# Original Contributions

# Long-term Effects of Home Visitation on Maternal Life Course and Child Abuse and Neglect

## Fifteen-Year Follow-up of a Randomized Trial

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**Context.**—Home-visitation services have been promoted as a means of improving maternal and child health and functioning. However, long-term effects have not been examined.

**Objective.**—To examine the long-term effects of a program of prenatal and early childhood home visitation by nurses on women's life course and child abuse and neglect.

**Design.**—Randomized trial.

**Setting.**—Semirural community in New York.

**Participants.**—Of 400 consecutive pregnant women with no previous live births enrolled, 324 participated in a follow-up study when their children were 15 years old.

**Intervention.**—Families received a mean of 9 home visits during pregnancy and 23 home visits from the child's birth through the second birthday.

**Data Sources and Measures.**—Women's use of welfare and number of subsequent children were based on self-report; their arrests and convictions were based on self-report and archived data from New York State. Verified reports of child abuse and neglect were abstracted from state records.

**Main Results.**—During the 15-year period after the birth of their first child, in contrast to women in the comparison group, women who were visited by nurses during pregnancy and infancy were identified as perpetrators of child abuse and neglect in 0.29 vs 0.54 verified reports ($P<.001$). Among women who were unmarried and from households of low socioeconomic status at initial enrollment, in contrast to those in the comparison group, nurse-visited women had 1.3 vs 1.6 subsequent births ($P=.02$), 65 vs 37 months between the birth of the first and a second child ($P=.001$), 60 vs 90 months' receiving Aid to Families With Dependent Children ($P=.005$), 0.41 vs 0.73 behavioral impairments due to use of alcohol and other drugs ($P=.03$), 0.18 vs 0.58 arrests by self-report ($P<.001$), and 0.16 vs 0.90 arrests disclosed by New York State records ($P<.001$).

**Conclusions.**—This program of prenatal and early childhood home visitation by nurses can reduce the number of subsequent pregnancies, the use of welfare, child abuse and neglect, and criminal behavior on the part of low-income, unmarried mothers for up to 15 years after the birth of the first child.

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IN RECENT YEARS, home-visitation services have been promoted widely as a means of preventing a range of health and developmental problems in children from vulnerable families. The US Advisory Board on Child Abuse and Neglect, for example, has recommended that home-visitation services be made available to all parents of newborns as a means of preventing child abuse and neglect.[1]

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**See also pp 644 and 680.**

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Many of these recommendations have been based on the results of a randomized trial of a comprehensive program of prenatal and early childhood home visitation by nurses that was conducted in Elmira, NY.[2-11] Findings from this trial indicated that the program reduced the rates of subsequent pregnancy, increased labor force participation, and reduced government spending for low-income unmarried women from the birth

of the first child through the child's fourth birthday, ie, through 2 years after the program ended.[8,9] Although the rates of state-verified cases of child maltreatment among high-risk families were reduced while the program was in operation (through age 2 years),[5] the effects were attenuated during a 2-year period after the program ended,[6] most likely because of increased surveillance for child abuse and neglect set in motion among the nurse-visited families.[7] Children's health care encounters in which injuries were detected also were reduced from ages 1 through 4 years.[5,6]

Although this program produced positive effects on maternal and child health from pregnancy through the child's fourth year of life,[4-11] its long-term effects remain unexamined. The present study was conducted to determine the extent to which the beneficial effects of the program instituted early in the life cycle altered the life-course trajectories of the mothers through the child's 15th birthday. We examined the long-term effects of the program on 2 domains of maternal functioning: (1) maternal life course (subsequent number of children, use of Aid to Families With Dependent Children [AFDC], employment, substance abuse, and encounters with the criminal justice system) and (2) perpetration of child abuse and neglect. We hypothesized that the program effects, as in earlier phases of the study, would be greater for families in which the mothers experienced a larger number of chronic stressors and had fewer resources to manage the challenges of living in poverty and being a parent.

## DESIGN AND METHODS

### Setting

The study was originally conducted in and around Elmira, NY, a small city with a population of 40 000 in a semirural area of central New York State (NYS). Patients were recruited from a clinic offering free antepartum services sponsored by the county health department and the offices of private obstetricians.

### Participants

From April 1978 through September 1980, 500 consecutive eligible women were invited to participate. Pregnant women were actively recruited for the study if they had no previous live births, could register in the study prior to the 25th week of gestation, and had at least one of the following sociodemographic risk characteristics: young age (<19 years at registration), unmarried, or low socioeconomic status (SES) (Medicaid status or no private insurance). To avoid creating a program stigmatized as being exclusively for

the poor, any woman who asked to participate and had no previous live birth was accepted into the study. Approximately 10% of the target population (low income, unmarried, or teenaged) was not recruited because of late registration for prenatal care, and another 10% was not recruited because they were not referred from the offices of private obstetricians.

