately poor, minority-group members, and otherwise disenfranchised groups. Programs were provided for the most part within schools and social service agencies, and most prevention service providers were nonprofessional community caregivers, educators, and members of program recipients' families.

Some readers may be surprised by the fact that relatively few programs survived the initial screening. One reason for that is that only one third of the programs systematically evaluated their efforts, and a significant number of these lacked program manuals or other means of documenting their efforts. Because these programs had only vaguely defined procedures, they had little chance to be replicated successfully in other settings. With such high attrition, it is misleading to use the total number of submissions as a framework for assessing the efficacy of existing prevention programs. A more accurate indicator of the state of the field might be the 52 programs that we examined in detail. Of these, nearly 25% lacked follow-up information considered essential by Task Force members to document the enduring achievement of preventive goals. A number of others appeared to have methodologically flawed evaluations that cast a shadow on program outcome findings or insufficient documentation to permit program replication. Although the final group of 14 programs are not flawless, they may provide a reasonable estimate of the profile of currently mature preventive intervention strategies.

Many of the programs not selected represented interesting, potentially promising ideas which had not yet evolved into fully developed preventive interventions. For some, too little time had passed to assess the preventive strategy's impact on the desired outcome. Others simply lacked systematic program evaluations. In some of those cases, the strategy's value as a preventive intervention was accepted without question by its adherents, that is, the need to evaluate the program was not perceived.

The range and substance of the submittals persuaded the Task Force members to believe that effective prevention programs will increase significantly over the coming years as necessary outcome data are obtained using longitudinal evaluations. We view the results of the original survey optimistically and look forward to continued healthy growth in the development of viable preventive interventions.

Overview of the Model Programs

This volume is divided into three sections describing programs focused on infancy and early childhood, school-age children and adolescents, and prevention programs for youth and adults. The targets of these programs are diverse. They include preschool minority children, poor teenage

mothers, school-age children in health classes, young people who have just entered the juvenile justice system, grade school children experiencing a transition to high school, newly separated couples, mothers about to undergo caesarean birth, bereaved widows, and members of entire communities at risk of cardiovascular disease.

Authors were asked to follow a uniform structure in their presentations and to aim their presentation at practitioners interested in replicating these programs in their home communities. We proposed a uniform structure in which all authors begin with a brief discussion of the program's issues, problems, and goals; describe how

the program actually works; discuss briefly the research evidence for program effectiveness; highlight the program's limitations as well as positive aspects; and offer practical suggestions for starting a new program.

What follows, we feel, are descriptions of prevention programs that are the product of considerable ingenuity focused on the goal of prevention. Although there is a need for many more such model programs, as well as for their adoption in the work of practicing psychologists, the present volume is, nevertheless, an exciting beginning.

CHAPTER

1

The Prenatal/ Early Infancy Project

The Prenatal/Early Infancy Project consisted of a program of nurse home visitation designed to prevent a wide range of maternal and child health problems associated with poverty. The program was established to improve women's prenatal health habits, infant caregiving skills, social support, use of community services, and educational and occupational achievements and to help women reduce unwanted additional pregnancies and their reliance on welfare. These changes in maternal behavior and experience were expected to lead to a reduction in child health disorders including prematurity and low birth weight, growth and nutritional problems, accidents, ingestions, acute infectious illnesses, cognitive delays, behavioral problems, and child abuse and neglect.

Our research team at the Prenatal/Early Infancy Project viewed these maternal and child afflictions as expressions of a dysfunctional caregiving system. By caregiving system, we meant not only parents and families, but the larger communities in which they lived including the social and material resources available to parents to

help them care for their children, as well as those forces that work against their providing optimal care such as employment, poverty, single parenthood, and racial and class discrimination. Viewing these problems from this broad perspective had important implications for the way the program was designed.

Background

In recent decades, our society has experienced high rates of young-adolescent and single-parent families. Becoming a parent too early and without adequate social support leads to dropping out of school, interference with employment, and welfare dependence (Card & Wise, 1978; Furstenberg, 1980). Moreover, teenaged and unwed women produce a disproportionate number of low-birth-weight and preterm babies (Naeye, 1981; Garn & Petzold, 1983). Tragically, the adverse sequelae of preterm delivery and low birth weight are most likely to emerge when children are born into impoverished homes, where parents have few personal and social resources (Sameroff & Chandler, 1975).

Even if children are born full term and with adequate birth weight, they are at considerably greater risk for disorders in health and socio-emotional and cognitive functioning if they are born to unmarried teenagers living in impoverished circumstances (Phipps-Yonas, 1980). Moreover, if teenagers give birth to a second child soon after the birth of a first, their second child is at

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increased risk for pregnancy complications, later health problems, and death, compared with first children born to other mothers of the same age (McCormick, Shapiro, & Starfield, 1984). Studies of social class differences in low birth weight (Miller and Merritt, 1979) and later child health and development (Miller, Court, Walton, & Knox, 1960; Elardo, Bradley, & Caldwell, 1975) suggest that a major explanation for these social class differences can be traced to maternal prenatal health behaviors and subsequent infant caregiving. Commonalities in the origins of the problems addressed by this program are highlighted when they are viewed from an ecological perspective (Bronfenbrenner, 1979). The ecological model refers to the interdependence among social systems operating at the level of the marital and parent-child dyad, the family system as a whole, the interrelations among these systems, and larger socioeconomic influences operating at the level of the community.

One implication of the ecological model is that the health habits and caregiving behaviors of disadvantaged parents need to be understood in terms of the circumstances with which they have to contend. Stress can often interfere with caregiving (Belle, 1982) and maternal prenatal health behaviors (Newton & Hunt, 1984) by contributing to higher rates of maternal depression (Fergusson, Hons, Horwood, Shannon, 1984). Moreover, it is suggested increasingly that stress in and of itself can affect health directly, by suppressing the functioning of the immune system (Locke, 1982).

Although the evidence regarding social support as a moderator of stress is more difficult to interpret, it is commonly observed that individuals who are isolated from supportive social networks have higher rates of mortality and morbidity (Berkman & Syme, 1979), and isolated parents are at much greater risk for smoking cigarettes during pregnancy (McCormick et al., 1986), heavy prenatal alcohol consumption (Stephens, 1985), and caregiving dysfunction (Garbarino & Crouter, 1978).

Some people have argued that the best way to improve the caregiving system is through national policies aimed at creating jobs and reducing unemployment, the subsidy of housing for a larger portion of the population, and income maintenance arrangements. Although we at the Prenatal/Early Infancy Project would support such approaches, these kinds of solutions are not politically feasible at this time and are long-range solutions of unknown consequences for maternal and child health.

Notwithstanding the influence of larger social and economic influences, we decided to test a more focused prevention strategy that is within the purview of health professionals, that is potentially more easily implemented on a wide scale, and that has increasing scientific documentation concerning its effectiveness. Although the program we devised emphasized regular medical care, we started from the assumption that many health and psychosocial dysfunctions are attributable to environmental conditions that are beyond the reach of traditional office or clinic practice. Our approach to this issue was to have the home-visiting nurses in our program try to minimize the stressful situations that characterize living under oppressive social and economic conditions.

Our strategy relied on nurse home visitation during an important phase in the life cycle of high-risk families—pregnancy and the first 2 years of the baby's life. By improving the conditions for pregnancy, birth, and early child rearing, it was expected that the environmental adversity leading to a number of later health problems would be reduced, saving the individual untold suffering and saving society an exorbitant part of its health-care costs. The content of the Elmira home-visiting program was designed to meet the needs of parents for information, emotional support, and the relief of life stress, in an attempt to address simultaneously those factors that undermine parents' own personal achievements, their health habits, and the care of their children.

We believed that it was important to test the effectiveness of the program in a randomized trial. Other intervention studies directed toward improving the outcomes of pregnancy and early child rearing had often been difficult to interpret because of problems with the design of the research or program. Many programs, for example, provided a variety of services that might be of help to socially disadvantaged families, but their evaluations were carried out with control groups that were not randomly assigned. Consequently, the treatment and control groups often were not equivalent at the beginning of the study. In other cases, more rigorously designed studies were carried out on interventions focused on single variables such as reducing prenatal smoking (Sexton & Hebel, 1984), supplementing prenatal nutrition (Rush, Stein, & Insoln, 1980), or encouraging parents to childproof their homes (Dershewitz & Williamson, 1977). These kinds of focused interventions do not address the full range of stressful family and community circumstances that often interfere with optimal maternal health habits

and caregiving. In designing the present study, we tried to learn from the experience of these earlier investigators.

Our work was carried out during a period of decline in community-health nursing services. Even though nurse home visiting recently has been given considerable attention as a means of promoting child health (Kempe, 1976; Wynn & Wynn, 1979), its funding has been cut drastically in our large cities, where the need for this type of intervention is greatest (Chavigny & Korse, 1983). The reticence of state and local legislatures to fund nurse home-visiting services is due, in part, to the absence of good empirical evidence that home visitation services are indeed effective (Combs-Orme, Reis, & Ward, 1985).

The Setting

The program was carried out in a small, semi-rural county of approximately 100,000 residents in the Appalachian region of New York State. At the time the study was initiated, the community was well served from the standpoint of both health and human services. Prenatal care was available through nine private obstetricians and a free antepartum clinic sponsored by the health department. Pediatric care was provided by two sophisticated pediatric practices (with a total of 11 pediatricians) and eight physicians in family practice. A variety of social services was available for children and families. In spite of an abundance of health and human services, the community has consistently exhibited the highest rates of reported and confirmed cases of child abuse and neglect in the State (New York State Department of Social Services, 1973-82). Moreover, in 1980 the community was rated the worst standard metropolitan statistical area in the United States in terms of its economic conditions (Boyer & Savageau, 1981).

The Sample

Because we were interested in preventing a wide range of maternal and child health problems, we used general criteria (risk factors) for the identification of the families most likely to benefit from the service. At the time that we designed the study, the literature suggested that being a teenager, being unmarried, and being poor increased the likelihood of poor health and developmental outcomes on the part of the child and arrested

personal development on the part of the mother (Birch & Gussow, 1970; Card & Wise, 1978).

Because the literature was not clear on which of these factors was most important in predicting poor outcomes, we recruited women with any one of these three risk characteristics. We limited the program to women having first children. We reasoned that women having first children would be more receptive to the nurses' offers of help, that the skills and resources that they developed in coping with their first pregnancies and children would be carried over to subsequent children, and that it would be easier for women to return to school and work if they had only one child to manage. Thus, by targeting first-time parents,¹ we expected to increase the long-term impact of the program and its cost-effectiveness. Because we also were interested in creating a program that was not stigmatized as being exclusively for the poor or for parents at risk for child abuse or neglect, we welcomed the enrollment of anyone bearing a first child, regardless of their risk status. In so doing, we think that we increased the willingness of women to participate. Moreover, by creating sample heterogeneity through the enrollment of these nonrisk women, we also were better able to determine the extent to which the effects of the program were greater for families at higher risk.

Consequently, we actively recruited women who were at less than 25 weeks of gestation if they had no previous live births and had any *one* of the following characteristics: (a) young age (< 19 years), (b) single-parent status, or (c) low socioeconomic status (SES). Anyone bearing a first child, however, was welcome to register. Some women were registered after the 25th week of gestation because of problems with dating the pregnancy, but all women were enrolled prior to the 30th week. They were recruited through the health department antepartum clinic, the offices of private obstetricians, Planned Parenthood, the public schools, and a variety of other health and human service agencies. Approximately 10% of the target population was not invited to participate, because they registered for prenatal care after the 25th week of gestation. An additional 10% of the target population (poor, unmarried, or teenaged women bearing first children) were dismissed because they were not referred from the offices of private obstetricians. Five hundred

¹Throughout this chapter, we refer to parents (rather than mothers) because about 40% of the women were married at registration and a significant number of the unmarried women were living with the father of the baby. To the extent possible, the program focused on fathers as well as mothers.

women were interviewed between April 1978 and September 1980, and 400 enrolled. There were no differences in age, marital status, or education between those 400 women who participated and the 100 who declined. Ninety-four percent of the non-Whites (mostly Blacks) enrolled, as opposed to 80% of the Whites ($P = .02$). At registration, 47% of the participating women were under 19 years of age, 62% were unmarried, and 61% came from families in Hollingshead's social class CS IV and V (semiskilled and unskilled laborers) (Hollingshead, 1976). Eight-five percent of the women met at least one of the age, marital status, or SES criteria, and 23% had all three risk characteristics.

This statistical profile of the sample does not fully describe its risk status. From the nurses' reports, we learned that a substantial number of the families lived under oppressive circumstances such as households with open sewers, caving-in roofs, bedrooms located in a dirt basement, and no running water or cooking facilities. Violence, alcoholism, and drug abuse were common. One young woman was mysteriously beaten unconscious during pregnancy and had no recollection of the incident. Another was jailed for holding up a local establishment with a knife and had to be visited by her nurse in the county jail. Many women reported having been abused as young children.

The Home Visitation Program

Theoretical Foundations

The program embraced a variety of psychological theories, including cognitive development (Piaget, 1952), attachment (Bowlby, 1969), and social learning (Bandura & Walters, 1963). It was influenced most, however, by the ecological framework articulated by Bronfenbrenner (1979) and the concepts of naive psychology (Baldwin, 1967).

The ecological framework played a role in systematizing environmental influences on parental health habits, qualities of infant caregiving, and the child's health and development. The ecological perspective recognizes the importance of parental caregiving while, by virtue of its attention to the situational determinants of parental behaviors, avoids blaming parents for caregiving dysfunction. One policy implication of this is that to be successful, programs must be able to influence in significant ways the enduring environment in which the family is functioning.

Many of the assumptions of the program plan also were built on the framework of naive psychology or a commonsense orientation to parental behavior (Baldwin, 1967). Parents were conceived of as being influenced by culturally defined norms for appropriate behavior during pregnancy and early child rearing. Most of those norms (especially those that led to aspirations for the child's well-being and success in life) are shared by all members of the society, although there can be numerous variations on how to best achieve those aspirations. The nurses (who were all parents themselves) operated on the assumption that the new parents were committed to the well-being of their child and that family members would behave, for the most part, in accordance with what most parents would define as appropriate behavior during pregnancy and the early child-rearing years. A failure to follow through with that commitment was assumed to reflect a lack of knowledge regarding what children need, interference from other life pressures, or mental illness. Because the program was grounded in commonsense concepts, the content of the program was congruent with family members' ways of thinking about what constitutes the optimal conditions for pregnancy, birth, and early care of the child. Naive psychology also provides a basis for interpreting the behavior of others and empathizing with their experiences, both of which were crucial for the nurses' effective work with families.

At the same time, we reviewed the scientific literature regarding influences on the well-being of the mother and child and incorporated our findings into a systematic parent education program. At times, "commonsense" notions came into conflict with the empirical literature. Many new parents, for example, believed that picking up a crying newborn would spoil it and lead to more crying later, a view refuted by careful longitudinal research (Ainsworth, 1973). Because of the importance of parental responsiveness for the development of a secure attachment, the nurses held to their position that it was wise to pick up a crying newborn, which did not make sense to some new parents. When the evidence was less conclusive, the nurses were less insistent. For example, at the time our program was carried out, it was standard pediatric advice to delay the introduction of solids until the child was about 2 months of age, and then only to introduce new foods one at a time. Many parents, however, introduced their babies to cereal at a much earlier time (often to promote sleeping through the

night), because this had been a standard practice in their families for several generations. Because the evidence on the value of delaying the introduction of solids was equivocal, the nurses did not push as hard on this topic. In general, when conflicts arose between the commonsense or culturally defined norms for caregiving and professional advice, the nurses accepted the culturally defined behaviors unless there was clear evidence that those behaviors posed an imminent threat to the mother or child.

Although each of these theoretical perspectives by itself was an inadequate basis for organizing the intervention, in combination they helped create a more coherent approach to the complexities encountered by the nurses as they attempted to optimize families' adjustment to parenthood.

Building the Nurse-Parent Relationship: The Importance of Timing

In working with parents, we believed that it was essential to build the program on a foundation of respect for them, an appreciation for differences in their life-styles, and their strengths. Because we wanted to avoid giving parents the message that they were incompetent or incapable of caring for their children, it was important to begin in the program during pregnancy. Offering help once the baby was born might have been interpreted as an indication that we thought parents had made mistakes or were incapable of caring for their children. Moreover, because some of our objectives (such as the prevention of low birth weight and prematurity) had to be accomplished by the time of the child's birth, assistance had to begin during pregnancy at the latest. In general, we reasoned that women would be more likely to accept support when they were going through the profound biological, psychological, and social changes produced by pregnancy.

Program Content

During their home visits, the nurses carried out three major activities: (a) parent education about influences on fetal and infant development; (b) the involvement of family members and friends in the pregnancy, birth, early care of the child, and support of the mother; and (c) the linkage of family members with other formal health and human services. In the following sections, each of

these activities is analyzed in terms of how it enables parents to create a healthy environment for their baby's development.

Parent Education

In the home-based education program, the nurses provided parents with information on fetal and infant development in order to improve parental health habits and behaviors that theoretically affect the child's well-being. The nurses also encouraged parents to complete their own educations, to obtain vocational training, and to make decisions for themselves about finding employment and bearing additional children.

Prenatal education. It is important to note that the nurse's activities during pregnancy varied considerably among families. The material covered depended, in large part, on the mother's stage of pregnancy (Rubin, 1975). During the first trimester and part of the second, time was set aside for the mother to verbalize her feelings and reactions to the pregnancy, as well as to determine the feelings and support of significant others. During the second trimester, often coinciding with the recognition of fetal movement, the mother began to orient to the fetus as a living being. At this time, she became more eager to learn about fetal growth and development, as well as about how her health and behavior could affect the growth and development of her baby. As the mother began to anticipate labor and delivery during the third trimester, she became more concerned with preparation for labor, delivery, and early infant care (Rubin, 1975). Although the program was structured, it was designed to capture the interest of women as they progressed through the developmental stages of pregnancy and to address an issue when it presented the greatest opportunity for change.

The home visitation schedule during pregnancy called for the initial visit to be made within 7 days after enrollment. The nurses visited families once every other week throughout pregnancy with visits of 60 to 90 minutes duration. The women's primary support person was invited to attend every visit, but he or she was especially encouraged to attend special visits that addressed (a) nutrition and health habits; (b) fetal development and the physiology of pregnancy; (c) preparation for labor, delivery, and newborn care; and (d) the women's plans for returning to school, work, and methods of family planning. The nurse tried to

schedule these visits when the primary support person could be present.

