

Enduring Effects of Nurse Home Visitation on Maternal Life Course

A 3-Year Follow-up of a Randomized Trial

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FOR SEVERAL DECADES, FEDERAL, state, and local governments and a variety of private organizations have attempted to reduce the incidence of welfare dependency, child abuse and neglect, and crime and delinquency through a variety of health and human service intervention strategies. Central to the prevention of these untoward outcomes has been the promotion of family planning, workforce participation, and competent and responsible care of the child.¹⁻³ Unfortunately, it has become increasingly clear in recent years that most social interventions designed to improve economic conditions and parental caregiving in low-income families have failed or produced only minimal effects.⁴⁻⁷ Now that welfare has been turned over to the states in the form of block grants (Temporary Assistance for Needy Families),⁸ states are searching for effective ways to help low-income, at-risk families become economically self-sufficient.⁹ While home visitation

Context A home visitation program using nurses to improve maternal and child outcomes had favorable results in a randomized trial with a primarily white, semirural population. Many of the short-term findings have been replicated with urban blacks, but whether the program will continue to demonstrate effectiveness after its conclusion is uncertain.

Objective To determine the effectiveness of a prenatal and infancy home visitation program on the maternal life course of women in an urban environment 3 years after the program ended.

Design and Setting Three-year follow-up of a randomized controlled trial of women seen consecutively between June 1990 and August 1991 at an obstetrical clinic in Memphis, Tenn, who were enrolled in a visitation program for 2 years after the birth of their first child.

Participants A cohort of 743 women who were primarily black, were pregnant for less than 29 weeks, had no previous live births, and had at least 2 sociodemographic risk factors (unmarried, <12 years of education, or unemployed).

Intervention An average of 7 (range, 0-18) home visits during pregnancy and 26 (range, 0-71) from birth to the child's second birthday.

Main Outcome Measures Rate of subsequent pregnancy, mean interval between first and second birth, and mean number of months of welfare use.

Results Compared with the control group, women who received home visits by nurses had fewer subsequent pregnancies (1.15 vs 1.34; $P=.03$), fewer closely spaced subsequent pregnancies (0.22 vs 0.32; $P=.03$), longer intervals between the birth of the first and second child (30.25 vs 26.60 months; $P=.004$), and fewer months of using Aid to Families with Dependent Children (32.55 vs 36.19; $P=.01$) and food stamps (41.57 vs 45.04; $P=.005$). Compared with the effect of the program while the program was in operation, the effect after it ended was essentially equal for Aid to Families with Dependent Children, greater for food stamps, greater for rates of closely spaced subsequent pregnancies, and smaller for rates of subsequent pregnancy overall.

Conclusions We found enduring effects of a home visitation program on the lives of black women living in an urban setting. While these results were smaller in magnitude than those achieved in a previous trial with white women living in a semirural setting, the direction of the effects was consistent across the 2 studies.

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services have been promoted as a way to help families achieve this goal,^{10,11} almost every home visitation program that has attempted to promote economic self-sufficiency has failed.^{6,12,13}

The exception to this pattern is a program of prenatal and infancy home visitation by nurses conducted with a primarily white sample in Elmira, NY, that showed effects at program termination, as well as at 4 and 15 years after delivery of the first child.^{14,15} In the Elmira trial, by 2 years after the end of the program, nurse-visited, low-income, unmarried women had 43% fewer subsequent pregnancies and greater participation in the labor force than did their counterparts randomly assigned to comparison services.¹⁴ This produced substantial savings to the government¹⁶ and was accompanied by reductions in emergency department visits and health care encounters in which childhood injuries were detected.¹⁷ Recent evidence shows that the beneficial effects of the program on maternal life course and care of the child among low-income, unmarried women lasted for up to 15 years after the first child's birth.¹⁵ The program reduced child abuse and neglect and the children's involvement with the criminal justice system, emergent use of cigarettes and alcohol, and promiscuous sexual activity.¹⁸

It is important to know whether these beneficial effects found for whites in central New York State can be reproduced with low-income minorities living in a major urban area. A recent report indicates that many of the beneficial effects of the Elmira program on qualities of parental caregiving, childhood injuries, and maternal life course were replicated with a low-income, primarily black sample in Memphis, Tenn, during the time the program was in operation (during pregnancy and the first 2 years postpartum).¹⁹ Of particular interest for the current study, nurse-visited women had 23% fewer subsequent pregnancies by the end of the program than did women assigned to the comparison group. The next major question is whether those beneficial effects endured beyond the end of the program.

