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

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**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**

| | Treatment Group | | | |
|---|---|---|---|---|
| Services Provided | 1<br>N = 90 | 2<br>N = 94 | 3<br>N = 100 | 4<br>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 | | | | + |

for further evaluation and treatment. No services were provided through the research project during pregnancy.

*Treatment 2*—Families 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, as well as the sensory and developmental screening outlined in Treatment 1.

*Treatment 3*—Families were provided a nurse home visitor during pregnancy, in addition to the screening and transportation services. The nurses visited families approximately once every two weeks and made an average of nine visits during pregnancy. Each visit lasted approximately 1 hour and 15 minutes.

*Treatment 4*—Families received the same services as those in Treatment 3, but in addition the nurse continued to visit until the children were two years of age. For six weeks following delivery the nurses visited families every week; from six weeks to four months they visited every three weeks; from 14 to 20 months they visited every four weeks; and from 20 to 24 months they visited every six weeks. Under predetermined crisis conditions, the nurses visited weekly. As during pregnancy, the visits lasted approximately 1 hour and 15 minutes.

### Program Focus on Maternal Life-Course

Beginning during pregnancy, the nurses attempted to form an effective therapeutic relationship with the women by emphasizing the women's personal strengths. For example, the nurses:

- encouraged the women to clarify plans for completing their education, returning to work, and bearing additional children;
- stressed that the decision to return to school or seek employment after delivery should be made after fully considering what was in the women's own and their babies' best interests;
- helped interested women find appropriate educational and vocational training services and make concrete plans for child care;
- advised them in finding jobs and interviewing;
- showed the women and their partners birth control devices and discussed the advantages of different methods of family planning.

The discussions of family planning were carried out in the context of the women's desires for continued education, work, and achieving what they considered to be their optimal family size. When the women so desired, their husbands, boy friends, mothers, and other family members were encouraged to participate in the home visits. Families were also referred to other health and human services as needed.

The nurses used a detailed curriculum to guide their activities, but tailored the specific content of their home visits to the individual needs of each family. They refrained from imposing family planning methods on couples who had already decided that they wanted to have large families and their children spaced closely together.

Five registered nurses (none with baccalaureate degrees) were hired through a nonprofit private agency expressly for this experimental program. Before being assigned families in the experimental program, they participated in a three-month training program in which they each began working with two "pilot" families. Each nurse followed a caseload of 20–25 families from pregnancy through the child's second birthday. The nurses worked in two-person teams, with each member serving as a backup for her partner. By visiting one another's

families at least once during both the pregnancy and the postpartum period, the members of the team were able to serve as ongoing supports for one another on a day-to-day basis. Detailed descriptions of the program are provided elsewhere.[39–42]

### The 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. In spite of this abundance of services, the community has consistently exhibited the highest rates of reported and confirmed cases of child abuse and neglect in the state.[43] Moreover, between 1967 and 1982 the number of manufacturing jobs in the area dropped from 17,400 to 9,000 (a 48 per cent decline)[44]; in 1981, the community was rated the worst Standard Metropolitan Statistical Area in the country in terms of its economic conditions.[45]

### The 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: young age (<19 years); single-parent status; low socioeconomic status (SES). The study design nevertheless allowed the enrollment of any woman who asked to participate and who was bearing her first child. This avoided creating a program that was stigmatized as being exclusively for the poor; furthermore, 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 before their 30th week of pregnancy. They were recruited through a free antepartum clinic sponsored by the health department, the offices of private obstetricians, Planned Parenthood, the public schools, and a variety of other health and human service agencies. Approximately 10 per cent of the target population was missed because of late registration for prenatal care. An additional 10 per cent 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 were enrolled. There were no differences in age, marital status, or education between those women who participated and those who declined. Eighty-eight of 442 Whites (20 per cent) declined to participate compared to two of 48 others (mostly Black). At registration, 47 per cent of the participating women were under 19 years of age, 62 per cent were unmarried, and 61 per cent came from families in Hollingshead's social classes IV and V (semiskilled and unskilled laborers).* Fifteen per cent of the women were not at risk according to the age, marital status, or SES criteria, and 23 per cent possessed all three risk characteristics.

The 46 non-Whites were excluded from the analyses reported here because this sample was too small to provide adequate subclass sizes when other factors of importance were included in the statistical model. The analysis of the non-White sample is presented elsewhere.[46]

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*Hollingshead A: Four factor index of social status (unpublished manuscript), Yale University, 1976. 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.

## Data Collection

The interviews that produced data for this report were carried out at registration (prior to the 30th week of pregnancy) and at the 6th, 10th, 22nd, and 46th months of the children's lives. Except in a small number of cases where women inadvertently disclosed their treatment assignments, all interviews were conducted by staff members unaware of the women's treatment.