Four hundred of the 500 women enrolled in the study. All enrollees completed approved informed consent procedures. There were no differences in the age, education, or marital status of women who chose to enroll and those who declined; there was a difference by race, with 80% of white women vs 96% of the African-American women agreeing to participate.

Eighty-five percent of the sample originally recruited had at least 1 of the 3 risk characteristics used for recruitment. Forty-eight percent were younger than 19 years, 62% were unmarried, and 59% were from households classified as low SES[12] at registration during pregnancy. Eleven percent of the sample was African American.

### Treatment Conditions

The research design included 4 treatment conditions. Families randomized to treatment 1 (n=94) were provided sensory and developmental screening for the children at 12 and 24 months of age. Based on these screenings, the children were referred for further clinical evaluation and treatment when needed. Families randomized to treatment 2 (n=90) were provided the screening services offered those in treatment 1, plus free transportation (using a taxicab voucher system) for prenatal and well-child care through the child's second birthday. There were no differences between participants in treatments 1 and 2 in their use of prenatal and well-child care (both groups had high rates of completed appointments). Therefore, these 2 groups were combined to form a single comparison group as in earlier reports. Families randomized to treatment 3 (n=100) were provided the screening and transportation services offered those in treatment 2 in addition to being provided a nurse who visited them at home during pregnancy. Families randomized to treatment 4 (n=116) were provided the same services as those in treatment 3, except that the nurse continued to visit through the child's second birthday.

### Randomization

Women were stratified by marital status, race, and 7 geographic regions within the county (based on census tract boundaries). At the end of the intake interview, women drew their treatment assignments from a deck of cards and placed them in a sealed envelope. The cards were transferred to a research associate who managed the randomization. The stratification was executed by using separate decks of cards 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 treatment groups with smaller numbers of subjects, a procedure similar to the Efron biased coin designs.[13] Women in treatments 3 and 4 subsequently were assigned on a rotating basis, within their stratification blocks, to 1 of 5 nurse home visitors.

There were 2 deviations from this randomization procedure. First, 6 women who were enrolled were living in the same household as were other women who were already participating in the study. To avoid potential horizontal diffusion of the treatment in case of different assignments within households, the 6 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-visitation program with treatments 1 and 2 on infant health and developmental outcomes. A thorough analysis conducted at earlier phases of the trial indicated that this slight confounding of treatments with time did not affect the treatment effects.

### Program Plan and Implementation

The experimental home-visitation program was administered by Comprehensive Interdisciplinary Developmental Services, Inc, of Elmira. In the home visits, the nurses promoted 3 aspects of maternal functioning: (1) health-related behaviors during pregnancy and the early years of the child's life; (2) the care parents provided to their children; and (3) maternal personal life-course development (family planning, educational achievement, and participation in the workforce). In the service of these 3 goals, the nurses linked families with needed health and human services and attempted to involve other family members and friends in the pregnancy, birth, and early care of the child. The program was based on theories of self-efficacy, human ecology, and human attachment.[14] The nurses used detailed assessments, record-keeping forms, and protocols to guide their work with families, but adapted the content of their home visits to the individual needs of each family. They provided a comprehensive educational program designed to promote parents' and other family mem-

bers' effective physical and emotional care of their children. The nurses also helped women clarify their goals and develop problem-solving skills to enable them to cope with the challenges of completing their education, finding work, and planning future pregnancies. Developing a close working relationship with the mother and her family, the nurses helped mothers identify small achievable objectives that could be accomplished between visits that, if met, would build mothers' confidence and motivation to manage the demands of caregiving and become economically self-sufficient. The nurses completed an average of 9 (range, 0-16) visits during the pregnancy and 23 (range, 0-59) visits from the child's birth to second birthday. Details of the program can be found elsewhere.[14,15]

## Overview of Follow-up Study

The present phase of the study consists of a longitudinal follow-up of those 400 families who were randomized to treatment and comparison conditions and in which the mother and child were still alive and the family had not refused participation in earlier phases. The flow of patients from recruitment through the 15-year follow-up is presented in Table 1. As this table indicates, we completed assessments at 15 years on 81% of participants originally randomized and on 90% of women for whom there was no miscarriage, stillbirth, death (infant, child, or maternal), or child adoption. There were no treatment differences in the rates of completed assessments at the 15-year follow-up. Table 1 also shows that reviews of children's Child Protective Service (CPS) records were completed for an average of 13.4 years for those cases on which 15-year interviews were conducted with the mother. There were no treatment differences in the number of years for which we had CPS data.