During pregnancy, the nurses concentrated on achieving the following educational objectives:

1. *Help women improve their diet and monitor their weight gain.* The nurses carried out systematic evaluations of the women's diet using 24-hour diet recalls at least every other visit and monitored their weight gain by plotting it on a standard weight-gain chart. The nurses reviewed daily nutritional requirements and suggested a diet plan that coincided with the women's food preferences and their life-styles. The nurses addressed specific problems, such as nausea and vomiting, over- and undereating, pica, and inadequate finances, and offered practical tips about how to shop resourcefully. The nurses reinforced the physician's recommendations for vitamins, iron supplements, and special diets, and this helped women plan ways of improving their intake to ensure more complete antepartum nutrition.

2. *Help women eliminate the use of cigarettes, alcohol, and drugs.* The nurses assessed the women's use of cigarettes, alcohol, and drugs and devised plans to reduce their use. Early in the sequence of visits, the nurses explained in detail how these substances affect fetal development and the mother's health. Individualized plans were developed for reducing their intake using behavioral analysis techniques. The nurses encouraged a reduction in smoking, for example, by helping women identify the contexts in which they usually smoked, by substituting nutritious snacks in the place of cigarette smoking, by gradually reducing the nicotine levels in the brand of cigarettes they smoked (nicotine fading), and by encouraging women to follow the advice offered in smoking cessation pamphlets and to attend smoking clinics.

3. *Teach parents to identify the signs of pregnancy complication.* The nurses discussed in detail the common signs of pregnancy complication and preterm delivery, including conditions associated with hypertensive disorders of pregnancy (such as blurred vision, dizziness, edema), genitourinary tract infection (e.g., vaginal discharge and burning sensation with urination), and the symptoms of preterm or complicated labor. The nurses helped women distinguish false labor (Braxton-Hicks contractions) from real contractions and urged the women to call the physician's office or clinic at the first sign of any complication.

4. *Encourage regular rest, appropriate exercise, and good personal hygiene related to obstetrical health.* The nurses taught the women the importance of regular rest (including resting several times per day and lying on the left side to promote uterine blood flow), the maintenance of exercise consistent with prepregnant levels, sexual activity that reflected knowledge about the potential health risks to mother and fetus (avoiding a partner with venereal disease, avoiding sexual activity if intercourse was uncomfortable or if there were sign of premature labor), and basic hygienic practices that reduce the chances of genitourinary tract infections.

5. *Prepare parents for labor and delivery.* All women were encouraged to attend the local childbirth education classes offered by the local hospitals. If the mother was unable or unwilling to attend, the nurse covered the topics of labor and delivery and demonstrated the breathing and relaxation exercises during the home visits. The nurses arranged a tour of the labor and delivery rooms for those women who did not attend the formal classes. (One of the most common reasons that women did not attend was that they had no one to accompany them as a support person.) As indicated above, all women were taught to identify the complications of pregnancy and labor and to notify the physician or emergency room, depending on the type of problem identified. The labor and delivery routines followed by the local hospitals were discussed with both mother and her support person.

6. *Prepare parents for the early care of the newborn.* The nurses encouraged optimal care of the newborn by helping parents prepare for the child. The nurses taught the parents about newborn competencies and the value of early and extended contact between parents and the newborn (Klaus & Kennell, 1976). Parents were encouraged to spend the first hour after delivery getting to know their new family member and to request rooming-in. The advantages and disadvantages of rooming-in were discussed so that the parents would be able to make the choice without feeling coerced and so that they would continue to feel that their birthing experience was under their control. Similarly, parents were encouraged to choose a feeding method (after considering the advantages and disadvantages of breast versus bottle feeding); to obtain baby clothes, equipment, and a place for the baby to sleep upon returning home from the hospital; and to choose a source of pediatric care. One of the most critical features of the program involved the nurses dis-

cussing variations in newborn crying patterns and temperament with parents (Thomas, Chess, & Birch, 1963). The nurses emphasized the tremendous variability in the extent to which newborns cry, and they stressed that infants who cried a lot were not intending to make life difficult for parents and that their crying was not an indication that the parents were incompetent.

7. *Encourage appropriate use of the health care system.* The nurses urged the women to attend all prenatal appointments, to make a list of their concerns and questions before the visit (so that they could make best use of their time with the physician), to comply with the physician's recommendations, to call the physician whenever any sign of pregnancy complication arose, and to discuss the results of their prenatal visits with the nurses themselves.

8. *Encourage mothers to make plans regarding subsequent pregnancies, returning to school, and finding employment.* A central aspect of the nurses' educational program was to encourage parents to clarify their plans for completing their education, returning to work, and bearing additional children. The nurses emphasized that the decision to return to school or seek employment after delivery should be made after parents fully considered what was in their own and their babies' best interest. Toward the end of pregnancy and throughout the first 2 years postpartum, the nurses helped them make concrete plans for child care and advised them in methods of finding jobs and interviewing. The advantages of different methods of birth control were discussed and birth control devices presented. The discussions of family planning were carried out in the context of the women's desires for their continued education, work, and achievement of what they considered to be their optimal family size. The nurses tailored the specific content of their home visits to the individual needs of each family. For example, the nurses helped all interested women find employment but gave special consideration to those who were poor and lacked other sources of income; they discussed family planning with all families but gave extra attention to those who

wanted to avoid additional pregnancies. The nurses refrained from imposing family planning methods on couples who had already decided that they wanted to have large families with their children spaced closely together.

Infancy education. The infancy curriculum focused on five developmental periods, each of which was described in terms of the adaptive tasks of the mother and development of the infant. As during pregnancy, the curriculum was organized so that the nurses were able to cover issues of common concern to all new parents, while responding to the individual needs of each family. Because support persons often were unable to attend all home visits, the nurses made special efforts to encourage their attendance at selected visits. The frequency of visits during each of the five developmental periods and the visits support persons were especially encouraged to attend are specified in Table 1-1.

In general, each visit (which lasted from 60 to 90 min) started with an inquiry about how the mother was doing. The focus of the visit then shifted to the baby. As with the prenatal curriculum, the nurse decided how much material to cover and in what order. The specific educational objectives for the infancy period were as follows:

1. *Improve parents' understanding of the infant's temperament.* The nurses continued to help parents understand their infant's temperament after delivery. The nurses encouraged the parents, for example, to administer some of the items of the Brazelton Newborn Examination (Brazelton, 1973), so the parents might increase their confidence in handling their newborn and become sensitized to their child's individual way of responding to the world. With this information, parents could organize their infant's environment to minimize distress and optimize development. A passive infant, for example, may need extra stimulation, because it does not engage others as readily. By contrast, an irritable child who responds poorly to change may need to be protected from hordes of well-wishing relatives and friends. In general, the concepts of temperament and individual personality, beginning in the ear-

Table 1-1. Visits of Support Persons

Child's age	Stage	Frequency of visits	Support person attendance
0-6 weeks	Integration and adaptation	Weekly	2 days and 10 days
6 weeks-4 months	Consolidation	Every 2 weeks	4 months
4 months-14 months	Attachment	Every 3 weeks	8 months
14 months-20 months	Mobility	Every month	17 months
20 months-24 months	Autonomy/socialization	Every 6 weeks	20 months and 24 months

liest days after delivery, formed a consistent theme throughout the 2 years after delivery. The nurses spent a considerable portion of their time during the child's first 6 months helping parents understand how to interpret cries. For those whose babies cried excessively (a surprisingly small proportion, on the basis of nurses' reports), the nurse taught methods of coping with a colicky infant, with techniques such as holding, rocking, swaddling, carrying, talking, and singing to the baby.

2. *Promote the infant's socioemotional and cognitive development.* The nurses encouraged parents and other family members to engage in sensitive, growth-promoting care of the infant, including interpreting and responding to the infant's cues (e.g., crying, changes in activity level, grimacing, smiling, refusing to feed); communicating with the child by holding, talking, singing, naming objects, and reading; playing interactive games (such as patty-cake, peek-a-boo, hide and seek); making play things that were appropriate for the child's stage of development; turning routine care such as feeding and diaper changing into opportunities for communication and play; and organizing the child's daily routine to create variety. As the child grew older and more mobile, the nurses discussed the child's need to explore and later to develop a sense of autonomy. The nurse suggested methods of controlling undesirable behavior (e.g., negativism, temper tantrums, getting into everything, resistance to toilet training) with techniques such as removing and distracting the child, which do not involve physical punishment and yelling. Much time was spent helping parents understand their children's need for responsive caregivers whom they could learn to trust to respond to their needs.

The nurses carried out these activities after they assessed the child and family and decided which particular aspect of the child's development and the parents' caregiving deserved the greatest attention. They achieved these objectives by modeling appropriate caregiving, discussing the child's developmental course, and providing parents with a library of materials on these topics written for individuals with varying reading levels. They tried to introduce topics when parents seemed to be most interested or concerned with them. Sometimes, however, the nurses introduced issues because the parents seemed unaware of the problem, such as the excessive punishment of infants and a failure to respond to crying because of a fear of spoiling the child.

3. *Promote the physical health of the child.* The nurses assessed the extent to which parents knew how to provide routine care of the child including appropriate feeding, dressing, and bathing; managing common problems such as rashes, spitting up, and constipation; and preventing accidents and ingestions. Where needed, the nurses taught basic caregiving skills. They discussed the use of infant car seats and safety belts; the use of safety locks on kitchen cabinet doors; the prevention of falls from beds, tables, and couches and of burns from hot liquids (such as tea, coffee, baths); and the avoidance of cribs with small slats and thin plastic sheets on sleeping surfaces. The nurses also spent considerable time on the child's age-specific nutritional needs, how to know when the child had eaten enough, and how to hold the child during feeding in ways that would promote parent-child communication. The nurses taught parents about immunizations, well-baby care, and how to take the child's temperature and recognize signs of illness (such as a consistent refusal to eat, change in activity level, lethargy or irritability). The nurses encouraged the parents to call a physician or emergency room if the child appeared ill, to be prepared to provide the child's temperature and describe other signs of illness, and to assist the physician in deciding whether an office or emergency-room visit was warranted.

Enhancing Informal Support

The nurses sought to enhance the informal support available to women during pregnancy, birth, and the first 2 years after delivery. Early in the sequence of visits, the nurses asked the women to identify family members and friends whom they felt close to and could count on to help them. On the basis of this assessment, the nurses identified the mother's primary and secondary support person and urged each woman to invite these persons to participate in the home visits. In the visits, the nurses encouraged the women's family and friends to help the women with household responsibilities, to accompany them to the hospital at the time of delivery, to be present for the birth, to aid in the subsequent care of the child, and to reinforce the advice of the nurses in their absence. The nurses encouraged them to be sensitive to the women's needs and to help them follow appropriate health behaviors—without nagging and finding fault. The women's husbands or boyfriends and their own mothers were especially called on to participate in the home visits. These individuals were assumed to play

decisive roles in determining the extent to which the women would improve their health habits, finish their educations, find work, secure appropriate child care, and address the needs of the child. In order to facilitate the involvement of friends and family members in the home visits, the nurses visited some women on weekends and evenings, when the women's family members and friends could participate.

In identifying individuals who might serve as supports for the mother, the nurses assessed the extent to which each individual of significance in the mother's life supported the mother and the goals of the program; the nurse tried to assess the likelihood that the program would create or intensify hostilities among members of the support network or between the mother and the support person. It was not uncommon for the women to be involved, for example, with men who were engaged in illegal activities or who were abusive to them. In some of the cases, the nurses were able to serve as a support to the women as they broke away from these destructive relationships. In others, the women seemed to be committed to maintaining contact, at almost any cost.

Linkage with Formal Services

The nurses also connected families with formal health and human services, in order to reduce family stresses that the family was unable to handle alone. Parents were urged to keep prenatal and well-child care appointments and to call the physician's office when a health problem arose, so that the office staff might help them make decisions as to whether sick or emergency-room visits were necessary. The nurses sent regular reports of their observations regarding medical, social, and emotional conditions to both the obstetricians and pediatricians who provided the mothers' and babies' care. Each physician received at least two written reports; where needed, case conferences and phone contacts were used to communicate more completely or more rapidly. In this way, the physicians and office nurses could provide more informed and sensitive care in the office, and by communicating regularly with the mothers' and babies' primary health care providers, the nurses could clarify and reinforce physicians' recommendations in the home. When necessary, parents were referred to other services such as Planned Parenthood, mental health counseling, legal aid, and the nutritional supplementation program for women, infants, and children (WIC). Thus, to the extent possible, the resources

of the formal health and human service system were summoned to meet the needs of the families visited by the nurse.

Results

We tested the effects of the program by comparing those families who had been randomly assigned to receive the nurse with families who had been randomly assigned to service conditions that did not involve home visiting (free transportation for regular prenatal and well-child care and sensory and developmental screening for the child at 1 and 2 years of age).² Even though the program ended at the child's second birthday, we followed the children and families until the children were 4 years of age to determine the long-range impact of the program. Details of the research design can be found in our empirical reports (Olds, Henderson, Chamberlain, & Tatelbaum, 1986; Olds, Henderson, Tatelbaum, & Chamberlin, 1986).

During pregnancy, we found that, compared to women who had been assigned to receive the transportation and screening services, women who had received the nurse made better use of the formal services that were available to them. They experienced greater informal social support, improved their diets more, and reduced the number of cigarettes smoked.

The positive effects of the program on birth weight and length of gestation were concentrated on the very young teenagers, for whom we observed a 395 gram improvement in birth weight, and smokers, for whom we observed a 75% reduction in preterm delivery (Olds, Henderson, Tatelbaum, & Chamberlin, 1986).

After delivery, we compared women who had received the postnatal nurse home visitation program with those assigned to receive either the screening or the transportation and the screening. One of the most important issues that we examined after delivery was the impact of the program on the rates of verified cases of child abuse and neglect. For the group of women with all three of the risk characteristics used for sample recruitment (the poor, unmarried teenagers), we found a 75% reduction in the incidence of verified cases of child abuse and neglect—a reduction from 19 to 4%. This picture of maltreatment

²Forty-six non-Whites were removed from the analyses reported here because the sample of non-Whites was too small to cross-classify race with other variables of importance in the statistical analyses. Results for these non-White cases are presented elsewhere (Olds, Henderson, Birmingham, Chamberlin, & Tatelbaum, 1983).

prevention was painted by a number of other sources of data:

1. There was a trend for the nurse-visited, poor, unmarried teenagers themselves to tell us that their children were easier to care for.

2. Our interviewers observed less punishment and restriction and a greater number of growth-promoting playthings in the homes of nurse-visited, poor, unmarried teenagers.

3. Our medical record abstractors found that the nurse-visited, poor, unmarried teenagers took their children to the emergency room fewer times during the first year of life for upper respiratory infections than did the poor, unmarried teenagers in the comparison group.

4. During the second year of the child's life, nurse-visited women took their children to the emergency room 56% fewer times for accidents and ingestions than did women who had been assigned to the comparison group.

When we further examined the impact of the program on maltreatment and emergency-room visits, we found that as women's sense of control over their lives declined, the incidence of both maltreatment and emergency-room visits increased among women who had been assigned to the comparison services. However, among those women who had been assigned a nurse to visit them after delivery, the incidence of maltreatment and emergency-room visits remained relatively low—even among women who had little sense of control over their lives when they registered in the program (Olds, Henderson, Chamberlain, & Tatelbaum, 1986).

In examining the impact of the program on the women's own life-course development, we found that between birth and the child's fourth birthday, nurse-visited, poor, unmarried women worked 82% longer than their counterparts in the comparison group. During the first 2 years postpartum, only the nurse-visited, poor, unmarried, older women worked longer than their counterparts in the comparison group; but during the 2-year period after the program ended at the child's second birthday, the poor, unmarried teenagers began to work more than their counterparts in the comparison group as well.

Data derived from interviews with mothers at the 10th and 22nd months of the infants' life help explain the increased employment observed for the nurse-visited, poor, unmarried teenagers during the 24- to 48-month period. In these inter-

views, the nurse-visited, poor, unmarried teens reported greater concern about eventually finding employment than the poor, unmarried teens in the comparison group. In other words, the nurse-visited, poor, unmarried teenagers wanted to work more but were unable to do so, probably because of their young age. (At 10 months postpartum, the average teenage mother had just turned 18 years of age). Once they became older (and more employable), they indeed worked more than their counterparts in the comparison group.

During the 46-month period following delivery, nurse-visited women had 22% fewer subsequent pregnancies than did women in the comparison group, an effect that was concentrated among poor, unmarried women for whom there was a 42% reduction.

Positive Aspects, Negative Side Effects, and Limitations of the Program

Positive Aspects

Our results indicate that home visitation is a useful vehicle for the delivery of prevention services. It provides a means of reaching out to parents who distrust formal service providers or who lack self confidence—those least likely to show up for office-based services. If properly carried out, home visitation can eventually increase parents' confidence, so they can express themselves more comfortably and feel less threatened about using other formal services.

Without a major home visitation component, a significant portion of the families who most need the service will not receive it. Clearly, home visitation cannot overcome the lack of participation by all insecure, distrustful parents—who can simply refuse to answer the door or can conveniently not be at home. A persistent, caring nurse, however, can be remarkably successful in engaging a significant portion of those who are unreachable through other means.

Another advantage of the program was that the nurses were able to acquire a more complete understanding of those factors in the home and family that interfered with parents' efforts to cope with the pregnancy and early care of the child. By assessing the home environment, the nurses could provide more sensitive, informed services themselves and could help other service providers do the same. Because the parents in our program did not always articulate their needs clearly, it helped to have sensitive home-visiting nurses get

to know them so that appropriate services could be provided.