Records from the county department of social services were reviewed by a social services employee (who also was unaware of families' treatment assignment) to determine the number of days that the women and their children received public assistance during the period from the index child's birth to fourth birthday. This review was carried out on women who were either unmarried, teenagers, or from social classes IV or V, for these conditions made them more likely to use public assistance; or whose interview data concerning public assistance use indicated that they had been recipients. Those cases in which women were believed to receive public assistance were treated as missing data if they moved out of the county for more than two months, even if partial public assistance data (based on the record review) were available. There were two exceptions to this rule:

- If the results of the record review indicated that the woman had been on public assistance for fewer days than indicated by her interview data, and she had moved out of the county during the interval under consideration, the woman's interview was used as the source of data.
- If the woman had temporarily moved out of the county and there was no indication of public assistance use before or after the move (from either the interview or record review), then 0 days on public assistance was entered as the outcome of our assessment.

## Combining Treatments 1 and 2 for Analysis

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 outcomes. The combination of Treatments 1 and 2 is referred to hereafter as the comparison group. Treatment 4 is referred to as the nurse-visited (NV) group, or in the tables as "NV Pregnancy/Infancy." Treatment 3 is labeled in the tables as "NV Pregnancy" (nurse-visited during pregnancy). Estimates of treatment differences focused on the contrast of NV-Pregnancy/Infancy vs the comparison group for both the whole sample and those groups defined at risk. The statistical model and methods of analysis are discussed in the Appendix.

## Results

### Preintervention Treatment Conditions

Table 2 shows that before assignment to treatment conditions, the nurse-visited and comparison-group women were equivalent on all standard sociodemographic background characteristics. They differed, however, on some social support and psychological characteristics: In contrast to the women in the comparison group, there was a trend for the nurse-visited group to expect less accompaniment to labor and delivery; the nurse-visited unmarried women had a greater sense of control; and the poor, unmarried teenagers assigned a nurse reported receiving greater support from their boy friends. Because sense of control and husband/boy friend

support were more consistently related 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 first two variables in the statistical model as covariates.

### Attrition

During the first four years after delivery, the women's rates of attrition varied from 15 per cent to 21 per cent (depending on assessment period) and there were no differences across treatments in the proportion of subjects with completed assessments. The nurse-visited women who discontinued the program, however, tended to have a greater sense of control over their lives than did those in the control group who discontinued. An examination of the reasons for these women's dropping out of the program indicated that they had either moved or miscarried. Because a larger number of women with greater sense of control discontinued in the nurse-visited group than did those in the comparison group, the preintervention treatment difference in sense of control for unmarried women was reduced in the sample on which 46th-month interviews were carried out.

### Educational Achievement

Table 3 shows that among women who had not graduated from high school when they registered for the study, 59 per cent of the nurse-visited and 27 per cent of the comparison group had either graduated or had enrolled in an educational program by their 6th month postpartum. By the 10th month postpartum, the effect of the program held only for those women who had been unmarried at registration. There were no treatment differences in the proportion of women who graduated or remained in high school at the 22nd month postpartum, and there were no treatment differences by the 46th month postpartum in overall educational achievement.

### Employment, Child Care, and Public Assistance

Table 4 shows that between birth and the 22nd month after delivery, nurse-visited, poor, unmarried older women had worked two and one-half times longer than their counterparts in the comparison group. By the 46th month postpartum, the nurse-visited, poor, unmarried teenagers also had begun to work more than their counterparts in the comparison group, leading to an 82 per cent increase in the number of months worked by nurse-visited, poor, unmarried women (both teenagers and older) in contrast to poor, unmarried women in the control group. A qualitative analysis of the employment data revealed that at the time of the 46th month interview, most of the women who worked held unskilled labor and service positions; some held semiskilled jobs; a few were clerical and sales workers.

Table 4 also indicates that at both the 10th and 22nd month interviews, the nurse-visited, poor, unmarried teenagers reported greater concern about eventually finding employment than did the poor, unmarried teens in the comparison group, in spite of equivalent employment histories at those points in time. Among the poor, unmarried older women, those who were nurse-visited reported at the 22nd month interview less concern about finding employment.

At the 10th month postpartum, in contrast to their comparison-group counterparts, the nurse-visited, poor, unmarried older women reported that other family members helped them more with child care. During the first two years after delivery, the nurse-visited, poor, unmarried older women were on public assistance 157 fewer days than poor, unmarried older women in the comparison group (a 40 per