## Statistical Power

Sample size and power were determined by the original design and subsequent attrition of subjects. Power calculations are given here for 3 key outcomes (number of months receiving AFDC, subsequent births, and verified reports of child abuse or neglect) with the assumption of $\alpha = .05$ and $\beta = .20$ (2-tailed tests); sample sizes as realized in the present study; and means and SDs obtained from the comparison subjects in the present study. The calculations were performed for the contrast of women in the comparison condition (treatment 1 + treatment 2) vs those in the nurse-visited-during-pregnancy-and-infancy condition (treatment 4)—for both the total sample and for the unmarried, low-SES subsample.

For the number of months receiving AFDC, a normal variable, we can detect a mean difference of 19 months in the total sample and 30 months in the higher-risk sample. For the number of subsequent births, also a normal variable, we can detect differences of 0.36 and 0.57 in the total and high-risk samples, respectively.

For the count of number of verified reports of abuse and neglect, the smallest detectable differences are 0.21 and 0.33, respectively. The actual analyses in this report use more fully specified models than those used for the power calculations, and thus have greater power.

## Masking

The mothers were informed that they were being interviewed as part of a follow-up to their participation in a study in which they originally enrolled when they were pregnant with their first child. All data were gathered by staff members who had no access to the families' treatment assignments, except in a few cases in which the mothers inadvertently revealed that they were visited by a nurse. Staff members who gathered data were told that the 15-year follow-up study was designed to assess the long-range effects of prenatal and early childhood services, including home visitation by nurses. The principal investigators and statisticians had access to the families' treatment assignments, although the operationalization of vari-

ables was made explicitly without reference to this information.

## Assessments and Definitions of Variables

Assessments conducted at earlier phases are specified in previous publications.[5,6,8] Intake interviews, which were conducted with women before randomization, included assessments of women's sociodemographic and personality characteristics (including a short-form measure of the locus of control scale of Rotter[16]), health-related behaviors, and health conditions. Women's household SES was estimated by using the Hollingshead 4-factor method[12]; families were classified into low SES (III and IV) and higher SES (I and II) levels.

At the 15th-year interview, mothers completed a life-history calendar that was designed to help them recall major life events (such as births of additional children, marriages, employment, household moves, and housing arrangements). Women were asked to estimate the number of months that they used AFDC, Medicaid, and food stamps, as well as the number of times that they were arrested or convicted from the time of the birth of their first child to the child's 15th birthday.

Women also were asked a series of questions adapted from the National Comorbidity Survey[17] regarding the impact of alcohol and other drug use on major aspects of their lives since the birth of their child. A variable was constructed

Table 1.—Profile of the Trial: Flow of Patients From Recruitment During Pregnancy Until 15 Years After Birth of First Child*

| | Treatments 1 and 2 (n=184) | Treatment 3 (n=100) | Treatment 4 (n=116) |
|---|---|---|---|
| **Program implementation** | | | |
| Completed prenatal home visits, mean (range) | . . . | 8.6 (0-16) | 8.6 (0-16) |
| Completed postnatal home visits, mean (range) | . . . | . . . | 22.8 (0-59) |
| **Intervening years** | | | |
| Fetal, infant, or child death | 10 | 7 | 9 |
| Child adopted† | 7 | 6 | 2 |
| Maternal death‡ | 1 | 1 | 0 |
| **15-y follow-up study** | | | |
| Missing (mothers) | 12 | 1 | 4 |
| Refused to participate§ | | | |
| Mothers | 6 | 5 | 4 |
| Adolescents | 10 | 8 | 7 |
| Completed assessments | | | |
| Mothers | 148 | 79 | 97 |
| Adolescents | 144 | 77 | 94 |
| Cases with CPS data‖ | 142 | 77 | 95 |
| Years of complete CPS data, mean (SD) [range] | 13.4 (3.2) [2.6-15.0] | 13.3 (3.1) [2.9-15.0] | 13.4 (3.1) [0.7-15.0] |

*Of 500 eligible patients, 100 refused participation. The 400 participants were randomized to treatment conditions: treatments 1 and 2 were combined to form a comparison group; treatment 3, nurse visitation during pregnancy; and treatment 4, nurse visitation during pregnancy and infancy. Data are given as number, unless otherwise indicated.
†There were 2 adoptions in which interviews were conducted with the child but not the mother. They are not shown in this table.
‡For both cases in which the mother died, the adolescents were interviewed.
§Refusals include 8 mothers who refused to participate during earlier phases and were not approached for the 15-year follow-up.
‖Child Protective Service (CPS) data were used to determine the number of state-verified reports of child abuse and neglect.

that summarized a count of 6 domains of women's lives that were affected by their use of alcohol (missing work, experiencing trouble at work, having a motor vehicle crash or traffic violation, having compromised care of their children, having received treatment). The same set of questions was repeated for their use of illegal and prescription drugs. The counts of domains affected by their use of alcohol and other drugs were summarized to create a "substance use behavioral impairment" scale with values ranging from 0 to 12.