By approaching pregnancy and early child rearing from an ecological framework, the nurses in our program were able to achieve considerable leverage in improving pregnancy outcomes (Olds, Henderson, Tatelbaum & Chamberlin, 1986), maternal life-course development (Olds et al., 1983), as well as qualities of maternal caregiving (Olds, Henderson, Chamberlain, & Tatelbaum, 1986). Improvements in these various areas of maternal and child functioning had a synergistic effect on one another. By calling attention to the adverse effects of maternal smoking and inadequate weight gain on fetal development, for example, the nurses helped women change those prenatal health behaviors that lead to intrauterine growth retardation and begin to appreciate how their behavior affected their children's well-being later in life. Moreover, because growth-retarded babies have more aversive cries, some investigators have argued that they are at increased risk for child abuse (Lester & Zeskind, 1978). Consequently, the prevention of low birth weight in itself may reduce the incidence of subsequent maltreatment. In a similar way, by involving other family members in the pregnancy, birth, and early care of the child, the nurses increased the social resources for mother and baby, which is important by itself. The enhancement of social support may be important for the prevention of child neglect as well, in view of its association with social isolation (Seagull, 1987).

In an analogous way, by linking parents with other health and human services, the nurses helped reduce many of the stresses that lead to maternal depression (Fergusson et al., 1984), poor prenatal health habits (Stephens, 1985), and interference with caregiving (Belle, 1982). By helping young women find ways to continue their education, find jobs, and plan future pregnancies, the nurses helped them increase their financial resources and reduce the stresses associated with caring for several young children. These aspects of the program undoubtedly also contributed to its success in reducing child abuse and neglect and improving other aspects of maternal caregiving.

Negative Side Effects

Although the program has shown promising results in a variety of areas of maternal and child functioning, it is important to acknowledge that our efforts to help families may not have always

brought about their intended effect—our supposedly supportive interventions may sometimes have produced harm. In designing the program, we attempted to anticipate the kinds of problems that might be created by the program in order to avoid or minimize them. With so much pressure on parents to uphold high standards in caring for their children, for example, feelings of anxiety and guilt were almost inevitable, unless specific precautions were taken. Under a great deal of stress, a mother may unwillingly react harshly to her child. By discussing such problems before they arose, the nurses helped parents rehearse problem-solving methods and minimized guilt by pointing out that many parents react similarly when faced with the same problems. Similarly, because 50 to 80% of the women who smoke at the start of pregnancy find it impossible to give it up, even with the assistance of a smoking cessation program (Windsor, 1986), we urged the nurses to avoid making women who were unsuccessful feel guilty.

Some parents simply felt overwhelmed by the volume of information imparted in the program. To counteract this, the nurses promoted change in small ways and outlined clear, specific, sequential, and attainable goals. The nurses also looked for signs of overload such as blank or puzzled expressions, wandering attention, or lack of verbal response. When this occurred, the nurse made sure that what they were saying addressed the needs and interests of the family. If the women were still unable to concentrate, the nurses shortened the length of the visit.

This kind of intervention can also lead to the nurses' interference with parents' own way of doing things. Examples include interference with the timing of feeding solids and spoiling young babies by picking them up when they cry, as noted earlier. The nurses addressed issues like these by (a) advising parents during pregnancy that health professionals and parents sometimes have different views and (b) encouraging parents to make their own decision after carefully considering which method they wished to follow. The nurses avoided challenging the family practice unless it posed an imminent threat to the mother or child.

The nurses' efforts to establish rapport and impart useful information increased the possibility that parents would become dependent on them. To prevent this, the nurses encouraged parents to assume the initiative in solving problems that confronted them. Achieving independence, however, sometimes required allowing dependence in times of unusual stress. The first few weeks after delivery, for example, are often difficult for new

mothers, so the nurses routinely visited more frequently during this time.

One of the more serious unintended effects involved the nurses' interfering with family dynamics and thereby exacerbating family conflict. The nurses tried to avoid these problems by listening respectfully to everyone's opinions and by urging them to listen carefully to each other. When serious family conflict emerged, the nurses referred the family for professional counseling. In general, it was our judgment that promoting the involvement of other family members diminished the potential conflict that home visiting might have created if the home visitor were to have focused her attention exclusively on the mother.

The primary risk in linking families with health and human services was in increasing the family's dependence on formal services. This problem was minimized by helping parents continue their education, find employment, and turn to friends and relatives for other assistance.

Limitations

Even though the program was more effective than we originally expected, it was not without limitations. The rate of child abuse and neglect, for example, although substantially reduced in the nurse-visited condition, was still 4 to 5%—a rate too high by any standard, especially for such young children. We tried to analyze why the nurses were unable to prevent the more intractable cases of maltreatment, but our data did not provide any explanations. (We see corresponding limitations in program impact on other outcomes, such as preterm delivery and low birth weight.) Because there is no empirical pattern to the failure of the program to prevent certain cases of maltreatment and other problems, it is useful to examine the limitations of the program on purely theoretical grounds.

Although the present program was designed to address those underlying emotions and cognitions that play an important role in caregiving, it may be that long histories of abuse or neglect in women's childhoods, in certain cases, continue to undermine their ability to form relationships and their quality of caregiving (Main & Goldwyn, 1984; Ricks, 1985), even in the presence of a 2½-year comprehensively designed program.

Although the nurses in the present program tried to moderate the effects of poverty on family life by linking parents with needed services in the community, ultimately there are structural

constraints limiting what is possible with this kind of intervention. Communities with high rates of unemployment, drug abuse, and other conditions antithetical to productive living exert powerful, insidious forces that work against the influence of the nurse. In light of this, it is not unreasonable for the nurses to fail in their prevention efforts in certain cases.

Other structural, community-wide factors need to be considered as well. Even though the nurses tried to imbue parents with an appreciation for the importance of nonviolent child-rearing methods, their efforts were counteracted by the cultural acceptance of physical punishment as a method of discipline. When questioned about their disciplinary practices during the research interviews, many parents apologized for not spanking their children *more* frequently.

In spite of its limitations, however, the present program does provide a basis for considerable hope that the incidence of a number of serious maternal and child health problems can indeed be reduced with home visitation services. Before these findings are used as a basis for a major public-policy initiative, it is important that they be replicated with different nurses and with families living in different circumstances.

Because our study was carried out in a semi-rural, essentially White community, we cannot say how effective it might be in a poor urban area with a primarily Black population. We suspect that it would be as effective there, in part because of promising results for the small Black sample in our original study (Olds et al., 1983), but we have no good evidence on this point.

Even if the questions of generalizability were resolved, significant questions would remain about whether such services are indeed cost-effective and how they should be funded. Preliminary cost-benefit analyses suggest that a major portion of the cost for home visitation can be offset by avoided foster-care placements, hospitalizations, emergency-room visits, and child-protective-service worker time incurred during the same period that the home-visiting is provided. Short-range projections (through the child's sixth year of life) of cost savings to the government resulting from the nurse-visited, unmarried women returning to the work force and reducing the number of subsequent children show even greater cost savings (Olds, Lombardi, & Henderson, 1986). Given the association between early maltreatment and subsequent psychosocial dysfunctions such as juvenile delinquency (Gargano & Plantz, 1986) and violent behavior (Lewis, Shanok, & Balla, 1979), the long-range financial

savings to the community may be substantially greater.

Even if our final cost-benefit analysis confirms these preliminary results, questions will remain about which government agency should fund this kind of service. The intervention itself is most likely to be carried out through departments of public health, yet the cost savings and human benefits are likely to be seen in a number of other government agencies such as social services, mental health, and education. Because of this, we recommend that the program costs be shared by a number of government agencies in proportion to the cost savings that are anticipated in each of their budgets.

Practical Suggestions for Starting a New Program

The present program and research required the active involvement of virtually every health and human service available to women and children in the community. Any attempt to replicate the program will require comparable community development. To elicit the cooperation of these service agencies, we developed a proposal to carry out the study and presented it to representatives of the local pediatric and obstetric groups; the county health department; the two local hospitals; the department of mental health, mental retardation, and alcoholism services; family services; Planned Parenthood; and the public schools. Representatives of these groups raised concerns about (a) the credentials and background of the nurses who would be selected as home visitors; (b) the possible interference with patient-care activities in the health department, physicians' offices, and hospitals; and (c) the possible duplication of services and consequent reduction in need for their own programs that served poor women and children. We considered each of their concerns and resolved them as we refined the program plan. The representatives also raised problems with the research, which we have discussed elsewhere (Olds, 1988). As the study proceeded, we informed them of the findings of the study. They in turn played a central role in seeing to it that the program was continued by the county health department after the original experimental phase of the study was completed.

One of the issues raised by the local steering committee concerned the qualifications of the nurses who were involved in the home visitation. In retrospect, this is one of the most important

issues to consider in planning this kind of home visitation program. We decided that it was important to hire nurses who were parents themselves and who displayed considerable life experience and wisdom in addition to their formal training. Although it is possible to educate helping professionals in methods of forming effective therapeutic relationships, we believed that it was even more important to find individuals who had demonstrated a wealth of personal experience that would help them relate effectively with the families and make sound judgments in the field.

If the selection of nurses is so important to the success of the program, how is the current nursing shortage likely to affect the viability of the program? It has been our experience that this kind of position is extremely attractive to many nurses, in part because of the work hours, the autonomy that it provides in the job definition, and the opportunities created for the nurses to follow through with their desire to serve others. Consequently, the position is likely to be very competitive with other attractive nursing positions. Moreover, it has been our experience that nurses with both the professional and the personal attributes that would make them good home visitors can be found in virtually every community in the country.

Conclusions

We have taken the position that the development of programs and policies for socially disadvantaged families should be based to a greater extent on rigorously conducted research, but we recognize that the problems faced by poor women, children, and their families during this stage in the life cycle are so pressing that program and policy planners cannot wait for the definitive study to direct their work. Indeed, given the complexities of these problems and the variety of community contexts in which a single program might be established, we will never be able to prescribe a single program plan for prenatal and infancy home visitation. Nevertheless, we hope that the results of our study will give program planners and policy makers a sense of direction as they try to promote the health of socially disadvantaged pregnant women and their children.

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Preventing Child Abuse and Neglect: A Randomized Trial of Nurse Home Visitation

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ABSTRACT. A program of prenatal and infancy home visitation by nurses was tested as a method of preventing a wide range of health and developmental problems in children born to primiparas who were either teenagers, unmarried, or of low socioeconomic status. Among the women at highest risk for care-giving dysfunction, those who were visited by a nurse had fewer instances of verified child abuse and neglect during the first 2 years of their children's lives ($P = .07$); they were observed in their homes to restrict and punish their children less frequently, and they provided more appropriate play materials; their babies were seen in the emergency room less frequently during the first year of life. During the second year of life, the babies of all nurse-visited women, regardless of the families' risk status, were seen in the emergency room fewer times, and they were seen by physicians less frequently for accidents and poisonings than comparison group babies ($P \leq .05$ for all findings, except where indicated.) Treatment differences for child abuse and neglect and emergency room visits were more significant among women who had a lower sense of control over their lives. *Pediatrics* 1986;78:65-78; *child abuse, child neglect, home visitation.*

During the last 20 years, public concern about child abuse and neglect has grown dramatically.¹⁻³ Within the past decade, a National Center on Child Abuse and Neglect has been established by the federal government, a National Committee for the Prevention of Child Abuse has been created in the private sector, and the media routinely convey the

message that abuse and neglect are preventable. Two recent surveys have suggested a sharp increase in child abuse and neglect reports in the last 6 years.^{4,5} These reports indicate that hundreds of thousands of children and families are in crisis and emphasize the importance of preventive research efforts.⁶ In view of these developments, it is disturbing that little is known about the prevention of maltreatment.⁷

Four previous controlled trials of abuse and neglect prevention have produced mixed results. One investigation in this series studied the impact of extended postpartum contact (rooming-in) between mothers and newborns and found a reduction in subsequent care-giving dysfunction.⁸ In a second investigation, the effect of early and extended contact was compared to home visitation and a no-treatment control⁹; although modest benefits in the area of mother-child interaction were detected for the early contact group, no other benefits were observed for either early contact or home visiting. Treatment effects that may have been intensified for higher risk groups within their samples were not studied. This is unfortunate, because an intensification of treatment effect for higher risk families has been reported in one study of early contact that did not examine child abuse and neglect as an outcome.¹⁰

In a third controlled trial, from Bradford, England, a group of families at risk for child-rearing dysfunction was judged to be unaffected by the provision of preventive services.¹¹ The services (contact by the project social worker after mothers' and newborns' discharge from the hospital, creation of a drop-in center open one day a week, and provision of the project secretary's phone number) did not affect the complex, interrelated factors that

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undermine parents' capacities to care for their children.

The fourth study examined the effects of providing intensive pediatric consultation plus home visitation to a sample of women at risk for child abuse and neglect and found a reduction in hospitalization for serious injury. The findings are weakened, however, because evaluation follow-up was carried out on only half of the families and there were no other treatment differences in abnormal parenting practices.¹² It is evident that a variety of problems with research and program design make it difficult to interpret the earlier work in abuse and neglect prevention.

Home visitation has been postulated to be a potent means of preventing maltreatment.¹³⁻¹⁶ A comprehensive program of prenatal and postpartum nurse home visitation was evaluated in the present study; it was designed to prevent a wide range of childhood health and developmental problems, including abuse and neglect.

DESIGN AND METHOD

The study design consisted of a randomized clinical trial. Families were assigned at random to one of the four treatment conditions (Table 1).

Treatment Conditions

Treatment 1. Families in the first condition served as a control. During pregnancy, no services were provided through the research project. When the babies were 1 and 2 years of age, an infant specialist hired by the research project screened them for sensory and developmental problems. Suspected problems were referred to other specialists for further evaluation and treatment.

Treatment 2. Families in the second condition were provided free transportation for regular prenatal and well-child care at local clinics and physicians' offices through a contract with a local taxicab company. Sensory and developmental screening, as in treatment 1, was provided when the babies were 1 and 2 years of age.

Treatment 3. In the third condition, families were provided a nurse home-visitor during pregnancy in addition to screening and transportation services. The nurses visited families approximately once every 2 weeks and made an average of nine visits during pregnancy, each of which lasted approximately one hour 15 minutes.

Treatment 4. Families assigned to the fourth condition received the same services as those in treatment 3, but, in addition, the nurse continued to visit until the child was 2 years of age. For 6 weeks following delivery, the nurses visited families every week; from 6 weeks to 4 months, every 2 weeks; from 4 to 14 months, every 3 weeks; from 14 to 20 months, every 4 weeks; and from 20 to 24 months, every 6 weeks. When predetermined crisis conditions existed, they visited weekly. The visits lasted approximately one hour 15 minutes.

Postnatal Home Visitation Program

During their postnatal home visits, the nurses carried out three major activities that they had begun during pregnancy: parent education regarding fetal and infant development, the involvement of family members and friends in child care and support of the mother, and the linkage of family members with other health and human services. A central aspect of the nurses' approach was to emphasize the strengths of the women and their families.

In their home-based education program, the nurses provided parents with information on infant development, with the ultimate objective of improving parental behavior that theoretically affects the child's well-being. Specific objectives included improving parents' understanding of the following topics: the infant's temperament, especially crying behavior and its meanings; the infant's socioemotional and cognitive needs, including his or her need for responsive care giving and for progressively more complex motor, social, and intellectual experiences; the infant's physical health care needs, such as dietary requirements and bathing, how to take the baby's temperature and manage common

TABLE 1. Services Provided (+) in Each of the Four Treatment Groups

Services Provided	Treatment Group			
	1 (n = 90)	2 (n = 94)	3 (n = 100)	4 (n = 116)
Sensory and developmental screening when children 12 and 24 mo of age	+	+	+	+
Free transportation to regular prenatal and well-child visits		+	+	+
Nurse home visitation during pregnancy			+	+
Nurse home visitation during the child's first 2 years of life				+

health problems, and the need for routine health care and immunizations. The nurses used a detailed curriculum to guide their educational activities but tailored the content of their visits to the individual needs of each family.

The second major activity of the nurses was to enhance the informal support available to the women during early child rearing. As during pregnancy, the nurses encouraged the women's close friends and relatives to participate in the home visits, to help with household responsibilities, to aid in the care of the child, and to reinforce the advice of the nurses in their absence.

The nurses also connected families with community health and human service agencies. Parents were urged to keep well-child care appointments and to call the physician's office when a health problem occurred, so that the office staff might help them make decisions about whether office or emergency room visits were necessary. The nurses sent two regular reports of their observations regarding medical, social, and emotional conditions to the private physicians who provided the babies' pediatric care. When visiting families' homes, the nurses also clarified and reinforced the physicians' recommendations. When necessary, parents were referred to other services such as vocational training programs, Planned Parenthood, mental health counseling, legal aid, and the nutritional supplementation program for women, infants, and children (WIC).

Each of the program components—parent education, enhancement of informal support, and linkage of families with health and human services—was designed to work in an integrated, complementary way to improve conditions for bearing and rearing children in socially disadvantaged families.

Detailed record-keeping systems and regular case reviews were used to ensure that the home visit protocol was followed by each nurse. Detailed descriptions of the program are provided elsewhere.¹⁵⁻¹⁷

Setting

The study was carried out in a small, semirural county of approximately 100,000 residents in the Appalachian region of New York State. At the time the study was initiated, the community was well served from the standpoint of both health and human services. Prenatal care was available through nine private obstetricians and a free antepartum clinic sponsored by the health department. Pediatric care was provided by two sophisticated pediatric practices (with a total of 11 pediatricians) and eight physicians in family practice. A variety of social services was available for children and

families. In spite of an abundance of health and human services, the community has consistently exhibited the highest rates of reported and confirmed cases of child abuse and neglect in the state.¹⁸ Moreover, in 1980 the community was rated the worst Standard Metropolitan Statistical Area in the United States in terms of its economic conditions.¹⁹

Sample

Women were actively recruited if, at intake, they had no previous live births and had any one of the following characteristics that predispose to infant health and developmental problems: (1) young age (<19 years), (2) single-parent status, (3) low socioeconomic status. The study design, however, allowed any woman who asked to participate and who was bearing a first child to be enrolled. This avoided creating a program that was stigmatized as being exclusively for the poor and, by creating sample heterogeneity, it enabled us to determine whether the effects of the program were greater for families at higher risk. All women were enrolled prior to the 30th week of pregnancy. They were recruited through the health department antepartum clinic, the offices of private obstetricians, Planned Parenthood, the public schools, and a variety of other health and human service agencies. Approximately 10% of the target population was missed due to late registration for prenatal care. An additional 10% was missed because some eligible women from the offices of private obstetricians were not referred. Of 500 women interviewed between April 1978 and September 1980, 400 were enrolled. There were no differences in age, marital status, or education between those women who participated and those who declined. Of the nonwhite women (mostly blacks), 94% enrolled as opposed to 80% of the whites ($P = .02$). At registration, 47% of the participating women were younger than 19 years of age, 62% were unmarried, and 61% came from families in Hollingshead's²⁰ social class IV and V (semiskilled and unskilled laborers; Hollingshead's index was adapted slightly to accommodate the variety of household compositions found in our sample). Eighty-five percent of the women met at least one of the age, marital status, or socioeconomic status criteria, and 23% possessed all three risk characteristics.