TABLE 2—Estimates of Preintervention Treatment Differences and 95% Confidence Intervals for Maternal Background Characteristics

| Dependent Variable | Treatment Group | Whole Sample | | Poor, Unmarried Women | |
|---|---|---|---|---|---|
| | | X̄ | N | X̄ | N |
| Hollingshead social class score | Comparison | 58.02 | (165) | 41.05 | (67) |
| (range: 22–128)[a] | NV Pregnancy | 57.59 | (90) | 41.63 | (36) |
| | NV Pregnancy/Infancy | 59.21 | (99) | 43.95 | (37) |
| | Comparison-NV Infancy | −1.19 | | −2.90 | |
| | C.I. | (−6.70, 4.32) | | (−7.48, 1.68) | |
| Maternal age at registration | Comparison | 19.28 | (165) | 18.79 | (67) |
| (range: 14–34) | NV Pregnancy | 19.52 | (90) | 19.08 | (36) |
| | NV Pregnancy/Infancy | 19.50 | (99) | 18.90 | (37) |
| | Comparison-NV Infancy | −0.22 | | −0.11 | |
| | C.I. | (−0.82, 0.38) | | (−0.99, 0.77) | |
| Maternal education (years completed) | Comparison | 11.25 | (165) | 10.60 | (67) |
| (range: 7–17) | NV Pregnancy | 11.58 | (90) | 10.93 | (36) |
| | NV Pregnancy/Infancy | 11.32 | (99) | 10.68 | (37) |
| | Comparison-NV Infancy | −0.07 | | −0.08 | |
| | C.I. | (−0.41, 0.27) | | (−0.57, 0.41) | |
| Maternal sense of control[b] | Comparison | 12.21 | (165) | 11.95 | (67) |
| (range: 7–14) | NV Pregnancy | 12.31 | (90) | 12.30 | (36) |
| | NV Pregnancy/Infancy | 12.44 | (99) | 12.33 | (37) |
| | Comparison-NV Infancy | −0.23 | | −0.38 | |
| | C.I. | (−0.64, 0.18) | | (−0.98, 0.22) | |
| No. people/helping network | Comparison | 5.30 | (165) | 4.86 | (67) |
| (range: 0–10) | NV Pregnancy | 5.16 | (90) | 4.30 | (36) |
| | NV Pregnancy/Infancy | 5.01 | (99) | 4.83 | (37) |
| | Comparison-NV Infancy | 0.29 | | 0.03 | |
| | C.I. | (−0.37, 0.95) | | (−0.94, 1.00) | |
| No. intimates/helping network | Comparison | 1.75 | (165) | 2.01 | (67) |
| (range: 0–10) | NV Pregnancy | 2.08 | (90) | 1.78 | (36) |
| | NV Pregnancy/Infancy | 1.57 | (99) | 1.62 | (37) |
| | Comparison-NV Infancy | 0.18 | | 0.39 | |
| | C.I. | (−0.22, 0.58) | | (−0.23, 1.01) | |
| No. kin/helping network | Comparison | 3.42 | (165) | 2.44 | (67) |
| (range: 0–10) | NV Pregnancy | 3.09 | (90) | 1.98 | (36) |
| | NV Pregnancy/Infancy | 3.09 | (99) | 2.09 | (37) |
| | Comparison-NV Infancy | 0.33 | | 0.35 | |
| | C.I. | (−0.18, 0.84) | | (−0.40, 1.10) | |
| Expected accompaniment to labor and delivery | Comparison | 9.66 | (165) | 9.23 | (67) |
| (range: 0–16)[c] | NV Pregnancy | 9.36 | (90) | 9.31 | (36) |
| | NV Pregnancy/Infancy | 9.04 | (99) | 8.69 | (37) |
| | Comparison-NV Infancy | 0.62 | | 0.54 | |
| | C.I. | (−0.12, 1.36) | | (−0.17, 1.25) | |
| Grandmother support[d] | Comparison | 0.12 | (165) | 1.17 | (67) |
| (range: −7.10 to 16.10) | NV Pregnancy | −1.07 | (90) | −1.56 | (36) |
| | NV Pregnancy/Infancy | −0.07 | (99) | 1.33 | (37) |
| | Comparison-NV Infancy | 0.19 | | −0.16 | |
| | C.I. | (−1.26, 1.64) | | (−2.64, 2.32) | |
| Husband/boyfriend support[e] | Comparison | 0.85 | (165) | −4.90 | (67) |
| (range: −13.20 to 12.40) | NV Pregnancy | 1.55 | (90) | −2.53 | (36) |
| | NV Pregnancy/Infancy | 0.34 | (99) | −0.49 | (37) |
| | Comparison-NV Infancy | 0.51 | | −4.41 | |
| | C.I. | (−1.52, 2.54) | | (−7.37, −1.45) | |

(continued)