Mothers provided consent for the research staff to review CPS records from states in which they resided during the interval from the birth of their first child (focal child) to that child's 15th birthday. All reports involving either the mother or the focal child were recorded.

Substantiated reports were abstracted to ascertain key features of the maltreatment incident. All NYS records were searched, as well as those of most other states in which families resided during the 15-year period. In some states, data were not available for the entire 15-year period because these states expunge their records on a periodic basis. A few other states prohibit the release of case-level information. Six cases had fewer than 4 years of CPS data, and although none was indicated for abuse or neglect, they are retained as valid cases for this analysis. As shown in Table 1, our search covered an average of more than 13 years of the 15-year period in each treatment group, and there were no treatment differences in the amount of time searched, either for the sample as a whole or for the low-SES, unmarried subgroups. The primary outcome variable reported herein is the total number of substantiated reports during the entire 15-year period involving the mother as perpetrator.

Mothers' records of arrests and criminal convictions were abstracted from the NYS Division of Criminal Justice Services, after the principal investigator (D.O.) signed a nondisclosure agreement. Cases were matched based on the women's names, birth dates, ethnicity, and Social Security numbers. Data on the number of arrests and convictions and types of offenses were abstracted from this database. Arrests were separated by whether they occurred before randomization or between the child's birth and 15th birthday. (No arrests occurred between randomization and the child's birth.)

### Statistical Models and Methods

The study was conducted with an intent-to-treat approach. After examination of a large number of classification factors and covariates, a core statistical model was derived that was consistent with the one used in the earlier phases of this research. It consisted of a 3×2×2 factorial structure and 6 covariates. The classification factors were treatments (1 and 2 vs 3 vs 4), maternal marital status (married vs unmarried, at registration), and social class (Hollingshead I and II vs III and IV, at registration). All interactions among these factors were included. The basic conclusions reported herein were not modified by or limited to one race, and race was not included in final models.

The 6 covariates included in the final model were maternal age, education, locus of control, husband or boyfriend support, mother's employment status, and father's public-assistance status, all measured at registration. These covariates had consistently significant relationships with many of the outcomes examined in this report. All covariates were tested for homogeneity of regressions for the hypothesized contrasts.[18]

Dependent variables for which a normal distribution was assumed were analyzed in the general linear model and low-frequency count data (eg, number of substantiated reports of child maltreatment) in the log-linear model (assuming a Poisson distribution). In the log-linear model, the analysis was performed and estimates obtained in terms of the logs of the incidence. We use the term *incidence* in referring to the actual count or mean of counts over specific periods of measurement.

The distributions of each of the dependent variables were carefully examined, and cases with outlying values (above 20) were truncated to 20 to reduce the likelihood that the differences observed were the result of a few extreme values. This was done for 1 outcome variable, number of days jailed.

All treatment contrasts focused on the comparison of the combination of treatments 1 and 2 (the comparison group) with treatment 4 (the pregnancy and infancy nurse-visited group), because we hypothesized that the greatest treatment effect would be exerted by the combination of prenatal and postnatal home visitation, as found in earlier evaluations.[8,9] We also show treatment effects for the group defined by women's being unmarried and from low-SES households at registration during pregnancy; this constitutes our operationalization of women's experiencing higher levels of chronic stress (being from a low-SES household) and having few personal resources to manage stress (being unmarried).

### RESULTS

We conducted detailed examinations of 17 background variables to determine the extent to which the treatment groups were equivalent for families on which 15-year assessments were completed. As indicated in Table 2, the treatment groups were equivalent both for the sample as a whole and for women who were unmarried and from low-SES households at registration.

### Rates of Subsequent Births and Use of Welfare

As indicated in Table 3, in contrast to their counterparts in the comparison group, nurse-visited unmarried women from low-SES households had fewer subsequent pregnancies ($P=.03$) and live births ($P=.02$) and greater spacing between first and second births ($P=.001$). In addition, they reported using AFDC and food stamps fewer months than did unmarried, low-SES women in the comparison group ($P=.005$ and $P=.001$, respectively).

### Substance Abuse, Criminal Justice Encounters, and Child Abuse and Neglect

Table 4 shows that nurse-visited, low-SES, unmarried women reported being impaired in fewer domains by alcohol or other drug use, having been arrested fewer times, having been convicted fewer times, and having spent fewer days in jail ($P=.005$, $P<.001$, $P=.008$, and $P<.001$, respectively) since the birth of their first child than did low-SES unmarried women in the comparison group. Data from NYS showed that nurse-visited, low-SES, unmarried women had fewer actual arrests ($P<.001$) and fewer convictions ($P<.001$).

New York State arrests were classified into 3 categories: property crimes (eg, theft), person crimes (assault, robbery), and other (eg, vice, major traffic offenses). Overall, 67% of the crimes were for property offenses, 14% were for person crimes, and 19% were for other offenses. The treatment differences for low-SES, unmarried women were present for arrests for property offenses (0.12 vs 0.60; $P<.001$), but not at conventional levels of statistical significance for person offenses (0.02 vs 0.13; $P=.10$), and other offenses (0.02 vs 0.17; $P=.12$) (data not shown).