Forty-six nonwhite women were removed from the analyses reported here because the sample of nonwhite women was too small to cross-classify race with other variables of importance in the statistical analyses. Results for these nonwhite cases are presented elsewhere.²¹

Treatment Assignment

Families enrolled in the program were stratified by marital status, race, and seven geographic regions within the county (based on census tract boundaries). These families were assigned at random to one of the four treatment conditions. At the end of the intake interview, the women drew their treatment assignments from a deck of cards. The stratification was executed by using separate decks for the groups defined by the women's race, marital status at intake, and, for white women, the geographic region in which they resided. To ensure reasonably balanced subclasses, the decks were reconstituted periodically to overrepresent those treatments with smaller numbers of subjects, a procedure similar to Efron's²² biased-coin designs. Women in treatments 3 and 4 subsequently were assigned on a rotating basis, within their stratification blocks, to one of five home visitors.

There were two deviations from the randomization procedure. First, in six cases, women who enrolled were living in the same household as other women already participating in the study. To avoid potential horizontal diffusion of the treatment in the case of different assignment within households, the six new enrollees were assigned to the same treatment as their housemates.

Second, during the last 6 months of the 30-month enrollment period, the number of cards representing treatment 4 was increased in each of the decks to enlarge the size of that group and to enhance the statistical power of the design to compare the infancy home-visiting program with treatments 1 and 2 on infant health and developmental outcomes. Analysis of selected dependent variables confirmed that this slight confounding of treatments with time did not alter the pattern of treatment effects reported here.

Data Collection

Interviews and infant assessments were carried out at registration (prior to the 30th week of pregnancy), and at 6, 10, 12, 22, and 24 months of the infant's life. Medical records were abstracted for the infant's first 2 years of life, and the records of child abuse and neglect registries for 15 states in which families had lived were reviewed. Reliability of the medical record review procedure was checked on a systematic and regular basis and was found to be acceptable.²¹

Except in a small number of cases in which participating women inadvertently disclosed their treatment assignments, all interview and medical record data were collected by staff members who were unaware of the families' treatment assignments. The workers who reviewed the child abuse

and neglect registries did not know whether families were in a nurse-visited group.

At registration, prior to their assignment to one of the treatment conditions, the women were interviewed to determine their family characteristics, psychologic resources, health conditions, health habits, the availability of informal support, and childhood histories.

During infancy, the babies were brought to the project office at 6, 12, and 24 months for weighing and measuring. The infants also were administered developmental tests in the project offices, using the Bayley scales at 12 months and the Cattell scales at 24 months. At each of these assessments, the mothers were interviewed concerning common infant behavioral problems, such as feeding difficulties and crying, and how the mothers responded to these problems. When the babies were 6 months of age, the mothers were administered an infant temperament Q-sort procedure.²³

When the infants were 10 and 22 months old, the mothers were interviewed in their homes, and the Caldwell Home Observation checklist and interview procedure was completed. The Caldwell and Bradley²⁴ procedure evaluates qualities of the home environment and parental care giving according to six dimensions, including the mother's avoidance of restriction and punishment and the provision of appropriate play materials. Rates of interobserver agreement for the Caldwell procedure on individual items ranged from 82% to 100%.²¹

A list containing the names of all participating women and their children, their children's ages, and their addresses was given to state department of social service workers who thoroughly reviewed the department records for the presence of "indicated" (ie, verified) cases of abuse or neglect. Verified cases consisted of those that were reported for abuse or neglect and investigated by a department caseworker who determined that an episode of abuse or neglect, as defined by state law, had indeed occurred. Those cases were then reviewed by department workers to abstract standard information such as age of the child at the time of the first confirmed report, the specific type of abuse and neglect, the alleged perpetrator, and source of the maltreatment report. The names of children and parents who moved to 15 other states during the investigation were sent for review. Fourteen states cooperated, leaving only one case (a nurse-visited nonrisk family with no indication of maltreatment from the local records) that had to be omitted from the sample because of incomplete data.

Statistical Model and Methods of Analysis

For all analyses, a core statistical model was

derived that consisted of a $3 \times 2 \times 2 \times 2$ factorial structure (leading to 24 smallest subclasses): treatments (1 and 2 ν 3 ν 4) $\times$ maternal age (<19 ν ≥ 19 years) $\times$ marital status $\times$ social class (Hollingshead classes IV and V ν I, II, and III). Two covariates measured at registration (maternal sense of control and reported husband/boyfriend support) also were included in the model for most analyses to adjust for chance differences between treatment groups for certain at-risk subsamples and to reduce error variance.

Treatments 1 and 2 were combined for purposes of analysis after it was determined that there were no differences between these two groups in their use of routine prenatal and well-child care, the primary means by which transportation was hypothesized to affect pregnancy and infancy outcomes. We refer to the combination of treatments 1 and 2 as the comparison group and to treatment 4 as the nurse-visited group. In the tables, treatment 3 is labeled "nurse-visited: pregnancy" and treatment 4 is labeled "nurse-visited: infancy." Planned comparisons focused on the contrast of the nurse-visited ν the comparison group for the whole sample and for those subsamples defined as being at risk: the teenagers (<19 years of age), the unmarried, the poor, and the group with all three risk characteristics.

Dependent variables for which a normal distribution was assumed were analyzed in the general linear model, the one dichotomous outcome (presence or absence of abuse and neglect) in the logistic-linear model (assuming a binomial distribution), and low-incidence outcomes in the form of counts (number of emergency room visits) in the log-linear model (assuming a Poisson distribution). No formal tests of distributional assumptions were performed. Estimates and tests were adjusted for all covariates, classification factors, and interactions. Analysis was by our own computer programs, except that in the logistic- and log-linear cases the model-fitting algorithm of GLIM²⁵ was invoked as a subroutine. These programs have been developed over many years and have been subjected to rigorous accuracy tests.

The means presented correspond directly to the tests: they are equally weighted averages of the 24 smallest-subclass means, adjusted for the covariates. In the logistic- and log-linear cases, means are given in incidence form because this corresponds more closely to the presentation of general linear model results than would, for example, log odds ratios. Hypothesis tests are unaltered by the form of presentation.

A thorough investigation was carried out for each covariate to determine whether its relationship with

the dependent variable was the same for contrasting groups defined by levels of the classification factors, that is, whether the slopes were parallel (the regressions were homogeneous). Nonhomogeneous regressions represent an interaction between the covariate and one or more categorical variables, and certain tests of means depend on the covariate in that a different test exists for each value of the covariate.²⁶

For tests that depend on the covariate, the situation can be shown pictorially by plotting the separately estimated regression lines for the groups being compared. With the effects of other covariates and relevant subclasses subsumed in the intercept of the equation, the vertical distance between the lines represents the estimated mean difference at a given covariate value. A test of the mean difference can be carried out for any specified value, or, alternatively, a region can be computed within which means differ statistically. Because the region provides information about a continuum of covariate values, the use of simultaneous statistical inference is appropriate.²⁷⁻²⁹

In the current analysis, we have extended these methods to dependent variables with binomial and Poisson error distributions. The relationship between certain outcomes (child abuse or neglect and emergency room visits) and maternal sense of control differed depending on whether the women were visited by a nurse or assigned to the comparison group (Figs. 1 and 2). For these dependent variables, results are first presented without adjustment for maternal sense of control; then, the regions of significant treatment differences, delimited by values of this covariate, are shown. We used a significance level of .10 in computing these regions. It sometimes is suggested that a significance level higher than the conventional .05 be used in simultaneous inference, where achieving significance is more difficult.³⁰ As a comparison, we also present the value of "sense of control" at which treatments differ at the .05 level for a single test.

RESULTS

Preintervention Equivalence of Treatment Conditions

The treatment conditions were examined carefully to determine their equivalence at registration. The nurse-visited and comparison group women were equivalent on all standard sociodemographic characteristics (Table 2). On psychologic and social support variables, however, in contrast to their comparison group counterparts, there was a trend for the nurse-visited women to expect less accompaniment to labor and delivery ($P = .10$); the un-

TABLE 2. Preintervention Treatment Differences and 95 Percent Confidence Intervals for Maternal Background Characteristics

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers (<19 yr of age at registration)	
	$\bar{x}$	n	$\bar{x}$	n
Proportion in Hollingshead's social classes IV and V				
Comparison	0.61	165	1.00	32
Nurse-visited:pregnancy	0.62	90	1.00	19
Nurse-visited:infancy	0.60	99	1.00	23
Comparison minus nurse-visited (infancy)	0.01 ± 0.12		0.00 ± 0.24	
Proportion unmarried				
Comparison	0.57	165	1.00	32
Nurse-visited:pregnancy	0.59	90	1.00	19
Nurse-visited:infancy	0.60	99	1.00	23
Comparison minus nurse-visited (infancy)	-0.03 ± 0.12		0.00 ± 0.24	
Proportion <19 yr of age				
Comparison	0.41	165	1.00	32
Nurse-visited:pregnancy	0.47	90	1.00	19
Nurse-visited:infancy	0.49	99	1.00	23
Comparison minus nurse-visited (infancy)	-0.08 ± 0.12		0.00 ± 0.24	
Proportion with no risk characteristics				
Comparison	0.17	165	0.00	32
Nurse-visited:pregnancy	0.17	90	0.00	19
Nurse-visited:infancy	0.14	99	0.00	23
Comparison minus nurse-visited (infancy)	0.03 ± 0.09		0.00 ± 0.18	
Maternal education (years completed)				
Comparison	11.25	165	9.78	32
Nurse-visited:pregnancy	11.58	90	10.16	19
Nurse-visited:infancy	11.32	99	9.87	23
Comparison minus nurse-visited (infancy)	-0.07 ± 0.32		-0.09 ± 0.62	
Maternal sense of control*				
Comparison	12.21	165	11.93	32
Nurse-visited:pregnancy	12.31	90	12.47	19
Nurse-visited:infancy	12.44	99	12.48	23
Comparison minus nurse-visited (infancy)	-0.23 ± 0.41		-0.55 ± 0.78	
No. of people/helping network				
Comparison	5.30	165	4.75	32
Nurse-visited:pregnancy	5.16	90	3.95	19
Nurse-visited:infancy	5.01	99	4.87	23
Comparison minus nurse-visited (infancy)	0.29 ± 0.66		-0.12 ± 1.26	
No. of intimates/helping network				
Comparison	1.75	165	1.56	32
Nurse-visited:pregnancy	2.08	90	1.79	19
Nurse-visited:infancy	1.57	99	1.39	23
Comparison minus nurse-visited (infancy)	0.18 ± 0.40		0.17 ± 0.81	
No. of kin/helping network				
Comparison	3.42	165	2.69	32
Nurse-visited:pregnancy	3.09	90	1.85	19
Nurse-visited:infancy	3.09	99	1.96	23
Comparison minus nurse-visited (infancy)	0.33 ± 0.51		0.73 ± 0.97	
Expected accompaniment to labor and delivery				
Comparison	9.66	165	9.30	32
Nurse-visited:pregnancy	9.36	90	9.50	19
Nurse-visited:infancy	9.04	99	8.68	23
Comparison minus nurse-visited (infancy)	0.62 ± 0.74		0.62 ± 1.46	
Husband/boyfriend support†				
Comparison	0.85	165	-5.22	32
Nurse-visited:pregnancy	1.55	90	-2.41	19
Nurse-visited:infancy	0.34	99	-0.94	23
Comparison minus nurse-visited (infancy)	0.51 ± 2.03		-4.28 ± 3.87	

TABLE 2. Continued

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers (<19 yr of age at registration)	
	$\bar{x}$	n	$\bar{x}$	n
Grandmother support†				
Comparison	0.12	165	4.37	32
Nurse-visited:pregnancy	-1.07	90	-2.22	19
Nurse-visited:infancy	-0.07	99	3.62	23
Comparison minus nurse-visited (infancy)	0.19 ± 1.45		0.75 ± 2.79	
Predicted positive parenting‡				
Comparison	0.61	165	0.41	32
Nurse-visited:pregnancy	0.57	90	0.37	19
Nurse-visited:infancy	0.54	99	0.48	23
Comparison minus nurse-visited (infancy)	0.07 ± 0.10		-0.07 ± 0.19	

* Scale measuring extent to which women felt control over their life circumstances using a short-form variant of Rotter's³¹ locus of control instrument.

† Scale characterizing availability, contact, and anticipated help with pregnancy and child rearing from the women's husbands or boyfriends.

‡ Scale characterizing availability, contact, and anticipated help with pregnancy and child rearing from the women's own mothers.

§ Scale derived from discriminant analysis to predict quality of care giving, based on weighted sum of mother's reports of being yelled at, spanked, and treated restrictively in her own childhood; the level of psychosocial stress in her family of origin; her level of ego development; her prepregnant level of smoking; the economic status of her current household; and a housing-crowdedness index.

|| $P < .10$.

¶ $P < .05$.

married women assigned a nurse had a significantly greater sense of control over their lives ($P = .04$); and the poor, unmarried teenagers assigned a nurse reported greater support from their boyfriends ($P = .03$). Because sense of control and husband/boyfriend support were related more consistently to the outcomes of this study than was expected accompaniment to labor and delivery, the potential bias created by this initial nonequivalence was handled by including the two former variables in the statistical model as covariates.

Attrition

During the first 2 years of the children's lives, the rates of attrition varied from 15% to 21%, and there were no differences across treatments in the proportion of subjects with completed assessments. In the nurse-visited condition, however, the women who discontinued tended to have a greater sense of control than those who discontinued the comparison group ($P = .06$). An examination of the reasons for these women's discontinuation showed that they had either moved or miscarried. Because women with greater sense of control were more likely to discontinue the nurse-visited group than the comparison group, the preintervention treatment difference for unmarried women in sense of control was not significant in the sample available for assessment at the child's second birthday. Even though more women with greater sense of control dropped out of the nurse-visited group than from

the comparison group, the women who remained in the comparison and nurse-visited groups at the end of the program remained essentially equivalent.

Child Abuse and Neglect

During the first 2 years of the children's lives, 19% of the comparison group at greatest risk (the poor, unmarried teens) and 4% of their nurse-visited counterparts had abused or neglected their children ($P = .07$; Table 3). (There also was a trend [$P = .07$] for the nurse-visited teenagers to have fewer confirmed reports of abuse and neglect than the teenagers in the comparison group. Because there was little corroborating evidence to support the interpretation that the program was effective with all teenagers, irrespective of their marital status and poverty, we have not emphasized this finding in the remainder of the report.) Although the treatment contrasts for the groups at lower risk did not reach statistical significance, virtually all of the contrasts were in the expected direction. Moreover, in the comparison condition the incidence of abuse and neglect increased as the number of risk factors accumulated, but in the nurse-visited condition, the incidence of abuse and neglect remained relatively low, even in those groups at higher risk. Also, the incidence of maltreatment in treatment 3 (nurse-visited: pregnancy) in general, was between the infancy nurse-visited and comparison conditions. (This pattern, in which the means of the nurse-visited: pregnancy group was between the other two

TABLE 3. Treatment Differences and 95 Percent Confidence Intervals for Child Abuse and Neglect—Adjusted for Husband/Boyfriend Support*

Treatment Group	Sample																	
	Whole		Nonrisk		Nonpoor		Married		Older (≥19 yr)		Poor		Unmarried		Teenager (<19 yr)		Poor Unmarried Teenagers	
	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n
Comparison	0.10	161	0.05	27	0.08	62	0.10	69	0.05	94	0.12	99	0.10	92	0.15	67	0.19	32
Nurse-visited: pregnancy	0.08	86	0.00	11	0.00	31	0.09	35	0.10	45	0.17	55	0.08	51	0.07	41	0.18	18
Nurse-visited: infancy	0.05	95	0.00	14	0.04	40	0.04	38	0.06	48	0.07	55	0.06	57	0.05	47	0.04	22
Comparison minus nurse-visited (infancy)	0.05 ± 0.09		0.05 ± 0.10		0.04 ± 0.06		0.06 ± 0.13		-0.01 ± 0.12		0.05 ± 0.08		0.04 ± 0.07		0.10 ± 0.11†		0.15 ± 0.16†	

* For the whole sample, the unmarried, the teenagers, the poor, and the group for which all three risk characteristics were present, the comparisons of treatments were planned. Tests shown in this table are not independent; they are not to be interpreted as individual findings but are presented to illustrate in detail the pattern of results.

† $P < .10$.

groups, as indicated below, also held for most of the other outcomes.)

A qualitative review of the eight cases of abuse and neglect among the poor, unmarried teenagers in the comparison condition indicated that four of the eight cases consisted of neglect alone, whereas the remaining four involved a combination of abuse and neglect. In five of the eight cases, the mother was the sole perpetrator; in the three remaining cases, the mother and father shared responsibility for the incidents. Five of the eight families were reported by nonmandated sources (eg, neighbors, family members), and the remaining three were reported by mandated sources (professionals required by law to report suspected maltreatment). The one nurse-visited case consisted of a combination of abuse and neglect in which both the mother and her boyfriend were the perpetrators. This case was reported by a mandated source. Because the child abuse finding was only marginally significant and subject to potential reporting bias, it was important to determine the extent to which the finding was corroborated by other evidence.

Reports of Infant Temperament and Behavioral Problems, and Maternal Concern, Conflict, Scolding, and Spanking

In contrast to women assigned to the comparison condition, nurse-visited women reported that their babies had more positive moods (happier, less irritable dispositions) ($P = .04$) but that their babies had more frequent episodes of resisting eating ($P = .01$) (Table 4). There was a trend for the nurse-visited poor, unmarried teenagers to report that their babies cried less frequently ($P = .07$). In response to their 6-month-old infants' behavioral problems, nurse-visited women, irrespective of their

risk status, reported greater concern ($P = .05$), whereas there were trends for the nurse-visited poor, unmarried teenagers to report less conflict with and scolding of their babies than their comparison group counterparts ($P = .06$ and $P = .09$, respectively).