**TABLE 2—(continued)**

| Dependent Variable | Treatment Group | Whole Sample | | | Poor, Unmarried Women | | |
|---|---|---|---|---|---|---|---|
| | | X̄ | | N | X̄ | | N |
| | | Odds | | | Odds | | |
| Proportion husband/boyfriend employed | Comparison | 2.23 | 0.69 | (150) | 0.67 | 0.40 | (43) |
| | NV Pregnancy | 2.70 | 0.37 | (83) | 1.04 | 0.51 | (32) |
| | NV Pregnancy/Infancy | 2.45 | 0.71 | (92) | 1.22 | 0.55 | (35) |
| | Odds Ratio | 1.10 | | | 1.82 | | |
| | C.I. | (0.58, 2.08) | | | (0.77, 4.44) | | |

aValues less than 59 indicate Hollingshead classes IV and V.
bScale measuring extent to which women felt in control over their life circumstances, using a short-form variant of Rotter's locus of control instrument.[47]
cScale summarizing women's responses to 2 Likert scales measuring their confidence that the individual they identified as support person would accompany them to labor room and to delivery. Higher scores indicate greater confidence.
dScale characterizing availability, contact, and anticipated help with pregnancy and childrearing from the women's own mothers. Higher scores indicate greater support.
eScale characterizing availability, contact, and anticipated help with pregnancy and childrearing from the women's husbands or boyfriends. Higher scores indicate greater support.

Note: Odds Ratio = $\dfrac{\text{NV-Pregnancy/Infancy}}{\text{Comparison}}$

cent reduction); this effect, however, did not extend into the two-year period following the end of the intervention at the 24th month postpartum.

**Subsequent Pregnancies**

During the first 22 months after delivery, nurse-visited, poor, unmarried women had one-third as many subsequent pregnancies as poor unmarried women in the comparison group (Table 5). Between birth and 46 months postpartum, this reduction in number of subsequent pregnancies was present for the sample as a whole (for which there was a 23 per cent reduction), but as before it was concentrated among the poor, unmarried women (for whom there was a 43 per cent reduction). These differences in number of subsequent pregnancies were reflected in (nonsignificant) reductions in the number of births and spontaneous abortions, and in an interval between the birth of the first and second child that was an average of 12 months longer.

*Discussion*

During the first four years after delivery of their first child, nurse-visited women who had not completed their high school education at the time they registered in the study returned to school more rapidly than their comparison-group counterparts; and nurse-visited women who were poor and unmarried were employed 82 per cent more of the time, had 43 per cent fewer subsequent pregnancies, and delayed the birth of their second child an average of 12 months longer. The effects of the program on employment were conditioned by the age of the mothers and the period during which assessments of employment were carried out. During the first two years postpartum, the nurse-visited, poor, unmarried older women worked more than their counterparts in the comparison group, but the nurse-visited, poor, unmarried teenagers did not do so. The nurse-visited, poor, unmarried teenagers were more concerned about eventually finding work, however, and during the two-year period after the program ended, they began to work more than poor, unmarried teens in the comparison group.

With a program designed to respond flexibly to the individual needs of socially disadvantaged families, it makes sense that the positive effects of the program would depend on the families' circumstances. That the impact of the program on educational achievement would be greater among women who had not graduated from high school is consistent with the program plan, in that the nurses emphasized the importance of the young women at least completing their high school education. That the effect of the program was only temporary suggests that many young women sought employment as soon as they were old enough to do so, irrespective of what impact this might have on their long-term educational achievement. While many of the nurse-visited women apparently shifted their focus to earning a living, their counterparts in the comparison group caught up with them educationally.

Unmarried, poor women are at increased risk for welfare dependence once they bear a child,[22] so it is with this particular group that one would expect the program to have the greatest opportunity for improvement in employment status. It makes sense that the nurses' success in helping unmarried, poor women find employment would be conditioned by the women's age, because employment opportunities for adolescents were limited and because a substantial number were still trying to complete their high school education. The increase in number of months that the nurse-visited poor, unmarried teenagers worked during the two-year period after the program ended may be explained by their increasing age and their having returned to school more rapidly after delivery. It is worth noting (Table 4) that while the nurse-visited poor, unmarried teens worked more than their counterparts in the comparison groups, both groups worked more during the two-year follow-up period than they had during the first two years after delivery. The difference in employment probably was influenced by the reduction in number of subsequent pregnancies, although it also may be argued that the nurse-visited women's educational and occupational aspirations and achievements contributed to the prevention of repeated pregnancy.[5,48]

The marked reduction in subsequent pregnancy among poor, unmarried women is consistent with the nurses' efforts to prevent *unintended* pregnancy. Although the extent to which pregnancy is unintended among unwed women and adolescents is unclear,[49] it is more likely to be unintended in these groups than among older, married women.[50,51] From the available data, we are unable to determine the extent to which this reduction in subsequent pregnancy reflects in-