Table 4 also shows that in contrast to women in the comparison group, those visited during pregnancy and the first 2 years of the child's life were identified as perpetrators of child abuse and neglect in fewer verified reports during the 15-year interval ($P<.001$). This effect was greater for women who were unmarried and from low-SES households at registration ($P<.001$). The effect of the program on number of verified reports was especially strong for the 4- to 15-year period after the birth of the child—ie,

Table 2.—Equivalence of Treatment Conditions on Background Characteristics Measured at Registration for Women Assessed at 15-Year Follow-up*

| Dependent Variables | Whole Sample | | | Low-SES Unmarried Sample | | |
|---|---|---|---|---|---|---|
| | Treatments 1 and 2 (n=148) | Treatment 3 (n=79) | Treatment 4 (n=97) | Treatments 1 and 2 (n=62) | Treatment 3 (n=30) | Treatment 4 (n=38) |
| Unmarried, % | 62 | 59 | 64 | ... | ... | ... |
| Low-SES household, % | 64 | 70 | 61 | ... | ... | ... |
| White, % | 90 | 91 | 86 | 87 | 87 | 77 |
| Smoker (>4 cigarettes/d), % | 47 | 46 | 58 | 51 | 60 | 59 |
| Male child, % | 55 | 44 | 55 | 44 | 53 | 49 |
| Mother working, % | 39 | 36 | 31 | 24 | 20 | 20 |
| Mother receiving public assistance, % | 9 | 10 | 13 | 23 | 29 | 20 |
| Father working, % | 70 | 70 | 67 | 42 | 50 | 52 |
| Father receiving public assistance, % | 4 | 3 | 3 | 10 | 6 | 2 |
| Husband or boyfriend in house, % | 58 | 76 | 60 | 21 | 47 | 22 |
| Maternal age, mean (SD), y | 19.3 (2.9) | 19.5 (3.1) | 19.4 (3.7) | 18.6 (2.5) | 19.0 (2.8) | 18.2 (3.3) |
| Maternal education, mean (SD), y | 11.2 (1.5) | 11.6 (1.5) | 11.1 (1.6) | 10.7 (1.4) | 10.9 (1.4) | 10.3 (1.5) |
| Husband or boyfriend education, mean (SD), y | 11.4 (1.4) | 11.7 (1.7) | 11.5 (1.6) | 11.1 (1.4) | 11.0 (1.8) | 10.8 (1.5) |
| Grandmother support†‡ | 100.4 (10.1) | 97.7 (9.2) | 101.3 (10.3) | 101.6 (10.9) | 98.1 (10.3) | 104.1 (11.2) |
| Husband or boyfriend support†‡ | 99.6 (10.5) | 102.0 (9.0) | 99.0 (9.9) | 94.2 (10.6) | 98.6 (9.4) | 96.8 (9.3) |
| Locus of control† | 99.3 (10.1) | 100.6 (9.5) | 100.6 (10.2) | 97.5 (10.2) | 99.2 (10.3) | 99.1 (9.9) |
| Incidence of maternal arrests in New York State prior to randomization§ | 0.09 (−2.50) | 0.13 (−5.41) | 0.06 (−8.98) | 0.13 (−2.03) | 0.13 (−2.02) | 0.18 (−1.71) |

*See first footnote to Table 1 for explanation of treatment groups. SES indicates socioeconomic status.
†Standardized to mean=100 and (SD)=10.
‡Locally developed scale that assesses degree to which individual provides emotional and material support to mother.
§Incidence (log incidence) represents the mean number of infrequently occurring events within stated period. Individual cases may have values greater than 1, although the range is small.

Table 3.—Adjusted Maternal Life-Course Outcomes From Birth of First Child to 15 Years*