Provision of Appropriate Play Materials and Avoidance of Restriction and Punishment

Within the group at greatest risk (the poor, unmarried teenagers), the nurse-visited women were observed in their homes, when their babies were 10 and 22 months of age, to punish and restrict their children less frequently than were their counterparts in the comparison group ($P = .007$ and $P = .04$, respectively) (Table 5). Similarly, the nurse-visited poor, unmarried teenagers provided their children with a larger number of appropriate play materials than did the poor, unmarried teenagers in the comparison group ($P = .01$ and $P = .002$, respectively).

Developmental Quotient

As illustrated in Table 6, at 12 and 24 months of life, there were trends for the babies of poor, unmarried teenagers assigned to the nurse-visited condition to have higher developmental quotients than the babies of their counterparts assigned to the comparison group ($P = .06$ and $P = .08$, respectively).

Emergency Room Visits

During the first year of life, the babies of nurse-visited women, especially the babies of poor, unmarried teenagers, were seen in the emergency room fewer times than their counterparts in the

TABLE 4. Treatment Differences and 95 Percent Confidence Intervals for Reports of Infant Temperament, Behavioral Problems, and Maternal Reaction to Behavioral Problems at 6 Months of Age—Adjusted for Husband/Boyfriend Support and Maternal Sense of Control

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers	
	$\bar{x}$	n	$\bar{x}$	n
Positive mood*				
Comparison	2.29	135	2.12	28
Nurse-visited:pregnancy	2.34	64	2.20	13
Nurse-visited:infancy	2.40	74	2.32	14
Comparison minus nurse-visited (infancy)	$-0.11 \pm 0.10^\dagger$		$-0.20 \pm 0.20^\dagger$	
Crying (No. of episodes last 2 wk)				
Comparison	3.93	107	4.51	22
Nurse-visited:pregnancy	4.05	57	4.22	12
Nurse-visited:infancy	3.44	56	3.53	11
Comparison minus nurse-visited (infancy)	0.49 ± 0.59		$0.98 \pm 1.17^\dagger$	
Resist eating (No. of episodes last 2 wk)				
Comparison	1.72	107	1.88	22
Nurse-visited:pregnancy	2.01	57	1.83	12
Nurse-visited:infancy	2.29	56	1.89	11
Comparison minus nurse-visited (infancy)	$-0.57 \pm 0.45^\S$		-0.01 ± 0.90	
Night awake (No. of episodes last 2 wk)				
Comparison	2.83	107	3.43	22
Nurse-visited:pregnancy	3.25	57	3.15	12
Nurse-visited:infancy	2.69	56	3.44	11
Comparison minus nurse-visited (infancy)	0.14 ± 0.66		-0.01 ± 1.30	
Worry or concern (Sum of positive responses for behavioral problems)				
Comparison	0.54	107	0.52	22
Nurse-visited:pregnancy	0.61	57	0.34	12
Nurse-visited:infancy	0.83	56	0.84	11
Comparison minus nurse-visited (infancy)	$-0.29 \pm 0.28^\dagger$		-0.32 ± 0.55	
Conflict (Sum of positive responses for behavioral problems)				
Comparison	0.25	107	0.68	22
Nurse-visited:pregnancy	0.27	57	0.50	12
Nurse-visited:infancy	0.29	56	0.28	11
Comparison minus nurse-visited (infancy)	-0.04 ± 0.20		$0.40 \pm 0.40^\dagger$	
Yell or scold (No. of times last 2 wk)				
Comparison	7.90	103	8.45	22
Nurse-visited:pregnancy	7.56	48	10.48	10
Nurse-visited:infancy	3.99	56	0.70	10
Comparison minus nurse-visited (infancy)	3.91 ± 5.00		$7.75 \pm 8.82^\dagger$	
Spank or hit (No. of times last 2 wk)				
Comparison	1.09	103	1.89	22
Nurse-visited:pregnancy	1.71	48	2.00	10
Nurse-visited:infancy	0.19	56	-0.02	10
Comparison minus nurse-visited (infancy)	0.90 ± 1.75		1.91 ± 3.10	

* One of five dimensions of infant temperament measured. The others include adaptability, approach, activity level, and rhythmicity.

$^\dagger P < .10$.

$^\ddagger P < .05$.

$^\S P < .01$.

comparison group ($P = .04$ for both contrasts) (Table 7). A detailed review of the medical records revealed that these differences were explained by a reduction in visits for upper respiratory tract infections. During the second year of life, the babies of nurse-visited women were seen in the emergency room fewer times ($P = .01$) and presented with fewer accidents and poisonings than their counter-

parts in the comparison condition ($P = .03$).

Maternal Sense of Control as a Conditioner of Treatment Effects

Among the poor, unmarried teenagers, the treatment difference in child abuse and neglect was greater at lower levels of maternal sense of control

TABLE 5. Treatment Differences and 95 Percent Confidence Intervals for Avoidance of Restriction and Punishment and Provision of Play Materials When Infants Were 10 and 22 Months of Age—Adjusted for Husband/Boyfriend Support and Maternal Sense of Control

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers	
	$\bar{x}$	n	$\bar{x}$	n
Avoidance of restriction and punishment (10 mo)*				
Comparison	5.60	123	5.06	27
Nurse-visited:pregnancy	5.77	61	5.63	10
Nurse-visited:infancy	5.40	68	6.26	16
Comparison minus nurse-visited (infancy)	0.20 ± 0.46		$-1.20 \pm 0.87§$	
Provision of appropriate play materials (10 mo)†				
Comparison	7.26	128	5.94	28
Nurse-visited:pregnancy	7.45	67	6.70	11
Nurse-visited:infancy	7.36	73	7.35	16
Comparison minus nurse-visited (infancy)	-0.10 ± 0.56		$-1.41 \pm 1.08§$	
Avoidance of restriction and punishment (22 mo)*				
Comparison	6.28	115	5.28	24
Nurse-visited:pregnancy	5.53	56	6.12	8
Nurse-visited:infancy	5.82	65	6.45	15
Comparison minus nurse-visited (infancy)	0.46 ± 0.60		$-1.17 \pm 1.11‡$	
Provision of appropriate play materials (22 mo)†				
Comparison	8.65	126	7.76	26
Nurse-visited:pregnancy	8.66	64	8.35	11
Nurse-visited:infancy	8.68	72	8.59	15
Comparison minus nurse-visited (infancy)	-0.03 ± 0.26		$-0.83 \pm 0.52§$	

* Scale consisting of sum of eight yes/no items observed in home (eg, mother does not shout at child during visit; mother neither slaps nor spansks child during visit).

† Scale consisting of sum of nine yes/no items (eg, child has one or more muscle toys or pieces of equipment; child has push or pull toys).

‡ $P < .05$.

§ $P < .01$.

TABLE 6. Treatment Differences and 95 Percent Confidence Intervals for Infant Developmental Quotients at 12 and 24 Months of Life—Adjusted for Husband/Boyfriend Support and Maternal Sense of Control

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers	
	$\bar{x}$	n	$\bar{x}$	n
Bayley Mental Development Index (12 mo)				
Comparison	109.94	131	104.13	26
Nurse-visited:pregnancy	105.44	68	105.86	13
Nurse-visited:infancy	111.23	73	115.01	15
Comparison minus nurse-visited (infancy)	-1.29 ± 5.53		$-10.88 \pm 11.12^*$	
Cattell (24 mo)				
Comparison	106.49	122	101.94	25
Nurse-visited:pregnancy	105.73	64	96.02	12
Nurse-visited:infancy	109.34	71	110.56	16
Comparison minus nurse-visited (infancy)	-2.85 ± 5.23		$-8.62 \pm 9.64^*$	

* $P < .10$.

(Fig. 1). For the comparison group, the incidence of maltreatment increased as maternal sense of control declined ($P = .005$), but among the nurse-visited women, a decline in maternal sense of control did not lead to an increase in abuse and neglect ($P = .75$). The test of the difference between the two regression lines produced a probability of .11, a level low enough to have a significant effect on

the interpretation of treatment mean differences.²⁶ The shaded area of Fig. 1 indicates the simultaneous region of treatment differences in abuse and neglect ($P < .10$), allowing statements to be made over a continuum of covariate values. (At the single sense-of-control value of 11.5, the difference between the nurse-visited and comparison groups was significant at $P = .05$.)

TABLE 7. Treatment Differences and 95 Percent Confidence Intervals for Emergency Room Visits (Total and for Accidents and Poisonings) for the First and Second Years of Life—Adjusted for Husband/Boyfriend Support

Dependent Variable and Treatment Group	Sample			
	Whole		Poor, Unmarried Teenagers	
	$\bar{x}$	n	$\bar{x}$	n
No. of emergency room visits (1st year of life)				
Comparison	1.02	136	1.66	29
Nurse-visited:pregnancy	1.12	69	1.27	13
Nurse-visited:infancy	0.74	87	0.95	21
Comparison minus nurse-visited (infancy)	$0.28 \pm 0.20^*$		$0.71 \pm 0.64^*$	
No. of emergency room visits for accidents and poisonings (1st year of life)				
Comparison	0.06	136	0.12	29
Nurse-visited:pregnancy	0.12	69	0.07	13
Nurse-visited:infancy	0.12	87	0.09	21
Comparison minus nurse-visited (infancy)	-0.06 ± 0.14		0.03 ± 0.18	
No. of emergency visits (2nd year of life)				
Comparison	1.09	121	1.27	27
Nurse-visited:pregnancy	1.04	64	1.19	12
Nurse-visited:infancy	0.74	75	0.90	16
Comparison minus nurse-visited (infancy)	$0.35 \pm 0.28^\dagger$		-0.37 ± 0.67	
No. of emergency visits for accidents and poisonings (2nd year of life)				
Comparison	0.34	121	0.33	27
Nurse-visited:pregnancy	0.32	64	0.23	12
Nurse-visited:infancy	0.15	75	0.26	16
Comparison minus nurse-visited (infancy)	$0.19 \pm 0.17^*$		0.07 ± 0.42	

* $P < .05$.

† $P < .01$.

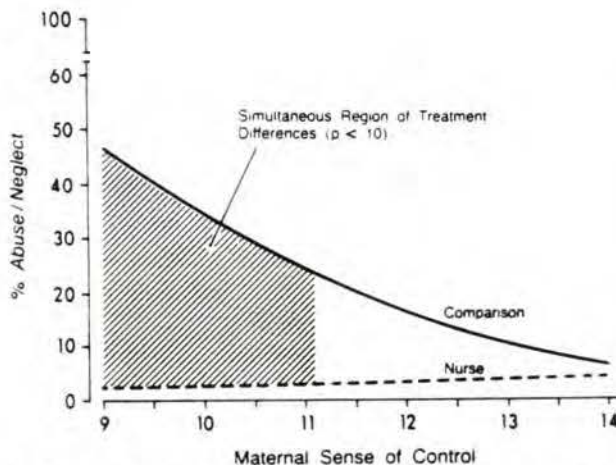


Fig 1. Estimated regression lines of abuse/neglect on maternal sense of control among poor, unmarried teenagers for nurse-visited and comparison group women.

The estimated regressions of number of emergency room visits during the second year of life on the women's reported sense of control, for all nurse-visited and comparison-group women, irrespective of their sociodemographic risk status, are shown in Fig. 2. For the comparison group, the incidence of emergency room visits increased as maternal sense of control declined ($P = .004$); but among the nurse-visited women, there was no such relation ($P = .53$). The difference between these regression lines

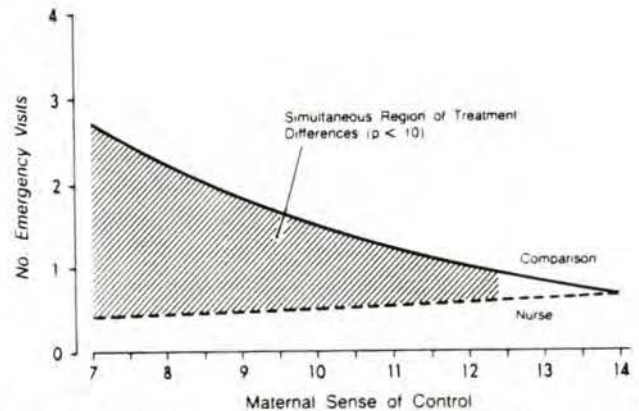


Fig 2. Estimated regression lines of number of second-year emergency room visits on maternal sense of control for nurse-visited and comparison group women—whole sample.

was significant ($P = .02$). The shaded area of Fig. 2 indicates the region of treatment differences ($P < .10$) in incidence of emergency room visits. (At the single sense-of-control value of 12.5, the treatment difference in number of emergency room visits was significant at $P = .05$.) A nearly identical pattern (not shown) emerged for the regression of number of second-year emergency room visits for accidents and poisonings on women's sense of control.

DISCUSSION

The pattern of results from this investigation provides evidence that nurse home-visitors are capable of preventing a number of care-giving dysfunctions, including child abuse and neglect. The positive effects of the program were concentrated on those women at greatest risk for care-giving dysfunction, and the finding of abuse and neglect prevention was supported by a variety of sources: department of social service records, maternal reports of child behavior and maternal care giving, observations of maternal care giving, the children's developmental tests, and emergency room records.

As coherent as these results appear to be, they must be viewed with caution for two reasons. First, the nurse-visited unmarried women reported greater sense of control over their lives at the start of the study than did their counterparts in the comparison group. The intensification of treatment effects for the child maltreatment and emergency room outcomes among women with decreasing sense of control over their lives may be a product of this initial nonequivalence.

It should be noted, nevertheless, that these preintervention differences were attenuated, because women with greater sense of control were more likely to discontinue the nurse-visited condition than the comparison condition. Moreover, it is theoretically coherent that the positive effects of the program would intensify as the vulnerability of the population increases. It was only in the case of the dichotomous and low-frequency count data (the abuse and neglect and emergency room outcomes) that we encountered nonhomogeneous regressions by treatments—an intensification of the treatment effect on the given outcome as maternal sense of control declined. This intensification occurred, in large part, because the incidence of these adverse outcomes was relatively infrequent in the nurse-visited group, whereas the incidence increased among comparison group women who had little sense of control over their lives. For other care-giving outcomes, the regressions on maternal sense of control were homogeneous for treatments. Thus, tests of treatment differences could be made with conventional adjustments for biasing background characteristics.

The presence of treatment differences for reports of infant crying behavior, positive mood, maternal conflict with and scolding of the child, play materials, and observations of punishment and restriction (variables for which there is no interaction of treatments with sense of control) increases our confidence that the treatment differences for child abuse and emergency room visits are products of

the nurse intervention.

Moreover, it should be emphasized that we were unable to detect any other preintervention treatment differences in a careful examination of the sample on a wide range of theoretically important background characteristics that predispose to care-giving dysfunction. A scale was constructed, for example, to predict the extent to which women would provide optimal care to their children. It included data on the women's own child-rearing histories (including information related to their having been abused and neglected), their current level of psychologic functioning, their prenatal health habits, and the level of stress in their current household. There were no preintervention treatment differences on this measure (Table 2).

The second reason for caution in interpretation is that these findings may be the result of systematic reporting bias. For each of the sources of data, one can construct an alternative explanation for specific findings. For example, the nurse-visited women may have been taught by nurses to give more socially desirable answers and to behave more appropriately in front of the interviewers. Their friends, neighbors, and relatives may have been more reluctant to report them for abuse and neglect than were associates of women in the comparison group. The finding of superior care giving for the highest risk nurse-visited women over their comparison group counterparts comes from a variety of sources, however, and it is unlikely that each of these sources could have its own idiosyncratic bias and still produce the same pattern of results overall. Assuming that the treatment differences observed are truly a reflection of the nurse's work, how do these pieces of evidence fit together?

The nurse-visited women reported less crying and fussiness on the part of their babies. Because reports of temperament and behavioral problems may be just as much a reflection of the mother's characteristics as the child's,^{32,33} we interpret reports of excessive crying and irritability as a problem in the parent-child relationship. One previous intervention study, which focused on adolescent parents of high-risk newborns, found more favorable reports of infant temperament as a result of intervention.³⁴ It is not surprising that we detected treatment differences in parents' reports of their infants' temperaments and crying behavior in the present study because the nurses spent a considerable portion of their prenatal and postpartum visits helping parents appreciate and manage differences in the temperaments of young infants. Beginning during pregnancy and following with a Brazelton³⁵ examination after delivery, the nurses encouraged parents to anticipate and recognize differences in

infant temperament, especially crying behavior, so that they would not misinterpret the babies' cries as either care-giving failure on their own part or as an indication that the infants were intentionally trying to disrupt their lives. We suspect that the nurse-visited poor, unmarried teenagers were able to interpret their infants' cries more correctly and respond more appropriately, thus forming the basis for secure attachments, which may protect children from abuse and neglect.³⁶⁻³⁸

This interpretation is supported by the pattern of results derived from the interviewers' assessments of the highest risk mothers' treatment of their children and the provision of appropriate play materials during the tenth- and 22nd-month interviews. In the extreme, restriction and punishment are abusive, and the absence of appropriate play materials is a form of neglect.

Additional corroboration for the nurses' prevention of child abuse and neglect is provided by the reduction in emergency room visits. Although the treatment difference in emergency room visits during the first year of life was attributable to the comparison group mothers taking their babies more frequently for upper respiratory tract infections, the more appropriate use of the emergency room on the part of nurse-visited women can be viewed as indirect corroboration, because it shows that the program was working as intended. Moreover, the reduction in emergency room visits for accidents and poisonings for nurse-visited women during their infants' second year of life provides more direct corroboration of the child abuse and neglect finding, because accidents and poisonings are tied more closely to the quality of parental care.³⁹⁻⁴¹

Although there clearly is some overlap, the underlying factors leading to child maltreatment and excessive use of the emergency room, even for accidents and poisonings, in many cases are quite different. Overuse of the emergency room, in large part, probably reflects heightened parental concern about the child's well-being and little knowledge about where to turn for help, factors that are likely to be present in a broad portion of the socially disadvantaged population. Abuse and neglect, on the other hand, appear to be the products of converging psychologic, economic, and social risks, factors that are limited to a much smaller segment of that population. This probably explains why the treatment difference in abuse and neglect was concentrated on the highest risk subsample, whereas the treatment difference in emergency room visits was present for the whole sample. That we observe treatment differences consistent with these general models of risk, as well as with the objectives of the program, lends credibility to the pattern of results

overall.