TABLE 3—Estimates of Treatment Effects and 95% Confidence Intervals for Educational Achievement at 6, 10, 22, and 46 Months Postpartum (Adjusted for Covariates Husband/Boy Friend Support, Maternal Sense of Control, Maternal Age, and Social Class)

| Dependent Variables | Treatment Group | Women < 12 Years Education at Registration | | | Unmarried Women < 12 Years Education at Registration | | |
|---|---|---|---|---|---|---|---|
| | | Odds | X̄ | N | Odds | X̄ | N |
| Proportion enrolled or graduated (6th month postpartum)[a] | Comparison | 0.37 | 0.27 | (52) | 0.54 | 0.35 | (42) |
| | NV-Pregnancy | 0.35 | 0.26 | (20) | 0.22 | 0.18 | (13) |
| | NV-Pregnancy/Infancy | 1.44 | 0.59 | (35) | 2.23 | 0.69 | (28) |
| | Odds Ratio | 3.89 | | | 4.12 | | |
| | C.I. | (1.04, 15.48) | | | (1.20, 15.18) | | |
| Proportion enrolled or graduated (10th month postpartum)[a] | Comparison | 0.56 | 0.36 | (51) | 0.45 | 0.31 | (41) |
| | NV-Pregnancy | 0.56 | 0.36 | (21) | 0.47 | 0.32 | (12) |
| | NV-Pregnancy/Infancy | 1.08 | 0.52 | (34) | 1.50 | 0.60 | (27) |
| | Odds Ratio | 1.93 | | | 3.33 | | |
| | C.I. | (0.63, 6.25) | | | (0.96, 11.70) | | |
| Proportion enrolled or graduated (22nd month postpartum)[a] | Comparison | 0.61 | 0.38 | (49) | 0.67 | 0.40 | (38) |
| | NV-Pregnancy | 1.63 | 0.62 | (20) | 1.78 | 0.64 | (12) |
| | NV-Pregnancy/Infancy | 1.08 | 0.52 | (32) | 0.85 | 0.46 | (26) |
| | Odds Ratio | 1.77 | | | 1.27 | | |
| | C.I. | (0.49, 6.11) | | | (0.38, 4.06) | | |
| Number of years education completed month postpartum) | Comparison | — | 11.13 | (54) | — | 11.46 | (42) |
| | NV-Pregnancy | — | 11.54 | (21) | — | 11.91 | (12) |
| | NV-Pregnancy/Infancy | — | 11.35 | (41) | — | 11.53 | (33) |
| | Comparison-NV Infancy | | −0.22 | | | −0.07 | |
| | C.I. | | (−0.83, 0.39) | | | (−0.62, 0.48) | |

[a]Dichotomous variable constructed to distinguish those women who at the time of interview had either graduated from high school, remained in high school, or enrolled in some other form of vocational training from those who had dropped out of high school before graduating.

Note: Odds Ratio = $\dfrac{\text{NV-Pregnancy/Infancy}}{\text{Comparison}}$

creased knowledge on the part of the nurse-visited women about how to prevent unintended pregnancy as opposed to their protecting their new prospects for educational and occupational achievement.

The presence of treatment effects concentrated on groups in greatest need in these areas is conceptually coherent, consistent with the program plan, and in keeping with at least one other intervention study addressing these issues.[28] The recent evaluation of Project Redirection, a national demonstration program aimed at helping young disadvantaged women attain economic self-sufficiency, found the strongest and most enduring effects to be concentrated among the most disadvantaged women.[28]

Several earlier studies also indicated that program effects on subsequent pregnancy, education, and employment disappeared within two to three years after the service ended.[23,28,29] In the current study, the corresponding pattern is mixed. For the sample as a whole, the impact of the program on subsequent pregnancy became stronger over time, while it began to diminish for the poor unmarried women. For those who had not yet graduated from high school, the influence of the program on educational achievement was short-lived; but for the poor, unmarried teenagers its impact on employment was not realized until after the program ended — once they became old enough to hold jobs.

Despite their coherence, these findings must be viewed with caution. Before the provision of services, the nurse-visited, unmarried women exceeded their comparison-group counterparts in sense of personal control, and the nurse-visited poor, unmarried teenagers exceeded their counterparts in boy friend support. Although we adjusted statistically for these preintervention differences, it is possible that there were other associated conditions that biased the sample in unknown ways. It should be emphasized, nevertheless, that this preintervention difference was attenuated because nurse-visited women with a greater sense of control discontinued the study more frequently than did their comparison-group counterparts. Moreover, no other preintervention differences were detected after a careful examination of the sample for a wide range of conditions that might bias relevant treatment contrasts.

Another reason for caution in interpretation is that the positive results of the current study were focused on specific at-risk subgroups. It may be argued that such findings have a greater chance of being sampling artifacts than do findings present for the sample as a whole. We do not subscribe to this interpretation, however, for two reasons. First, the effects detected for particular high-risk groups emerged from a series of planned comparisons incorporated in a set of statistical models that included factors (risk characteristics) identified at the stage of research design and used for sample recruitment (see Appendix). The second reason is the coherence of the findings.