| Dependent Variables | Whole Sample | | | | Low-SES Unmarried Sample | | | |
|---|---|---|---|---|---|---|---|---|
| | Mean No. | | | Estimate† (95% CI), Treatments 1 and 2 vs Treatment 4 | Mean No. | | | Estimate† (95% CI), Treatments 1 and 2 vs Treatment 4 |
| | Treatments 1 and 2 | Treatment 3 | Treatment 4 | | Treatments 1 and 2 | Treatment 3 | Treatment 4 | |
| Subsequent pregnancies | 2.1 | 1.9 | 1.7 | 0.4 (−0.1 to 0.8) | 2.2 | 2.0 | 1.5 | 0.7‡ (0.1 to 1.3) |
| Subsequent births | 1.6 | 1.4 | 1.3 | 0.3 (−0.0 to 0.6) | 1.6 | 1.4 | 1.1 | 0.5‡ (0.1 to 1.0) |
| Months between birth of first and second child | 37.3 | 39.8 | 41.7 | −4.4 (−14.9 to 6.1) | 37.3 | 46.6 | 64.8 | −27.5§ (−44.1 to −10.9) |
| Months receiving AFDC | 65.9 | 70.2 | 52.8 | 13.1 (−0.9 to 27.0) | 90.3 | 81.8 | 60.4 | 29.9§ (9.0 to 50.7) |
| Months employed | 89.7 | 87.5 | 96.4 | −6.7 (−20.4 to 7.0) | 80.0 | 74.9 | 95.9 | −15.9 (−36.6 to 4.6) |
| Months receiving food stamps | 56.4 | 62.0 | 47.9 | 8.5 (−6.3 to 23.3) | 83.5 | 84.0 | 46.7 | 36.8§ (14.6 to 59.0) |
| Months receiving Medicaid | 70.0 | 71.1 | 61.8 | 8.2 (−7.6 to 24.0) | 95.4 | 92.4 | 72.3 | 23.1 (−0.6 to 46.8) |

*Adjusted for socioeconomic status (SES), marital status, maternal age, education, locus of control, support from husband or boyfriend, working status, and husband or boyfriend use of public assistance at registration. See first footnote to Table 1 for explanation of treatment groups. AFDC indicates Aid to Families With Dependent Children; CI, confidence interval.
†Estimate = (treatments 1 and 2 mean) − (treatment 4 mean).
‡$P<.05$.
§$P<.01$.

the period not assessed in previous reports (data not shown).

## COMMENT

In contrast to women in the comparison group, those visited by nurses during pregnancy and the first 2 years after the birth of their first child were identified as perpetrators of child abuse and neglect in fewer verified reports. Among women who were unmarried and from low-SES households at registration, those who were visited by nurses during pregnancy and infancy had fewer subsequent children, months receiving AFDC and food stamps, behavioral impairments from use

of alcohol and other drugs, arrests, convictions, and number of days jailed during the 15-year period after birth of their first child. For most outcomes, the group that was visited only during pregnancy exhibited levels of functioning that fell in between the comparison group and the group that was visited during pregnancy and infancy, indicating a dose-response relationship for level of home visitation.

These findings have some limitations. First, most of the positive results were concentrated among mothers who were unmarried and from low-SES households at registration during pregnancy. While we hypothesized originally that the effects

would be greater for women who experienced higher levels of stress and who had fewer personal resources, we did not fully operationalize the stress and resource variables prior to the beginning of the trial. We chose to employ characteristics used for sample recruitment as indicators of chronic stress (coming from a low-SES household) and having few personal resources (being unmarried). The marital status and poverty variables chosen to reflect the personal resource and stress constructs, however, are both well-established risk factors for several adverse outcomes. The concentration of program effects in women who are unmarried and

Table 4.—Adjusted Rates of Maternal Substance Abuse, Arrests, Convictions, and Child Abuse and Neglect Reports From Birth of First Child to 15 Years*

| | Whole Sample | | | | Low-SES Unmarried Sample | | | |
|---|---|---|---|---|---|---|---|---|
| | Incidence (Log Incidence)† | | | Estimate‡ (95% CI), Treatments 1 and 2 vs Treatment 4 | Incidence (Log Incidence)† | | | Estimate‡ (95% CI), Treatments 1 and 2 vs Treatment 4 |
| Dependent Variables | Treatments 1 and 2 | Treatment 3 | Treatment 4 | | Treatments 1 and 2 | Treatment 3 | Treatment 4 | |
| Substance use impairments§ | 0.43 (−1.09) | 0.45 (−0.82) | 0.34 (−1.33) | 0.24 (−0.39 to 0.87) | 0.73 (−0.31) | 0.61 (−0.49) | 0.41 (−0.89) | 0.58‖ (0.04 to 1.11) |
| Arrests | 0.22 (−2.02) | 0.16 (−2.17) | 0.09 (−5.21) | 3.19 (−99.66 to 106.04) | 0.58 (−0.55) | 0.36 (−1.01) | 0.18 (−1.74) | 1.19‖ (0.49 to 1.89) |
| Convictions | 0.13 (−2.29) | 0.05 (−9.48) | 0.03 (−9.62) | 7.33 (−408.24 to 422.91) | 0.28 (−1.28) | 0.11 (−2.22) | 0.06 (−2.74) | 1.46‖ (0.38 to 2.54) |
| Days in jail | 0.65 (−4.36) | 0.13 (−9.20) | 0.01 (−13.36) | 9.00 (−481.52 to 499.53) | 1.11 (0.10) | 0.47 (−0.76) | 0.04 (−3.22) | 3.32‖ (2.16 to 4.48) |
| NYS arrests | 0.38 (−1.57) | 0.34 (−1.12) | 0.12 (−5.03) | 3.46 (−105.59 to 112.50) | 0.90 (−0.11) | 0.39 (−0.95) | 0.16 (−1.85) | 1.74‖ (0.94 to 2.54) |
| NYS convictions | 0.27 (−4.92) | 0.28 (−1.32) | 0.12 (−5.30) | 0.38 (−226.81 to 227.57) | 0.69 (−0.37) | 0.29 (−1.25) | 0.13 (−2.02) | 1.65‖ (0.79 to 2.52) |
| Substantiated reports of child abuse and neglect | 0.54 (−0.63) | 0.35 (−1.26) | 0.29 (−1.40) | 0.77‖ (0.34 to 1.19) | 0.53 (−0.64) | 0.63 (−0.47) | 0.11 (−2.25) | 1.61‖ (0.87 to 2.35) |