Finally, the improved intellectual functioning of nine to 11 points on the developmental tests for children from the highest risk families, although only marginally significant statistically, is of clinical importance. Treatment effects in this range are consistent with those obtained for children of this age enrolled in intensive early childhood intervention programs aimed specifically at enhancing cognitive development.⁴²

It is important to emphasize that the home-visiting service tested in this investigation was in several ways unlike conventional community health nursing, at least as it is practiced today.⁴³ The program called for the nurses to visit frequently enough to establish rapport with families and to identify and reinforce family strengths, the content of the curriculum was structured and yet flexible, and it called for the nurses to summon both formal and informal community support for parents. By addressing these factors in this way, the nurses were able to achieve considerable leverage in improving not only the qualities of care giving, but pregnancy outcomes⁴⁴ and maternal life-course development (such as rates of employment, education, and fertility) as well.²¹

Because of its service intensity, the present program is more expensive than most other home-visiting programs. Preliminary cost-benefit analyses suggest that a major portion of the cost for home visitation can be offset by avoided foster care placements, hospitalizations, emergency room visits, and child protective service worker time incurred during the same period that the home-visiting program is provided. The long-range financial savings to the community are in all likelihood substantially greater, as is the reduction in human suffering.

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Improving the Delivery of Prenatal Care and Outcomes of Pregnancy: A Randomized Trial of Nurse Home Visitation

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ABSTRACT. We evaluated a comprehensive program of prenatal and postpartum nurse home visitation. The program was designed to prevent a wide range of health and developmental problems in children born to primiparous women who were either teenagers, unmarried, or of low socioeconomic status. During pregnancy, women who were visited by nurses, compared with women randomly assigned to comparison groups, became aware of more community services; attended childbirth classes more frequently; made more extensive use of the nutritional supplementation program for women, infants, and children; made greater dietary improvements; reported that their babies' fathers became more interested in their pregnancies; were accompanied to the hospital by a support person during labor more frequently; reported talking more frequently to family members, friends, and service providers about their pregnancies and personal problems; and had fewer kidney infections. Positive effects of the program on birth weight and length of gestation were present for the offspring of young adolescents (<17 years of age) and smokers. In contrast to their comparison-group counterparts, young adolescents who were visited by nurses gave birth to newborns who were an average of 395 g heavier, and women who smoked and were visited by nurses exhibited a 75% reduction in the incidence of preterm delivery. ($P \leq .05$ for all findings.) *Pediatrics* 1986;77:16-28; prenatal care, pregnancy, nurse, home visitation, birth weight, health habit.

Despite improvements in perinatal care and reductions in infant mortality, the incidence of low-birth-weight infants ($\leq 2,500$ g) has decreased only slightly during the past decade.^{1,2} Low birth weight

is still the greatest threat to the life and well-being of infants in the United States.^{3,4} It is more prevalent in lower socioeconomic groups, a phenomenon that can be explained, in large part, by differences in maternal health habits (such as smoking and alcoholism) and behavioral choices (such as age at conception and use of prenatal care) but not by differences in medical complications.⁵

During the 1960s and early 1970s, in an effort to improve the outcomes of pregnancy and early child rearing among the poor, the federal government funded a number of health service demonstration programs for poor, young, pregnant women and their children.⁶⁻¹⁰ Most of the programs provided a greater array of services (eg, medical, psychologic, social) than had been available previously, but they continued to be delivered from traditional clinic-based settings. Although this greater variety of services represents an improvement over what was previously available, office-based services often do not reach those in greatest need. Moreover, without an appreciation for the full set of stressful family and community influences on women's health habits and behaviors, office-based personnel are not in a strong position to foster change. This is especially true in the case of socially disadvantaged women, for whom there are many difficult life circumstances that interfere with appropriate health habits. The evaluations of clinic-based programs have been difficult to interpret because the control groups, when used at all, were not randomly assigned.

Randomized and other controlled trials of prematurity and low-birth-weight prevention strategies have been carried out, but they typically have tested single preventive agents¹¹⁻¹⁹; thus, the greater

Received for publication March 4, 1985; accepted June 12, 1985. Reprint requests to (D.L.O.) Department of Pediatrics, University of Rochester, Rochester, NY 14642. PEDIATRICS (ISSN 0031 4005). Copyright © 1986 by the American Academy of Pediatrics.

sicians.¹³ In addition to these attitudinal issues, communication problems complicate the decision to use narcotics in children. Preverbal children cannot request relief and older children may not know appropriate ways to signal their distress. Therefore, attention to physiologic and behavioral cues is vital. This represents a significant burden for the nursing staff, and unless the child is in obvious distress, there may be a tendency to underestimate discomfort. In addition, a number of investigators¹² have suggested that children are often reluctant to request narcotics because they fear that analgesics will be parenterally administered. All of these factors suggest a need to find alternative ways to determine whether children are in discomfort.

Given that it remains unknown whether children experience less pain than adults, we believe that the results of our study imply that increased attention should be given to the possibility of pain in children. Physiologic cues such as increased heart rate, respiratory rate, and blood pressure should be noted in young children. Nursing and medical staff should be certain that children are aware that pain relief is possible and that children understand the meaning of the word "pain" if a child's verbal response to questioning is used to gauge analgesic therapy. It should be assumed that an injury that would cause pain in an adult would cause pain in a child. Finally, we believe our study further discredits the PRN dosing regimen which is predicated upon the patient's request of narcotics. This regimen, which is now in disfavor in adults for pharmacologic and humanitarian reasons,¹⁴ may place children at an even further disadvantage because of their inability or reluctance to communicate their discomfort. Further research is obviously necessary

to find better ways to assess and treat pain in children.

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do not get this right

rigor in design was offset by the futile search for a "magic bullet." The results of these single-agent interventions have been inconsistent. Because preterm delivery and low birth weight have multiple determinants, it was our judgment that the problem needed to be addressed with home visitation services that could moderate a range of risk factors simultaneously.

Home visitation has been given considerable attention as a possible means of improving child health.^{20,21} Prior to this report, however, the effect of prenatal home visitation on pregnancy outcomes had not been studied in rigorous fashion, although a few studies had examined postnatal home visitation programs.²²⁻²⁴ The prenatal phase of the home visitation program evaluated in the present study was based on the premise that comprehensive home visitation by nurses should be an effective means of (1) reaching women who are reluctant to use traditional health and human services, (2) responding flexibly to the stressful life circumstances with which socially disadvantaged women must contend, (3) improving their health habits and behaviors, and (4) ultimately, reducing the rates of preterm delivery and low-birth-weight infants. The prenatal and postpartum home visitation service was designed to prevent a wide range of childhood health and developmental problems. This report evaluates the effectiveness of the prenatal program as a means of enhancing the antepartum social support, health habits, and obstetrical health status of socially disadvantaged women and of improving the length of gestation and birth weight of their babies.

DESIGN AND METHODS

The study design consisted of a randomized, clinical trial. Participating families were assigned at random to one of the four treatment conditions outlined in Table 1.

Treatment Conditions

Treatment 1. Families in the first group served as a control. During pregnancy, no services were

provided through the research project. When the babies were 1 and 2 years of age, an infant specialist hired by the research project screened them for sensory and developmental problems. Suspected problems were referred to other specialists for further evaluation and treatment.

Treatment 2. Families in the second group were provided free transportation for regular prenatal and well-child care at local clinics and physicians' offices through a contract with a local taxicab company. Sensory and developmental screening, as in treatment 1, was provided when the babies were 1 and 2 years of age.

Treatment 3. Families in the third group were provided a nurse home-visitor during pregnancy in addition to the screening and transportation services. The nurses visited families about once every 2 weeks and made an average of nine visits during pregnancy, each of which lasted approximately one hour and 15 minutes.

Treatment 4. Families assigned to the fourth group received the same services during pregnancy as those in treatment 3, but, in addition, the nurses continued to make visits until the babies were 2 years of age. For the first month after delivery, the nurses visited once a week; thereafter, they visited on a schedule of diminishing frequency until the infants were 18 to 24 months of age, when visits were made every 6 weeks.

Prenatal Home Visitation Program

During their visits, the nurses carried out three basic activities: parent education, the enhancement of the women's informal support systems, and the linkage of the parents with community services. A central aspect of the nurses' approach was to emphasize the strengths of the women and their families.

An average of 83% of the nurses' home-visiting time during the prenatal period was devoted to education. The prenatal education program provided information on fetal and infant development, with the ultimate objective of improving parental behavior that theoretically affects fetal growth and

TABLE 1. Services Provided (+) in Each of the Four Treatment Groups

Services Provided	Treatment Group			
	1 (n = 90)	2 (n = 94)	3 (n = 100)	4 (n = 116)
Health and developmental screening at the child's 12th and 24th month of life	+	+	+	+
Free transportation to regular prenatal and well-child visits		+	+	+
Nurse home visitation during pregnancy			+	+
Nurse home visitation during the child's first 2 years of life				+

well-being of the newborn. Specific objectives included improving women's diets; helping women monitor their weight gain and eliminate the use of cigarettes, alcohol, and drugs; teaching parents to identify the signs of pregnancy complication; encouraging regular rest, appropriate exercise, and good personal hygiene related to obstetrical health; and preparing parents for labor, delivery, and early care of the newborn. The nurses used a detailed curriculum to guide their educational activities but tailored the content of their visits to the family's individual needs.

The second major activity of the nurses was to enhance the informal support available to the women during pregnancy, birth, and subsequent early child rearing. The nurses encouraged the women's relatives (usually their husbands and own mothers) as well as their close friends (including boyfriends) to participate in the home visits, to accompany the women to childbirth classes, to help them with household responsibilities, and to act as coaches during labor and delivery.

The nurses also linked families with community-based health and human services. Parents were urged to keep prenatal care appointments, to enroll in childbirth education classes, and, when needed, to seek other community services, such as the nutritional supplementation program for women, infants, and children.

The nurses worked closely with the clinic personnel and private office staff members responsible for the women's primary prenatal care. The women themselves were encouraged to call the physician or clinic at the first sign of any complication of pregnancy. In addition, the nurses sent two formal reports to the private obstetricians and the clinic staff informing them of the nurses' observations of maternal medical, social, and emotional conditions. The nurses clarified and reinforced physicians' recommendations in the home.

Detailed record-keeping systems and regular case reviews were used to make sure that the home visit protocol was followed by each nurse. Detailed descriptions of both the prenatal and postpartum programs are provided elsewhere.²⁵⁻²⁷

Setting

The study was carried out in a small, semirural county of approximately 100,000 residents in the Appalachian region of New York State. The community was well served from the standpoint of health and human services. Prenatal care was available through nine obstetricians and a free antepartum clinic sponsored by the health department. Prior to 1974, the county had one of the highest rates of infant mortality in the state (an average of

21.8 deaths per 1,000 births for the years 1971 to 1973). After the recruitment of a full-time neonatologist at a local hospital in 1974, the rates of infant mortality declined. For the 3-year period immediately preceding the current study (1975 to 1977), the mortality rate was 15.2 deaths per 1,000 births.²⁸ Moreover, the community has consistently exhibited the highest rates of reported and confirmed cases of child abuse and neglect in the state.²⁹ In 1980, the community was rated the worst Standard Metropolitan Statistical Area in the United States in terms of its economic conditions.³⁰

Sample

Pregnant women were actively recruited if they had no previous live births and had any one of the following characteristics that predispose to infant health and developmental problems: (1) young age (<19 years), (2) single-parent status, (3) low socioeconomic status. The study design, however, allowed any woman who asked to participate and who was bearing a first child to be enrolled. This avoided creating a program that was stigmatized as being exclusively for the poor, and it enabled us to determine whether the effects of the program were greater for families at greater risk by creating sample heterogeneity. Women more than 25 weeks pregnant were to be excluded, but because of the difficulty of estimating length of gestation at the time of registration, 30 women were enrolled between the 26th and 29th week of pregnancy.

Women were recruited through the health department antepartum clinic, the offices of private obstetricians, Planned Parenthood, the public schools, and a variety of other health and human service agencies. Approximately 10% of the target population was missed due to late registration for prenatal care. An additional 10% was missed because some eligible women from the offices of private obstetricians were not referred. Between April 1978 and September 1980, 500 women were interviewed, and 400 enrolled. Appropriate informed consent was obtained. There were no differences in age, marital status, or education between those women who participated and those who declined. Ninety-four percent of the nonwhite women (mostly black) enrolled as opposed to 80% of the white women ($P = .02$).

At enrollment, 47% of the participating women were younger than 19 years of age, 62% were unmarried, and 61% came from families in Hollingshead's³¹ social classes IV and V (semi-skilled and unskilled laborers). (Hollingshead's index was adapted slightly to accommodate the variety of household compositions found in our sample. Details of the procedure can be obtained from the

first author.) Fifteen percent of the women were not at risk according to either the age, marital status, or socioeconomic status criteria, and 23% possessed all three risk characteristics. Sixty-eight percent of the women obtained antepartum care at the health department clinic, whereas the remaining 32% received care from private obstetricians.

Forty-six nonwhite women were removed from the analyses reported here because the sample of nonwhite women was too small to cross-classify race with other variables of importance in the statistical analyses. Twenty cases with maternal or fetal conditions predisposing to preterm delivery and/or aberrations in fetal growth were removed from the analysis in order to minimize the number of cases unalterable by the home-visiting service. The design-matrix location of these nonwhite women and medically complicated cases is presented in Table 2; the results of analyses including these cases are presented elsewhere³² but are virtually the same as those reported in this paper.

Treatment Assignment

Families enrolled in the program were stratified by marital status, race, and seven geographic regions within the county (based on census tract boundaries). These families were assigned at random to one of the four treatment conditions. At the end of the intake interview, the women drew their treatment assignments from a deck of cards. The stratification was executed by using separate decks for the groups defined by the women's race, marital status at intake, and, for white women, the geographic region in which they resided. To ensure

reasonably balanced subclasses, the decks were reconstituted periodically to overrepresent those treatments with smaller numbers of subjects, a procedure similar to Efron's³³ biased-coin designs. Women in treatments 3 and 4 subsequently were assigned on a rotating basis, within their stratification blocks, to one of five home visitors.

There were two departures from the randomization procedure. First, in six cases, women who enrolled were living in the same household as other women already participating in the study. To avoid potential horizontal diffusion of the treatment in the case of different assignment within households, the six new enrollees were assigned to the same treatment as their housemates.

Second, during the last 6 months of the 30-month enrollment period, the number of cards representing treatment 4 was increased in each of the decks in order to enlarge the size of that group and to enhance the statistical power of the design to compare, during the postpartum phase of the research, the infancy home-visiting program with treatments 1 and 2. Analysis of selected dependent variables confirmed that this slight confounding of treatments with time did not affect the pattern of treatment differences reported below.

Data Collection

Interviews were carried out with participating women by project staff members at the time of registration in the project (prior to their assignment to treatments) and again at the 32nd week of pregnancy. Obstetrical, labor, delivery, and newborn records were abstracted by two registered nurses

TABLE 2. Distribution of Nonwhite Women and Serious Fetal or Maternal Medical Conditions Associated With Fetal Growth Retardation Removed From Analysis of Pregnancy Data

Condition	Treatment Group	Age 14-16 yr		Age 17-34 yr	
		Smokers	Nonsmokers	Smokers	Nonsmokers
Nonwhite	Nurse-visited	1	9	3	14
	Comparison	2	4	1	12
Fetal conditions					
Twins	Nurse-visited				1
	Comparison				1
Major malformations	Nurse-visited	1		3*	
	Comparison			1	1
Maternal conditions					
Diabetes	Nurse-visited				
	Comparison			1†	1
Hypertension	Nurse-visited			1*	2
	Comparison			4†	1
Uterine malformation	Nurse-visited				1
	Comparison				
Stillbirths	Nurse-visited			1	1
	Comparison			1	

* In one case, the newborn had major malformations and the mother had hypertension.

† One woman had both diabetes and hypertension.

who were trained to reliability by our obstetrical co-investigator (R.T.).³² Diagnoses used for this study were those recorded in the medical record. Nurses in the labor and delivery room completed forms indicating whether the women were accompanied to labor and delivery by a support person. The interviewers and medical record reviewers hired by the research project did not know to which treatment the women had been assigned.

At intake, the women were interviewed to determine their family structure, socioeconomic background, psychologic characteristics, health conditions, health habits, the availability of informal support, and their child-rearing histories. At the 32nd week of pregnancy, they were interviewed regarding their use of other health and human services, the support provided to them by significant persons in their informal networks, and their health habits.

Dietary intake was measured at both assessment periods, using 24-hour diet records and 24-hour recalls. For 74% of the sample, dietary data were gathered for two consecutive 24-hour periods at each assessment period; for an additional 14% of the sample, data were available for a single 24-hour period. These data were aggregated into a nutrient-adequacy ratio (NAR index), which converted the intake of 12 nutrients into a summary of percentages of Recommended Dietary Allowances.³⁴ Using an extension of intraclass correlation techniques, we found the reliability of the dietary data to be acceptable.³²

Serum cotinine assays were done to validate the women's reported level of smoking on a subsample of 116 patients who received their antepartum care at the health department clinic. Serum was derived from blood samples drawn routinely at the patients' registration in the clinic and at approximately the 36th week of pregnancy. Cotinine levels were determined by radioimmunoassay.^{35,36}

Estimates of length of gestation gave priority to newborn physical and neurologic examinations (based on the Dubowitz procedure) and to ultrasound readings taken before the 28th week of pregnancy. Reported last menstrual periods (LMPs) and measurements of uterine size made before 20 weeks were used when newborn examination and ultrasound data were not available. The gestational age of all low-birth-weight babies was estimated from the newborn physical examination findings.

Statistical Models and Methods of Analysis

For all analyses, a core statistical model was derived that consisted of a $2 \times 2 \times 2 \times 2$ factorial structure (leading to 16 smallest subclasses): treatments (1 and 2 v 3 and 4) $\times$ maternal smoking

status (zero to four v five or more cigarettes per day) $\times$ maternal age (<17 v ≥ 17 years) $\times$ sex of child. This model was extended to include a repeated-measures structure for dependent variables measured both early and late in pregnancy. Three covariates measured at registration (maternal prepregnant weight, prepregnant height, and number of cigarettes smoked per day at intake) were included in the model when birth weight and length of gestation were analyzed as dependent variables in order to reduce error variance and improve the precision of our estimates.