There are a number of features of the present study that

**TABLE 4—Estimates of Treatment Differences and 95% Confidence Intervals for Employment, Child Care, and Public Assistance Outcomes (Adjusted for Husband/Boy Friend Support and Maternal Sense of Control)**

| Dependent Variable | Treatment Group | Whole Sample | | Poor, Unmarried Teenagers (<19 years at registration) | | Poor, Unmarried Older Women (≥19 years at registration) | |
|---|---|---|---|---|---|---|---|
| | | X̄ | N | X̄ | N | X̄ | N |
| No. months employed (0–22 months postpartum) | Comparison | 5.89 | (122) | 2.17 | (26) | 3.61 | (25) |
| | NV Pregnancy | 7.57 | (63) | 1.56 | (10) | 5.41 | (12) |
| | NV Pregnancy/Infancy | 6.15 | (72) | 2.06 | (15) | 9.27 | (10) |
| | Comparison-NV Infancy C.I. | −0.26 (−2.22, 1.70) | | 0.11 (−4.67, 4.89) | | −5.66 (−11.12, −0.20) | |
| No. months employed (0–46 months postpartum) | Comparison | 12.65 | (127) | 10.03 | (28) | 7.14 | (26) |
| | NV Pregnancy | 17.01 | (69) | 5.03 | (12) | 15.08 | (13) |
| | NV Pregnancy/Infancy | 15.18 | (81) | 14.90 | (16) | 16.41 | (12) |
| | Comparison-NV Infancy C.I. | −2.53 (−7.29, 2.23) | | −4.87 (−13.89, 4.15) | | −9.26 (−19.45, 0.91) | |
| | Comparison-NV Infancy C.I. | | | −7.07 (0.25, 13.89) | | | |
| Concern about finding work[a] (10th month postpartum) | Comparison | 2.17 | (128) | 2.48 | (27) | 2.64 | (25) |
| | NV Pregnancy | 2.43 | (67) | 1.98 | (11) | 2.39 | (12) |
| | NV Pregnancy/Infancy | 2.38 | (74) | 3.44 | (16) | 2.26 | (11) |
| | Comparison-NV Infancy C.I. | −0.21 (−0.58, 0.16) | | −0.96 (−1.69, −0.23) | | 0.38 (−0.45, 1.21) | |
| Concern about finding work (22nd month postpartum) | Comparison | 1.92 | (121) | 1.90 | (25) | 2.65 | (26) |
| | NV Pregnancy | 2.24 | (62) | 1.97 | (10) | 2.51 | (11) |
| | NV Pregnancy/Infancy | 1.97 | (71) | 2.67 | (15) | 1.77 | (10) |
| | Comparison-NV Infancy C.I. | −0.05 (−0.43, 0.33) | | −0.77 (−1.51, −0.03) | | 0.88 (0.05, 1.71) | |
| Help with child care[b] (10th month postparum) | Comparison | 2.64 | (130) | 2.96 | (28) | 2.36 | (26) |
| | NV Pregnancy | 2.77 | (67) | 2.46 | (11) | 2.57 | (12) |
| | NV Pregnancy/Infancy | 2.76 | (74) | 2.77 | (16) | 3.17 | (11) |
| | Comparison-NV Infancy C.I. | −0.12 (−0.42, 0.18) | | 0.19 (−0.39, 0.77) | | −0.81 (−1.47, −0.15) | |
| Help with child care (22nd month postpartum) | Comparison | 2.76 | (125) | 2.68 | (26) | 2.52 | (26) |
| | NV Pregnancy | 2.94 | (64) | 2.83 | (11) | 2.70 | (12) |
| | NV Pregnancy/Infancy | 2.83 | (72) | 2.80 | (15) | 3.05 | (10) |
| | Comparison-NV Infancy C.I. | −0.07 (−0.40, 0.26) | | −0.12 (−0.77, 0.53) | | −0.53 (−1.26, 0.20) | |
| Help with child care (46th month postpartum) | Comparison | 3.00 | (107) | 3.02 | (23) | 2.71 | (17) |
| | NV Pregnancy | 2.97 | (60) | 2.64 | (9) | 3.25 | (10) |
| | NV-Pregnancy/Infancy | 3.18 | (76) | 2.95 | (13) | 3.22 | (12) |
| | Comparison-NV Infancy C.I. | −0.18 (−0.48, 0.12) | | 0.07 (−0.54, 0.68) | | −0.51 (−1.17, 0.15) | |
| No. days on public assistance (0–22 months postpartum) | Comparison | 244 | (122) | 352 | (52) | 396 | (26) |
| | NV Pregnancy | 268 | (63) | 471 | (22) | 265 | (12) |
| | NV Pregnancy/Infancy | 236 | (72) | 419 | (25) | 239 | (10) |
| | Comparison-NV Infancy C.I. | 8 (−76, 92) | | −67 (−223, 89) | | 157 (−23, 337) | |
| No. days on public assistance (0–48 months postpartum) | Comparison | 530 | (127) | 815 | (54) | 851 | (26) |
| | NV Pregnancy | 510 | (69) | 1020 | (25) | 443 | (13) |
| | NV Pregnancy/Infancy | 437 | (81) | 899 | (28) | 684 | (12) |
| | Comparison-NV Infancy C.I. | 93 (−78, 264) | | −84 (403, 235) | | 167 (−222, 556) | |

[a]Likert scale indicating frequency of worrying about finding work (range: 1 to 4).
[b]Scale based on average frequency of help with specific child care tasks (e.g., diaper changing, dressing, toilet training, feeding, playing) provided by other family members and friends (range: 1 to 4.86).