*Adjusted for socioeconomic status (SES), marital status, maternal age, education, locus of control, support from husband or boyfriend, working status, and husband or boyfriend use of public assistance at registration. See first footnote to Table 1 for explanation of treatment groups. NYS indicates New York State; CI, confidence interval.
†Incidence represents the mean number of infrequently occurring events within stated period. Individual cases may have values greater than 1, although the range is small.
‡Estimate = (treatments 1 and 2 log incidence) − (treatment 4 log incidence).
§Scale summarizes the counts of behavioral impairments (eg, missing work, motor vehicle crash) reported by women resulting from their use of alcohol and illegal drugs.
‖P<.01.

of lower SES suggests that they need these services and benefit from them to a greater extent than do those who are married and of higher SES. Consequently, such services should be made available to communities with high concentrations of low-income, unmarried women.

The second limitation is that several of the outcomes were based on self-report, which may be subject to treatment-related reporting bias. The data on maternal use of AFDC and food stamps, for example, were based on self-reports and covered up to 15-year time periods. We attempted to validate maternal report of welfare use by reviewing state and county records but found that they often were incomplete. Fortunately, we were able to obtain archived data from independent sources on other critical outcomes.

The child abuse and neglect findings, for example, were based on state archived data, which makes them less susceptible to reporting bias. Although we were unable to achieve complete reviews of these archived records for all families, they are substantially complete, and there is no indication that missing data resulted in any bias in favor of the nurse-visited groups. It should be noted, moreover, that the effects of the program overrode a tendency for nurse-visited families to be identified for maltreatment at lower thresholds of caregiving dysfunction than were families in the comparison group during the first 4 years of the child's life—a form of detection bias that worked against the hypothesis of program efficacy.[7]

Although it would have been preferable to have criminal records to corroborate the mothers' reports of all arrests and convictions, the analysis of their arrests and convictions archived in NYS produced a pattern of treatment effects that was even stronger than was found with maternal report. Thus, in spite of the knowledge nurse-visited women had of the purpose of

this study, they were at least as accurate in reporting this undesirable behavior as were women in the comparison group.

Finally, one may reasonably question the extent to which the findings of this study may be generalized to a wider range of low-SES, unmarried women today. This question led to a recently completed replication of this trial in Memphis, Tenn, with a sample of predominantly low-income, unmarried African-American mothers and their families.[19] The findings of the replication are congruent with the Elmira trial for the 2-year period after birth of the first child and indicate that the benefits of the program, at least through the first child's second birthday, are not limited by time, geography, or the sociodemographic characteristics of the families served. We believe that the results of these 2 trials now provide sufficient evidence to form a rationale for preliminary stages of program dissemination.

One of the most fundamental considerations in planning program dissemination is cost. As indicated in a forthcoming report, the reduction in family size, use of welfare, incidence of child abuse and neglect, and maternal criminality 15 years after the birth of the first child found for this program will lead to substantial savings to government in several domains of spending.[20] In considering the cost of the program (estimated to be $3300 in 1980 dollars and $6700 in 1997 dollars for 2½ years of service), it is important to note that the investment in the service, from the standpoint of government spending, was recovered for low-SES families before the child reached 4 years of age.[9] It would take longer for the investment to be recovered today because costs for such a program have increased more rapidly than costs of welfare benefits.

It is also important to note that the effects reported herein were produced

in the context of a controlled experiment, in which the program was conducted with high levels of fidelity to the underlying theoretical and clinical model.[14] The next challenge is to determine the extent to which this program can be replicated.[21] A modest dissemination effort is currently being conducted under the auspices of the US Departments of Justice and Health and Human Services that will shed light on community and organizational factors that contribute to or undermine fidelity of program implementation in new program sites.