A thorough investigation was carried out for each covariate to determine whether its relationship with the dependent variable was the same for contrasting groups defined by levels of the classification factors; that is, whether the slopes were parallel. This was to ensure the correct interpretation of adjusted mean differences and to evaluate any substantive findings resulting from such interactions of the covariate with classification factors.³⁷ Separate regressions of birth weight on prepregnant height were specified for older and younger women, because we found a trend for height, even after adjustment for prepregnant weight, to be related to birth weight among the young adolescents but not among the older women. For certain analyses of birth weight, length of gestation was added to the model as a covariate; in these cases, the square root of length of gestation was used instead of a linear term, because the relationship between birth weight and length of gestation is steeper at earlier dates (eg, between 27 and 37 weeks) than later. This transformed length-of-gestation variable was specified separately for older and younger women because we found, as did Horon *et al*,³⁸ that the relationship between birth weight and length of gestation differed depending on age of the mother.

Treatments 1 and 2 were combined for purposes of analysis after it was determined that there were no differences between these two groups in their use of routine prenatal care, the primary means by which transportation was hypothesized to affect pregnancy outcomes. Treatments 3 and 4 also were combined for the prenatal analysis because they were identical during this phase of the research. In the remainder of this paper, we refer to the combination of treatments 3 and 4 as the nurse-visited group. Planned treatment comparisons focused on the smokers (five or more cigarettes per day) and young adolescents (<17 years).

Dependent variables for which a normal distribution was assumed were analyzed in the general linear model and dichotomous outcomes (eg, preterm delivery and low birth weight) in the logistic linear model (assuming a binomial distribution).

Estimates and tests were adjusted for all covariates, classification factors, and interactions. Analysis was by our own computer programs, except that in the logistic case the model-fitting algorithm of Generalized Linear Interactive Modeling (GLIM) program³⁹ was invoked as a subroutine.

Comparisons of means pooled across two or more model subclasses (as in main effects and lower order interactions) are averaged equally over levels of the cross-classified fixed factors, except for maternal age, for which a 6:1 weighting of older women to young adolescents was used, in accordance with their proportions in the general population. The means presented correspond directly to the tests: they are functions of the 16 smallest-subclass means that have been adjusted for any covariates in the model. In the logistic case, means are given in incidence form because this approach corresponds more closely to the presentation of general linear model results than would, for example, log

odds ratios. Except where indicated, variations in *n* are attributable to missing data.

RESULTS

Preintervention Equivalence of Treatment Conditions

The treatment conditions were evaluated carefully to determine their equivalence at registration. Before assignment to treatment conditions, the nurse-visited and comparison-group women were equivalent on all standard sociodemographic and health characteristics (Table 3). In the area of social support, however, in contrast to the comparison-group women, there were trends for the women assigned a nurse to have fewer family members in their helping network ($P = .08$) and less confidence that someone would accompany them to labor and delivery ($P = .07$). Moreover, the nurse-visited non-smokers in the older than 16-year age group were

TABLE 3. Preintervention Background Characteristics of Sample

Variable	Range	Comparison Group (<i>n</i> = 165)	Nurse-Visited Group (<i>n</i> = 189)	Comparison Group-Nurse-Visited Group Difference and 95% Confidence Interval
Sociodemographics				
Age of mother (yr)	14-34	19.57	19.53	0.04 ± 0.66
No. of weeks pregnant (at registration in research)	7-29	17.12	17.44	-0.32 ± 1.01
Education of mother (yr completed)	7-17	11.21	11.34	-0.13 ± 0.32
Proportion of households in socioeconomic classes IV and V (semi-skilled and unskilled workers) ^(a)	0-1	0.61	0.61	0.00 ± 0.10
Proportion married	0-1	0.43	0.41	0.02 ± 0.10
Proportion nonrisk (older, married, not poor)	0-1	0.17	0.14	0.03 ± 0.08
Maternal health status/behavior				
Prepregnant wt (lb)	80-308	129.98	131.22	-1.24 ± 6.20
Prepregnant ht (cm)	140-180	162.15	162.23	-0.08 ± 1.40
Diastolic blood pressure (mm Hg) at first antepartum visit	30-98	64.43	62.83	1.60 ± 2.16
No. of drinks during previous week	0-15	0.23	0.25	-0.02 ± 2.03
No. of cigarettes/d	0-55	6.94	7.65	-0.71 ± 1.97
Adequacy of diet (average % Recommended Dietary Allowances of 12 nutrients)	14-100	72.46	69.34	3.12 ± 3.77
Maternal personality and social support				
Personal control (items) [†]	7-14	12.19	12.43	-0.24 ± 0.30
No. of people/helping network	0-10	5.24	4.95	0.29 ± 0.49
No. of intimates/helping network	0-10	1.85	1.69	0.16 ± 0.32
No. of kin/helping network	0-10	3.22	2.86	0.36 ± 0.41*
Expected accompaniment to hospital for labor and delivery [‡]	2-16	9.61	9.08	0.53 ± 0.56*
Husband/boyfriend support [§]	-13-12	-0.19	0.42	-0.61 ± 1.63
Mother support	-7-16	0.12	-0.46	0.58 ± 1.18

* $P \leq .10$.

† Personal control summarized the extent to which the women felt control over their life circumstances using a short-form variant of Rotter's Locus of Control scale.⁴⁰

‡ Scale based on addition of ratings of confidence in being accompanied to labor and delivery.

§ Scale characterizing availability, contact, and anticipated help from the women's husbands or boyfriends.

|| Scale characterizing availability, contact, and anticipated help from the women's mothers.

less securely embedded in a helpful kin network ($P = .007$), had less confidence that someone would accompany them to labor and delivery ($P = .06$), and were older ($P = .04$) than their counterparts in the comparison group.

Attrition

The rates of attrition were distributed equally across the treatment conditions: 12 comparison and 14 nurse-visited women dropped out. The women who discontinued the nurse-visited condition, however, had a greater sense of personal control ($P = .009$), a higher level of education ($P = .002$), and enrolled in the project earlier in their pregnancies ($P = .02$) than those who discontinued the comparison group. An examination of the reasons for these women's discontinuation showed that they had either moved or miscarried. Even though more advantaged women dropped out of the nurse-visited group than from the comparison group, the women who remained in the comparison and nurse-visited groups at the time of delivery were essentially equivalent.

Formal and Informal Support Systems

In contrast to their counterparts assigned to the comparison group, by the end of pregnancy, nurse-visited women were aware of more of the community services available to them ($P = .01$), attended childbirth education classes more frequently ($P =$

.01), received more WIC vouchers ($P = .03$), reported that they talked more frequently with service providers and members of their informal networks about the stresses of pregnancy and family life ($P = .02$), indicated that their babies' fathers showed a greater interest in their pregnancies ($P = .02$), and were accompanied by someone to the labor room more frequently ($P = .01$) (Table 4).

Maternal Obstetrical Conditions and Health Habits

The nurse-visited women had fewer kidney infections after enrollment ($P = .005$) (Table 5).

Nurse-visited women made greater improvements in the quality of their diets from registration to the 32nd week of pregnancy than women in the comparison group (Table 6), an effect that was especially strong among the smokers ($P = .04$ for both contrasts). During the course of pregnancy, nurse-visited smokers made greater reductions in the number of cigarettes smoked than smokers assigned to the comparison group, leading to a four cigarette-per-day difference at the end of pregnancy ($P = .0001$).

The relationship between the reported number of cigarettes smoked and serum cotinine was analyzed at intake and at 32 weeks of pregnancy. Highly significant regressions for both nurse-visited and comparison-group women are shown in Table 7. Among smokers, the relationship between

TABLE 4. Women's Use of Services and Support Person Behavior Reported at the 32nd Week of Pregnancy and Observed at Hospital Admission for Labor and Delivery

Variable	Range	Comparison Group		Nurse-Visited Group		Comparison Group-Nurse-Visited Group Difference and 95% Confidence Interval
		$\bar{x}$	n	$\bar{x}$	n	
Use of services						
No. of services known	0-10	4.91	137	5.47	157	$-0.56 \pm 0.45^*$
Childbirth education (proportion)	0-1	0.54	120	0.70	129	$-0.16 \pm 0.13^*$
No. of nutritional supplementation vouchers	0-8	1.56	136	2.18	152	$-0.62 \pm 0.55^\dagger$
No. of antepartum visits	0-19	10.50	136	10.49	156	0.01 ± 0.67
No. of calls to physician or clinic	0-10	1.72	136	1.43	156	0.29 ± 0.40
Support person behavior						
Talk about problems [‡]	20-74	36.19	138	38.39	158	$-2.20 \pm 1.87^\dagger$
Father interest pregnancy	1-5	3.72	132	4.07	146	$-0.35 \pm 0.29^\dagger$
Accompany to labor (proportion)	0-1	0.87	127	0.95	142	$-0.08 \pm 0.07^*$
Accompany to delivery (proportion)	0-1	0.39	125	0.45	139	-0.06 ± 0.12
Help with household [§]	5-35	16.57	138	15.39	158	1.18 ± 1.68

* $P \leq .01$; $^\dagger P \leq .05$.

[‡] Scale based on addition of number of times that women spoke with specific family members, friends, and professional service providers about the women's problems.

[§] Scales based on addition of maternal ratings regarding amount of help the women had for house cleaning, shopping, etc.

TABLE 5. Obstetrical Complications After Enrollment

Variable	Range	Comparison Group		Nurse-Visited Group		Comparison Group-Nurse-Visited Group Difference and 95% Confidence Interval
		$\bar{x}$	n	$\bar{x}$	n	
Kidney infection (proportion)	0-1	0.03	141	0.00	165	0.03 $\pm$ 0.02*
Bladder infection (proportion)†	0-1	0.06	141	0.10	165	-0.04 $\pm$ 0.06
Hematocrit (%) (last before delivery)	22-46	36.67	142	36.76	166	-0.09 $\pm$ 0.74
Proteinuria ($\geq 2+$) (proportion)‡	0-1	0.03	142	0.05	166	-0.02 $\pm$ 0.04
Edema (proportion)	0-1	0.58	142	0.62	166	-0.04 $\pm$ 0.08
Hypertensive disorder of pregnancy (proportion)	0-1	0.07	142	0.04	166	0.03 $\pm$ 0.05

* $P \leq .01$.

† Includes diagnosed bladder infections as well as urinary tract infections not identified specifically as kidney infections.

‡ Protein is measured on a 6-point scale with a range of values from 0 to 4+.

TABLE 6. Obstetrical Conditions and Health Habits Measured Early and Late in Pregnancy*

Variable	Range	Assessment Period	Comparison Group		Nurse-Visited Group		Comparison Group-Nurse-Visited Group Difference and 95% Confidence Interval
			$\bar{x}$	n	$\bar{x}$	n	
Bleeding (proportion)	0-1	Trimester 1	0.01	137	0.06	158	0.05 $\pm$ 0.07
	0-1	Trimester 3	0.06	137	0.06	158	
Δ			0.05		0.00		
Spotting (proportion)	0-1	Trimester 1	0.09	142	0.10	166	-0.03 $\pm$ 0.09
	0-1	Trimester 3	0.03	142	0.07	166	
Δ			-0.06		-0.03		
Blood pressure (diastolic mm Hg)	30-98	First visit	63.97	137	62.63	158	-0.47 $\pm$ 2.96
	40-118	Last visit	71.10	137	70.23	158	
Δ			7.13		7.60		
No. of alcoholic drinks/wk	0-15	Intake	0.18	136	0.22	157	-0.02 $\pm$ 0.15
	0-15	32nd wk	0.12	136	0.18	157	
Δ			-0.06		-0.04		
Weight gain (lb)	80-308	Prepregnant	127.58	136	128.69	153	-2.93 $\pm$ 3.13
	99-313	Last visit	160.36	136	164.40	153	
Δ			32.78		35.71		
Adequacy of diet (avg % Recommended Daily Allowances)	14-100	Intake	72.08	115	69.72	138	-4.47 $\pm$ 4.38†
	12-100	32nd wk	71.75	115	73.86	138	
Δ			-0.33		4.14		
No. of cigarettes/d	5-55	Intake	14.37	64	15.83	77	4.17 $\pm$ 1.01‡
	5-70	32nd wk	16.00	64	13.29	77	
Δ			1.63		-2.54		

* Δ , Early to late pregnancy change.† $P \leq .05$; ‡ $P \leq .001$.**TABLE 7. Estimated Regression of Number of Cigarettes Smoked per Day on Serum Cotinine Value at Intake and the 32nd Week of Pregnancy for Nurse-Visited and Comparison Women**

Sample	Treatment Group	Data Collection Period			
		Intake		32nd wk	
		$\hat{\beta}$ Value*	n	$\hat{\beta}$ Value*	n
Whole	Comparison	0.050†	18	0.060‡	17
	Nurse-visited	0.051†	20	0.086‡	29
Smokers (≥ 5 cigarettes/d)	Comparison	0.011	11	0.012	9
	Nurse-visited	-0.021	10	0.083‡	15

* Estimated regression coefficient.

† $P \leq .01$; ‡ $P \leq .001$.

reported cigarettes smoked and serum cotinine at the 32nd week of pregnancy was significantly greater for the nurse-visited women than for those in the comparison group ($P = .05$), suggesting that the nurse-visited smokers were more accurate in the recollection of their smoking habits at the end of pregnancy than smokers in the comparison group. Thus, the treatment difference in the reported number of cigarettes smoked did not derive from the nurse-visited women exaggerating their reduction.

Birth Weight and Length of Gestation

Although there were no overall treatment main effects for birth weight or length of gestation (Table 8), the nurse-visited young adolescents gave birth to babies who were an average of 395 g heavier than babies of young adolescents in the comparison group ($P = .02$). For the nurse-visited smokers, there was a 2% incidence of preterm delivery in contrast to 10% for smokers in the comparison group ($P = .04$). The nurse-visited older nonsmokers, in contrast to their comparison-group counterparts, gave birth approximately 1 week earlier ($P = .002$), primarily because 12% of the nurse-visited older nonsmokers delivered prematurely, in contrast to 3% of their comparison-group counterparts ($P = .03$); this was accompanied by nearly an 11% difference in low birth weight ($P = .001$).

By covarying social support and age in the analysis of birth weight and length of gestation, we examined the extent to which these unexpected treatment differences among the older nonsmokers were due to the preintervention treatment differences for this subgroup. We found that the social support and age variables were related to length of gestation for the nurse-visited older nonsmoking group but not for their counterparts in the comparison group (the regressions were nonhomogeneous). Evaluation of the plotted relationships (not shown) indicated that the treatment difference for this subgroup in length of gestation was concentrated in those nurse-visited cases in which the women were older and in which there was little social support.

To determine the extent to which the treatment differences for birth weight were produced by longer (or shorter) gestations, birth weight was analyzed again, after adding length of gestation as a covariate to the basic model (Table 9). After adjustment for length of gestation, among the young adolescents the treatment effect on birth weight was reduced from 395 to 324 g, an effect that remained significant ($P = .02$). Among smokers, the treatment contrast was reduced from 96 to 39 g, and among the older nonsmokers the treatment contrast shifted from 161 g in favor of the control group to 26 g in favor of the nurse-visited women, both

TABLE 8. Treatment Effects on Birth Weight and Length of Gestation Adjusted for Prepregnancy Height, Prepregnancy Weight, and Intake Smoking Habit for the Whole Sample, Adolescents, Smokers, and Older Nonsmokers*

Sample	Treatment Group	n	Dependent Variables			
			Birth Wt (g)	% Low Birth Wt ($\leq 2,500$ g)	Length of Gestation (wk)	% Preterm Delivery (< 37 wk)
Whole	Nurse-visited	166	3,285	5.78	39.57	6.90
	Comparison	142	3,262	2.61	39.71	7.27
	Difference		23 ± 134	3.17 ± 4.01	-0.14 ± 0.45	-0.37 ± 2.30
Adolescents (14-16 yr)	Nurse-visited	28	3,423	0.00	40.41	0.00
	Comparison	17	3,028	11.76	39.71	11.76
	Difference		395 ± 343	$-11.76^\dagger$	0.70 ± 1.49	$-11.76^\dagger$
Smokers (≥ 5 cigarettes/d)	Nurse-visited	78	3,331	1.46	40.10	2.08
	Comparison	64	3,235	3.79	39.46	9.81
	Difference		96 ± 177	-2.33 ± 4.12	0.64 ± 0.76	$7.73 \pm 7.05^\ddagger$
Older nonsmokers	Nurse-visited	71	3,210	10.57	38.86	11.83
	Comparison	72	3,370	0.00	40.03	3.13
	Difference		-160 ± 172	$10.57 \pm 5.20^\S$	$-1.17 \pm 0.75^\S$	$8.70 \pm 7.68^\ddagger$

* Interval estimates of mean differences are calculated with 95% confidence. The fetal outcomes (in particular, the dichotomized and continuous versions of the same variable) are not independent of one another. They both are provided to give a more complete portrayal of the impact of the program on different aspects of fetal growth.

† For young adolescents, estimates for percentage of low-birth-weight infants and preterm delivery are not adjusted for covariates because of instability in the solution of the logistic linear model. The means are shown for the model without covariates, which converges. Because the subclass sizes were small and there were only two cases of low-birth-weight infants and preterm delivery in the control group and none in the nurse-visited group, the confidence intervals and probabilities, although formally significant, are not shown.

‡ $P \leq .05$; § $P \leq .01$.

TABLE 9. Treatment Effects on Birth Weight Adjusted for Prepregnancy Height, Prepregnancy Weight, Intake Smoking Habit, and Length of Gestation for the Adolescents, Smokers, and Older Nonsmokers*

Sample	Treatment Group	n	Birth Wt (g)
Adolescents (14–16 yr)	Nurse-visited	28	3,335
	Comparison	17	3,011
Difference			324 ± 259†
Smokers (≥5 cigarettes/d)	Nurse-visited	78	3,282
	Comparison	64	3,243
Difference			39 ± 184
Older nonsmokers	Nurse-visited	78	3,337
	Comparison	72	3,311
Difference			26 ± 130

* Interval estimates of mean difference are calculated with 95% confidence.