**TABLE 5—Estimate of Treatment Differences and 95% Confidence Intervals for Subsequent-Pregnancy Outcomes (Adjusted for Husband/Boy Friend Support and Maternal Sense of Control)**

| Dependent Variable | Treatment Group | Whole Sample | | | Poor, Unmarried Women | | |
|---|---|---|---|---|---|---|---|
| | | Log Incidence | X̄ | N | Log Incidence | X̄ | N |
| No. pregnancies (0–22 months) | Comparison | −0.81 | 0.44 | (124) | −0.67 | 0.51 | (52) |
| | NV-Pregnancy | −1.17 | 0.31 | (64) | −0.76 | 0.46 | (23) |
| | NV-Pregnancy/Infancy | −0.97 | 0.38 | (72) | −1.77 | 0.17 | (25) |
| | Comparison-NV Infancy C.I. | 0.16 (−0.33, 0.65) | | | 1.10 (0.15, 2.05) | | |
| No. pregnancies (0–46 months) | Comparison | 0.06 | 1.06 | (126) | 0.0 | 1.02 | (54) |
| | NV-Pregnancy | −0.11 | 0.90 | (68) | 0.03 | 1.03 | (24) |
| | NV-Pregnancy/Infancy | −0.20 | 0.82 | (79) | −0.54 | 0.58 | (28) |
| | Comparison-NV Infancy C.I. | 0.26 (−0.04, 0.56) | | | 0.56 (0.03, 1.09) | | |
| No. spontaneous abortions (0–46 months) | Comparison | −2.08 | 0.13 | (126) | −2.21 | 0.11 | (54) |
| | NV-Pregnancy | −2.11 | 0.12 | (68) | −1.87 | 0.15 | (24) |
| | NV-Pregnancy/Infancy | −2.30 | 0.10 | (79) | −3.44 | 0.03 | (28) |
| | Comparison-NV Infancy C.I. | 0.22 (−0.63, 1.07) | | | 1.23 (−0.93, 3.39) | | |
| No. therapeutic abortions (0–46 months) | Comparison | −3.18 | 0.04 | (126) | −2.08 | 0.12 | (54) |
| | NV-Pregnancy | −2.95 | 0.05 | (68) | −1.80 | 0.17 | (24) |
| | NV-Pregnancy/Infancy | −3.02 | 0.05 | (79) | −2.31 | 0.10 | (28) |
| | Comparison-NV Infancy C.I. | −0.16 (−1.23, 0.91) | | | 0.23 (−1.15, 1.61) | | |
| No. births including first born (0–46 mos) | Comparison | 0.62 | 1.85 | (133) | 0.58 | 1.78 | (58) |
| | NV-Pregnancy | 0.57 | 1.77 | (70) | 0.55 | 1.74 | (25) |
| | NV-Pregnancy/Infancy | 0.50 | 1.65 | (83) | 0.32 | 1.37 | (31) |
| | Comparison-NV Infancy C.I. | 0.12 (−0.10, 0.34) | | | 0.26 (−0.10, 0.62) | | |
| No. months between first and second child[a] (0–46 mos) | Comparison | — | 37.11 | (133) | — | 37.28 | (58) |
| | NV-Pregnancy | — | 41.58 | (70) | — | 42.40 | (25) |
| | NV-Pregnancy/Infancy | — | 40.76 | (83) | — | 49.33 | (31) |
| | Comparison-NV Infancy C.I. | 3.65 (−1.34, 8.64) | | | 12.05 (4.48, 19.62) | | |

[a]Variable constructed to estimate interval between first and second birth. Those women who had not given birth to a second child and were not pregnant at the 46th-month interview were assigned interval values as if they gave birth 9 months after the date of the interview. Those women who were pregnant with their second child at the 46th-month interview were assigned interval values on the basis of their expected date of delivery.

limit its generalizability to other programs and communities: First, the program was carried out under favorable circumstances. The nurses were hired and trained exclusively for this experimental program, and each nurse carried a manageable caseload. Second, the community in which the research was carried out is not representative of hard-core inner cities or extremely isolated rural communities. Third, although the women and children enrolled in this study do represent a substantial portion of the women and children in the United States, there are many to whom these results cannot be applied (e.g., Blacks, those who register for prenatal care after 30 weeks of gestation). Consequently, the present study should be replicated in other settings, with other populations, and under different administrative arrangements before its findings are used as a basis for major policy or program initiatives in this area.