Finally, it should be emphasized that although many different kinds of home-visitation programs have been promoted, it is incorrect to assume that our results can be applied to home-visitation programs that are not based on this model. While some other types of home-visitation programs have shown some promise,[22,23] most have failed.[3] At least 3 well-designed trials of other home-visitation programs are under way that should give us a better understanding of the range of program characteristics that can affect important aspects of maternal, child, and family functioning.[24,25] In the meantime, as health and social welfare policy is redesigned in the near future, we believe that it makes sense to begin with programs that have been tested, replicated, and found to work.

## References

1. US Advisory Board on Child Abuse and Neglect. *Creating Caring Communities: Blueprint for an Effective Federal Policy on Child Abuse and Neglect.* Washington, DC: US Dept of Health and Human Services, Administration for Children and Families; 1991.
2. Olds D, Kitzman H. Can home-visitation improve the health of women and children at environmental risk? *Pediatrics.* 1990;86:108-116.
3. Olds D, Kitzman H. Review of research on home visiting for pregnant women and parents of young children. *Future Child.* 1993;3:53-92.
4. Olds D, Henderson C, Tatelbaum R, Chamberlin R. Improving the delivery of prenatal care and outcomes of pregnancy: a randomized trial of nurse home visitation. *Pediatrics.* 1986;77:16-28.
5. Olds D, Henderson C, Chamberlin R, et al. Preventing child abuse and neglect: a randomized trial of nurse home visitation. *Pediatrics.* 1986;78:65-78.
6. Olds D, Henderson C, Kitzman H. Does prenatal and infancy nurse home visitation have enduring effects on qualities of parental caregiving and child health at 25 to 50 months of life? *Pediatrics.* 1994; 93:89-98.
7. Olds D, Henderson C, Kitzman H, et al. Effects of prenatal and infancy nurse home visitation on surveillance of child maltreatment. *Pediatrics.* 1995;95: 365-372.
8. Olds D, Henderson C, Tatelbaum R, et al. Improving the life-course development of socially disadvantaged mothers: a randomized trial of nurse home visitation. *Am J Public Health.* 1988;78:1436-1445.

9. Olds D, Henderson C, Phelps C, et al. Effects of prenatal and infancy home visitation on government spending. *Med Care.* 1993;31:155-174.
10. Olds D, Henderson C, Tatelbaum R. Intellectual impairment in children of women who smoke cigarettes during pregnancy. *Pediatrics.* 1994;93:221-227.
11. Olds D, Henderson C, Tatelbaum R. Prevention of intellectual impairment in children of women who smoke cigarettes during pregnancy. *Pediatrics.* 1994;93:228-233.
12. Hollingshead A. *Four Factor Index of Social Status.* New Haven, Conn: Yale University Social Sciences Library; 1976. Manuscript.
13. Efron B. Forcing a sequential experiment to be balanced. *Biometrika.* 1971;58:403-417.
14. Olds D, Kitzman H, Cole R, et al. Theoretical and empirical foundations of a program of home visitation for pregnant women and parents of young children. *J Community Psychol.* 1997;25:9-25.
15. Olds D. The Prenatal/Early Infancy Project. In: Price R, Cowen E, Lorion R, Ramos-McKay J, eds. *Fourteen Ounces of Prevention: A Case Book of Practitioners.* Washington, DC: American Psychological Association; 1988.
16. Rotter JB. Generalized expectancies for internal versus external control of reinforcement. *Psychol Monogr Gen Appl.* 1966;80:1.
17. Kessler R. The National Comorbidity Survey: preliminary results and future directions. *Int Rev Psychiatry.* 1994;6:365-376.
18. Henderson C. Analysis of covariance in the mixed model: higher level, nonhomogeneous, and random regressions. *Biometrics.* 1982;38:623-640.
19. Kitzman H, Olds DL, Henderson CR Jr, et al. Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing: a randomized controlled trial. *JAMA.* 1997;278:644-652.
20. Karoly LA, Everingham SS, Hoube J, et al. *Benefits and Costs of Early-Childhood Interventions: A Documented Briefing.* Santa Monica, Calif: RAND; 1997.
21. Olds D, O'Brien R, Racine D, et al. Increasing the policy and program relevance of results from randomized trials of home visitation. *J Community Psychol.* In press.
22. Gutelius MF, Kirsch AD, MacDonald S, et al. Controlled study of child health supervision: behavioral results. *Pediatrics.* 1977;60:294-304.
23. Black MM, Nair P, Kight C, Wachtel R, Roby P, Schuler M. Parenting and early development among children of drug-abusing women: effects of home intervention. *Pediatrics.* 1994;94(4, pt 1):440-448.
24. Landsverk J, Carrilio T. *San Diego Healthy Families America Clinical Trial.* San Diego, Calif: Children's Hospital and Health Center; 1995.
25. Duggan AK, Buchbinder SB, Fuddy L, Young E, Sia C. Hawaii's Healthy Start Home Visiting Program: engagement of at-risk families. Presented at the annual meetings of the Ambulatory Pediatric Association; May 7, 1996; Washington, DC.