† $P \leq .05$.

nonsignificant differences after adjustment. This series of analyses indicated that the treatment effect on birth weight among smokers and older nonsmokers was explained largely by differences in length of gestation, whereas among the young adolescents it was not.

Differences in Program Effectiveness as a Function of Exposure to the Program

Birth weight and length of gestation were tested in a model in which gestational age at enrollment (categorized as before or after midgestation, or 140 days) was included as an indicator of the women's opportunities to be visited by the nurse (Table 10). The results of these analyses for the smokers and older nonsmokers showed no intensification of treatment effects for those who enrolled early. Among the young adolescents, on the other hand, the positive effect of the program on birth weight (adjusted for length of gestation) was concentrated exclusively on those young women who enrolled before midgestation, for whom a 515-g mean difference distinguished those assigned a nurse and those assigned to the comparison group ($P = .0002$).

DISCUSSION

This study is the first randomized trial of comprehensive prenatal services to show that the social and health contexts for child bearing among socially disadvantaged families can be improved. The results suggest that nurse home-visitors are capable of improving women's use of community services, informal social support, and health habits. Although these results may be explained by the nurse-visited women simply giving more socially desirable answers to questions about these topics, the available evidence does not support this interpretation. Our attempt to validate reported level of smoking

TABLE 10. Treatment Effects on Birth Weight Adjusted for Prepregnancy Height, Prepregnancy Weight, Intake Smoking Habit, and Length of Gestation for the Babies Born to Young Adolescents Who Enrolled Before and After Midgestation*

Treatment Group	Enrolled			
	Before Midgestation		After Midgestation	
	n	Birth Wt (g)	n	Birth Wt (g)
Nurse-visited	21	3,437	7	3,038
Comparison	11	2,922	6	3,287
Difference		515 ± 243†		-249 ± 377

* Interval estimates of mean difference are calculated with 95% confidence.

† $P \leq .001$.

suggests that the nurse-visited smokers were more rather than less accurate at the end of pregnancy than women in the comparison group. Moreover, the increased accompaniment by support persons to the hospital during labor on the part of nurse-visited women was determined by the observations of hospital maternity nurses. Thus, the general picture of improved social support and health habits is corroborated, in part, by data from sources other than the women themselves.

We have hypothesized that the observed reduction in kidney infections among nurse-visited women can be explained by two interrelated processes. First, nurse-visited women were encouraged to contact their physician at the first sign of pregnancy complication; therefore, we suspect that bladder infections were treated more promptly in the nurse-visited group. The relatively low incidence of treated bladder infections in the comparison group may reflect their underutilization of the physician for this condition which, untreated, developed into the higher rate of kidney infection. Second, the reduction in kidney infections is consistent with a theoretical model linking maternal

health habits, social support, and stress as influences on maternal host resistance to infection and, ultimately, preterm delivery.^{41,42} Hence, the reduction in kidney infections in the nurse-visited women may be one reflection of the salutary interaction between improved maternal health habits and social support.

Although no overall treatment effects on either birth weight or length of gestation were found, positive program effects were present for the offspring of young adolescents and women who smoked—two groups at special risk for preterm delivery and low-birth-weight infants.⁴³⁻⁵² It should be emphasized that the results for the smokers and young adolescents were examined thoroughly for possible biasing background conditions (none was found) and that the treatment effect among the young adolescents was concentrated exclusively on those who enrolled early in pregnancy and thus had greater exposure to the program. These results for young adolescents are consistent with a recent epidemiologic study of the effects of early prenatal care on the birth weight of offspring born to women in this age range⁵³ and with three other prenatal intervention studies.^{6,10,12}

The interpretation of the birth weight finding for the young adolescents, however, should be tempered by two observations: (1) the sample size for this group was quite small, and (2) the treatment effect size was larger than we would have predicted, given known influences on fetal growth.

Among the smokers, there was more than a 75% reduction in the incidence of preterm delivery. This finding is strengthened by the corresponding reduction in number of cigarettes smoked and improvement in diet for nurse-visited smokers.

Why did the nurse-visited older nonsmokers give birth to infants of shorter gestations than their counterparts in the comparison group? Because the nurse-visited older nonsmokers reported less family support and were older at registration than their comparison-group counterparts, and because there were no intervening behavioral outcomes, health habits, or obstetrical conditions identified that might explain their poorer performance, we have concluded that the apparent negative effect was attributable to a greater number of women in this nurse-visited subsample who were predisposed to deliver early.

During the past two decades, many efforts have been mounted to address the needs of disadvantaged pregnant women and their children, usually through traditional office- and clinic-based care systems. Although office-based care is an important ingredient in an overall strategy to improve the outcomes of pregnancy, the results of this study

suggest that it is not enough. The high incidence of low-birth-weight infants and preterm delivery among disadvantaged pregnant women is, in large part, the result of poor maternal health habits and behaviors which, in turn, are strongly affected by the stressful environmental conditions with which these women and their families must contend. A sensitively and comprehensively designed program of nurse home visitation appears to be a promising method of improving these behaviors and environmental conditions simultaneously.

In 1981, the Select Panel for the Promotion of Child Health⁵⁴ concluded that federal, state, and local governments should increase substantially their funding of home visitation services for pregnant women and high-risk infants, with the eventual goal of providing such services for all pregnant women and young children. The results of the present study provide the first evidence to support the position that standard office- and clinic-based prenatal care for socially disadvantaged women can be enhanced with home visitation. The positive effects for the newborn appear to be greatest for those born to women with specific risks for low birth weight infants, such as smoking and young age. The postnatal phase of the program has produced additional beneficial results.⁵⁵

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AMERICAN ACADEMY OF PEDIATRICS RESIDENCY FELLOWSHIPS STIPULATIONS

To enable young physicians to complete their pediatric training, the American Academy of Pediatrics will grant a small number of fellowships of \$1,000 and \$3,000 each to pediatric interns and residents for the year beginning July 1. Candidates must meet the following requirements:

1. Be legal residents of the United States or Canada;
2. Have completed, or will have completed by July 1, a qualifying approved internship (Pl-0) or have completed a Pl-1 program, and have made a definite commitment for a first year pediatric residency (Pl-1 or Pl-2) acceptable to the American Board of Pediatrics; or
3. Be pediatric residents (Pl-1, Pl-2, or Pl-3) in a training program and have made a definite commitment for another year of residency in a program acceptable to the American Board of Pediatrics;
4. Have real need of financial assistance; and
5. Support their application with a letter from the Chief of Service substantiating the above requirements; if a change in residency training program is contemplated (ie, moving to another institution), a letter from the chief of this service certifying acceptance to this program will also be necessary.

The fellowships have been provided through grants to the American Academy of Pediatrics by Mead Johnson Nutritional Division, Gerber Products Company, and the McNeil Consumer Products Company.

Although the fellowship awards are intended primarily for the support of first and second year pediatric residents, it is also recognized that some physicians may desire a third or fourth year of pediatric residency. Up to 25% of the fellowships may be awarded to persons in this category. Consideration will be given to geographic spread of awards, and preference will be exhibited for well-qualified but smaller training centers which perhaps have fewer resources for residents in training than do some of the larger centers.

The Committee on Residency Fellowships of the American Academy of Pediatrics will make final decision on the granting of the Awards. Those interested in applying may write to Jean D. Lockhart, MD, Department of Maternal, Child and Adolescent Health, American Academy of Pediatrics, 141 Northwest Point Rd, Elk Grove Village, IL 60007, for application forms.

The envelope must be postmarked no later than March 1, 1986 in order to be eligible.

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Improving the Life-Course Development of Socially Disadvantaged Mothers: A Randomized Trial of Nurse Home Visitation

DAVID L. OLDS, PhD, CHARLES R. HENDERSON, JR., ROBERT TATELBAUM, MD, AND ROBERT CHAMBERLIN, MD

Abstract: We evaluated a comprehensive program of prenatal and postpartum nurse home visitation for socially disadvantaged women bearing first children. Eighty-five per cent of the participating women were either teenagers (<19 years at registration), unmarried, or of low socioeconomic status. Women were randomly assigned to either nurse home visitation or comparison services (free transportation for prenatal and well-child care and/or sensory and developmental screening for the child). During the first four years after

delivery of their first child, in contrast to their counterparts in the comparison group, nurse-visited White women who had not graduated from high school when they registered in the study returned to school more rapidly; nurse-visited, poor, unmarried White women showed an 82 per cent increase in the number of months they were employed, had 43 per cent fewer subsequent pregnancies, and postponed the birth of second children an average of 12 months longer. (*Am J Public Health* 1988; 78:1436-1445.)

Introduction

In 1985 there were nearly 500,000 births to women under 20 years of age in the United States and over 800,000 to women who were unmarried, regardless of their age (12.7 per cent and 22.0 per cent of all births, respectively).¹ Adolescent and out-of-wedlock parenthood create substantial risks for both mothers and children. Adolescent mothers are in jeopardy of dropping out of school, having rapid successive pregnancies, and becoming dependent on welfare.²⁻⁶ Children of adolescent mothers are more likely to be afflicted with a variety of health and developmental problems.⁷⁻¹³ These maternal and child dysfunctions are even more likely to occur if an adolescent mother gives birth to a second child soon after the first.^{4,5,14} Out-of-wedlock births create economic hardships and corresponding pressure on women to take low-paying jobs and/or to rely on Aid to Families with Dependent Children (AFDC).¹⁵ Children born out of wedlock are also at risk for a host of problems,¹⁶⁻¹⁹ but the extent to which those problems are due to the mother's single-parent status as opposed to poverty or young age is unclear.^{15,20} Government expenditures on the sequelae of adolescent and out-of-wedlock childbearing are enormous.^{21,22}

During the past 20 years, numerous programs have been developed either to prevent unintended pregnancy in these socially disadvantaged groups^{23,24} or to reduce its consequences.²⁵⁻³³ The effectiveness of many of these programs is obscured, however, because of flaws with the evaluation designs.³⁴⁻³⁶ Furthermore, many services for these groups fail to address the full array of stressful conditions with which socially disadvantaged parents must contend as they try to improve their life situations.

Even though it is common for visiting nurses to help new parents reduce unwanted subsequent pregnancies, return to school, and find employment, there are no studies that have examined the effectiveness of nurse home visitation as a means of improving maternal life-course development. The present study was established to test a comprehensive and

intensive program of prenatal and postnatal nurse home visitation aimed at improving the outcomes of pregnancy, early childrearing, and life-course development of women who were either teenaged, unmarried, or poor, and bearing first children.

The program was based on the premise that nurse home visitors are in an optimal position to identify and help change factors in the family environment that interfere with maternal health habits, infant caregiving, and personal accomplishments in the areas of work, education, and family planning. In earlier papers we reported that the program improved the conditions and outcomes of pregnancy and reduced the incidence of caregiving dysfunction; many of the positive outcomes of the program were concentrated in families at highest risk for particular problems in these areas.^{37,38} The intervention also was designed explicitly to promote maternal educational and occupational achievements and to reduce the number of subsequent unintended pregnancies. This paper evaluates the effectiveness of the program in these areas.

Methods

Research Design

The study design consisted of a randomized clinical trial. Participating families were assigned at random (details in Appendix) to one of the four treatment groups outlined in Table 1.

Treatment Conditions

Treatment 1—When the children were one and two years of age, an infant specialist hired by the research project screened them for sensory and developmental problems and referred those with suspected problems to other specialists

TABLE 1—Services Provided in Each of the Four Treatment Groups

Services Provided	Treatment Group			
	1 N = 90	2 N = 94	3 N = 100	4 N = 116
Sensory and developmental screening at the 12th and 24th months of life	+	+	+	+
Free transportation to regular prenatal and well-child visits		+	+	+
Nurse home visitation during pregnancy			+	+
Nurse home visitation during the first 2 years of life				+

Address reprint requests to David L. Olds, PhD, Assistant Professor, Department of Pediatrics, University of Rochester, Rochester, NY 14642. Charles Henderson is with the Department of Human Development and Family Studies, Cornell University; Dr. Tatalbaum is with the Department of Obstetrics and Gynecology, University of Rochester; Robert Chamberlin is with the Department of Maternal and Child Health, Dartmouth Hitchcock Medical Center. This paper, submitted to the Journal January 20, 1988, was revised and accepted for publication April 11, 1988.

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Can Home Visitation Improve the Health of Women and Children at Environmental Risk?

David L. Olds, PhD, and Harriet Kitzman, PhD

From the University of Rochester, Rochester, New York

ABSTRACT. We reviewed randomized trials of prenatal and infancy home-visitation programs for socially disadvantaged women and children. Some home-visitation programs were effective in improving women's health-related behaviors during pregnancy, the birth weight and length of gestation of babies born to smokers and young adolescents, parents' interaction with their children, and children's developmental status; reducing the incidence of child abuse and neglect, childhood behavioral problems, emergency department visits and hospitalizations for injury, and unintended subsequent pregnancies; and increasing mothers' participation in the work force. The more effective programs employed nurses who began visiting during pregnancy, who visited frequently and long enough to establish a therapeutic alliance with families, and who addressed the systems of behavioral and psychosocial factors that influence maternal and child outcomes. They also targeted families at greater risk for health problems by virtue of the parents' poverty and lack of personal and social resources. *Pediatrics* 1990;86:108-116; *home visits, maternal-child health, birth weight, development, abuse.*

In recent months, the federal government has expressed increased interest in funding home-visitation services for pregnant women and young children.¹⁻⁴ In 1989, for example, Congress modified Title V of the Social Security Act for the first time to authorize explicitly funding of home visitation for pregnant women and infants,⁵ although they did not appropriate funds for this work. In addition, a number of states have begun supporting maternal and child home-visit services with Medicaid dollars, after years of cutbacks in these services.⁶ In light of this, it is particularly important to recognize that,

although home visitation is a promising strategy, many home-visitation programs simply do not work. Consequently, it is especially important to know what kinds of home-visitation programs work best for pregnant women and young children.

In this paper we examine randomized trials of home-visitation services from the standpoint of three factors that we believe are critical in determining their success: 1) the underlying causal model of influences on maternal and child outcomes; 2) the corresponding content and structure of the services; and 3) the degree to which the population served is at environmental, behavioral, or psychosocial risk for the particular problem under consideration. In examining the research from these perspectives, we have attempted to disentangle these issues from the design and methodologic problems that inevitably complicate field experiments.⁷ We have limited the review to randomized trials that tested programs designed either to improve the outcomes of pregnancy (in particular, birth weight or length of gestation) or the health or development of socially disadvantaged young children (less than 3 years of age) and their mothers. Secondary prevention programs delivered to populations already exhibiting problems (such as low birth weight or developmentally delayed babies) are excluded. Most previous reviews of home-visitation programs for socially disadvantaged women and children have produced largely discouraging conclusions.⁸⁻¹⁰ We have published a book chapter that provides additional details on the trials discussed in the present review.¹¹

All programs discussed in the present review attempted to recruit women or families that were at environmental risk for maternal and child health problems. There is substantial variation both within and between these samples in the degree to which they are at risk, but only a few of these studies examined the extent to which program effects were modified by the risk status of the sample.

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Home Visitation for Pregnant Women and Parents of Young Children

David L. Olds, PhD

• Many of the most pervasive, intractable, and costly problems faced by high-risk women and young children in our society today are a consequence of adverse maternal health-related behaviors (such as cigarette smoking, drinking, and drug use during pregnancy), dysfunctional infant care giving, and stressful environmental conditions that interfere with individual and family functioning. These problems include low birth weight, child abuse and neglect, childhood injuries, unintended and closely spaced pregnancy, and reduced economic self-sufficiency on the part of parents. Evidence is accumulating that these problems can be reduced with comprehensive programs of prenatal and infancy home visitation by nurses. While we are witnessing a renaissance of interest in home visitation as a means of addressing these problems, the recommendations of various health and human service advisory groups about the structure of proposed home-visitation initiatives are uncoordinated and frequently inconsistent with the empirical evidence. Home visitation is a promising strategy, but only when the program meets certain standards. The more successful programs contain the following: (1) a focus on families at greater need for the service, (2) the use of nurses who begin during pregnancy and follow the family at least through the second year of the child's life, (3) the promotion of positive health-related behaviors and qualities of infant care giving, and (4) provisions to reduce family stress by improving the social and physical environments in which families live.

(AJDC. 1992;146:704-708)

Prior to the 1970s community health nursing was an integral part of the US public health strategy to address the needs of at-risk children and their families. In the last 2 decades, such services have been reduced severely. Where home-visitation services have been provided, they have focused almost exclusively on pregnant women and children with identified health problems. Few home-visitation services have been devoted to prevention and health promotion.¹ In part, this is because

third-party payers have been willing to reimburse for tangible services, such as long-term care of the elderly and disabled children, while they have shied away from disease prevention and health promotion. It did not help that early evaluations of home-visitation services were not promising.² Many of the early studies were difficult to interpret because the programs tested were not designed to address the full range of adverse circumstances that interfere with maternal health and care-giving behaviors. Where the programs were designed well, the evaluations fell short of the highest standards for field experimentation. In spite of the reticence of third-party payers to support preventive services and the equivocal results of early research, home visitation is once again being promoted as a means of preventing the death and damage of our most vulnerable children.³⁻⁹

The US Advisory Board on Child Abuse and Neglect^{3,4} has declared child maltreatment a national emergency, has identified home visitation as the most promising method of addressing this problem, and has called for the development of a national home visitation program for all new parents. The National Commission to Prevent Infant Mortality^{5,6} has included home-visitation as a central part of its strategy to improve the outcomes of pregnancy and reduce infant mortality and morbidity. The Public Health Service Expert Panel on the Content of Prenatal Care has recommended that home visitation be included as part of an augmented set of services for low-income, at-risk women.^{7,8} The General Accounting Office⁹ issued a report in 1990 encouraging Congress to increase their level of support for home-visitation services through expansion of Title XIX of the Social Security Act. At least five legislative initiatives currently before Congress include provisions for expanding federal support for home-visitation services. In the meantime, at least 24 states have recently begun to increase their support of home-visitation services through a variety of Medicaid service categories.⁹

This renewed interest in home visitation derives from an increased appreciation for prevention in all aspects of health as well as from a recent accumulation of scientifically credible evidence that home visitation can be an effective preventive intervention for women and children.¹⁰ This report synthesizes the evidence on home visitation for pregnant women and parents of young children and examines the current legislative initiatives in light of that evidence. The findings from a randomized trial of prena-

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