Although the value of this kind of comprehensive program may be questioned on the basis of its impact on maternal life-course development alone, the potential cost-savings due to increased maternal employment and reductions in unintended pregnancy are substantial. Moreover, when considered from the standpoint of its simultaneous improvement of other aspects of maternal and child functioning, [37,38] it becomes a public health strategy worthy of careful consideration. Our results suggest that home-visiting nurses, working closely with parents and existing health and human service providers, may be able to produce demonstrable improvements in many aspects of maternal and child functioning that heretofore have been the province of several separate services. With augmented training, reasonable caseloads, and focused efforts, community health nurses could play a decisive role in reducing many of the risks and unfavorable outcomes associated with childbearing among poor, unmarried women.

# APPENDIX

## Treatment Assignment

Families enrolled in the program were stratified by marital status, race, and geographic region (based on census tract boundaries). These families were assigned at random to one of the four treatment groups. At the end of the intake interview the women drew their treatment assignments from a deck of cards. Separate decks were used for groups cross-classified by the women's race, marital status at intake, and for Whites, 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's biased-coin designs.[52] (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 random assignment of women to treatments.

- 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 assignments within households, the six new enrollees were assigned to the same treatment as their housemates.
- Second, during the last six 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 effectiveness of the infancy home-visiting program with that of Treatments 1 and 2 as a means of improving postpartum outcomes. Analysis of selected outcomes confirmed that this slight confounding of treatments with time did not affect the pattern of treatment effects reported here.

## The Basic Model and Methods of Statistical Analysis

Dependent variables for which a normal distribution was assumed were analyzed in the general linear model; dichotomous outcomes (such as educational status at 6, 10, and 22 months) in the logistic-linear model (assuming a binomial error distribution); and low-incidence outcomes in the form of counts (such as number of subsequent pregnancies) in the log-linear model (assuming a Poisson distribution).

A core model was derived consisting of a $3 \times 2 \times 2$ factorial structure: treatments (1 and 2 vs 3 vs 4) $\times$ maternal marital status (unmarried vs married) $\times$ social class (Hollingshead classes IV and V vs I, II, and III), with all interactions among these factors; two covariates measured at registration (maternal sense of control and reported husband/boy friend support) were included as well. Maternal age was also included in each analysis. For variables with assumed normal distributions, age was specified as a classification factor with two levels ($\leq$ 18 years vs > 18), as were its interactions with the three other factors. In the generalized cases (binomial and Poisson), estimation was more stable in models with fewer subclasses. Age, in these cases, was specified as a covariate.

The analyses of dichotomous dependent variables measuring whether women had either graduated from high school or were currently in some kind of educational program were carried out in the sample limited to those women who had not yet graduated from high school at the time of registration in the study. The model specified treatments, maternal marital status, and their interactions as classification effects, and age and SES as additional covariates.

A thorough investigation in all models was carried out for each covariate to examine its interactions with categorical variables. Interactions between a covariate and one or more categorical variables (nonhomogeneous regressions) indicate that certain tests of means depend on the covariate, in that a different test exists for each covariate value. This investigation was undertaken both to ensure correct interpretations of mean differences and to examine any substantive findings resulting from the interactions between continuous and categorical effects.[53]

Estimates and tests were adjusted for all covariates, classification factors, and interactions. Analysis was by our own computer programs; iterative weighted least squares was used in the generalized binomial logistic-linear and Poisson log-linear models. The means presented correspond directly to the tests: they are equally weighted averages of the smallest-subclass means, adjusted for the covariates. In the generalized case the analysis is carried out and estimates obtained in terms of the linearized form of the model — the logits (or log of the odds) in the logistic models, and the logs of the incidence in the log-linear models. The tables show the estimates in this form for the log-linear case; in the logistic case the estimates are converted to odds for individual groups and to odds ratios for the treatment contrasts. Confidence intervals were derived from the variance of the estimates and are placed on mean differences, the odds ratios, and on differences of logs of the incidence. All statements of treatment difference in the text are based on 95 per cent confidence intervals; the term "trends" refers to 90 per cent confidence

intervals. Also shown in the tables in the column labeled $\overline{X}$ is the transformation of these estimates to probabilities (for the logistic case) and to incidence (for log-linear cases).

We have reported the treatment main effects and the effects for poor unmarried women in those analyses that included treatments, social class, and marital status as the classification factors. The treatment effects are shown separately for the younger and older poor unmarried women in those analyses in which maternal age was added as a classification factor.

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# HRSA Funds $4 Million Home Health Program

More than $4 million was recently awarded by the Health Resources and Services Administration to five states under an innovative program designed to help low-income persons avoid unnecessary hospitalization by receiving health care in the home.

Grants were awarded to the states of Hawaii, Mississippi, North Carolina, South Carolina, and Utah. The states will implement the program through a variety of community-based organizations, and must contribute $1 to the program for every $3 in federal funds.

The program is intended to demonstrate how a multidisciplinary team of health and social service providers can effectively prevent unneeded hospitalization. Program funds may be used to pay for skilled medical and related health services, including those of the physician.

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