We hypothesized that the program would produce maternal life-course effects 3 years after the program ended, when the children were 5 years old, that were similar to those found in the Elmira trial, with increasing program-control differences on interpregnancy intervals, increasing participation in the workforce, and decreasing use of welfare for low-income, unmarried women.^{14,15}

METHODS

The basic features of the study design have been reported earlier¹⁹ and are summarized here. All participating women completed informed consent procedures approved by the institutional review boards of the University of Rochester (for both the original and 4.5-year follow-up phases) and the University of Colorado Health Sciences Centers (for the follow-up phase).

From June 1990 through August 1991, 1290 patients who met the study inclusion criteria and were seen consecutively at the obstetrical clinic of the Regional Medical Center in Memphis were invited to participate. We actively recruited low-income, unmarried women because this group was found to benefit the most in the Elmira trial. Specifically, women who were pregnant for less than 29 weeks were recruited if they had no previous live births, no specific chronic illnesses thought to contribute to fetal growth retardation or preterm delivery, and at least 2 of the following sociodemographic risk conditions: unmarried, received less than 12 years of education, and unemployed. A total of 1139 (88%) of the 1290 eligible women gave informed consent and were randomized to 1 of 4 treatment groups described below. Ninety-two percent of the women enrolled were black, 98% were unmarried, 64% were 18 years or younger at registration, and 85% came from households with incomes at or below the federal poverty guidelines.

Individual women were randomized to treatment groups using a computer program using methods that are extensions of those given by Soares and

Wu.²⁰ The randomization was conducted within strata from a model with 5 classification factors: maternal race, maternal age, gestational age at enrollment, employment status of head of household, and geographic region of residence. Women assigned to the home visitation groups subsequently were assigned at random to a nurse home visitor.

Women in treatment group 1 (n=166) were provided free round-trip taxi-cab transportation for scheduled prenatal care appointments; they did not receive any postpartum services or assessments. Women in treatment group 2 (n=515) were provided free transportation for scheduled prenatal care and developmental screening and referral services for the child at ages 6, 12, and 24 months. Women in treatment group 3 (n=230) were provided the free transportation and screening offered in treatment group 2 and intensive nurse home visitation services during pregnancy, 1 postpartum visit in the hospital before discharge, and 1 postpartum visit in the home. Women in treatment group 4 (n=228) were provided the same services as those in treatment group 3, but also were visited by nurses until the child's second birthday. For the evaluation of the postnatal phase of the study, treatment group 2 was contrasted with treatment group 4. Only these groups were assessed after delivery of the child.

The experimental home visitation program was carried out by the Memphis/Shelby County Health Department. The nurses completed an average of 7 home visits (range, 0-18) during pregnancy and 26 home visits (range, 0-71) during the first 2 years postpartum. Six percent of those in treatment group 4 received fewer than 4 visits, the number judged by the nurses to be necessary to achieve a minimal clinical impact. Moreover, due to staff turnover resulting from a nursing shortage in Memphis, 37% of the families had disrupted relationships with their originally assigned nurse (ie, $\geq 20\%$ of their home visits were completed by >1 nurse).

The nurses followed detailed visit-by-visit guidelines to help women improve their health-related behaviors, care of their children, and life-course development (pregnancy planning, educational achievement, and participation in the workforce). To improve maternal life-course outcomes, the nurses helped women clarify their goals and solve problems that may have interfered with completing their educations, finding work, and planning future pregnancies. The nurses promoted work, education, and family planning, but did so in the context of helping women envision a future and set goals for themselves at a crucial stage in their own personal development.

The program protocols were based on theories of human ecology, human attachment, and self-efficacy.²¹ The nurses helped families make use of 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 nurses also established trusting relationships to help the women set small, achievable, behavioral objectives between visits that, when met, would increase their confidence in their ability to manage greater challenges.²²

Interviews with participating women were carried out by masked research staff members at the time of registration (prior to their assignment to treatment groups), at the 28th and 36th weeks of pregnancy, and at the sixth, 12th, 24th, and 54th months of the child's life. Interview data for the current report were derived primarily from the intake and 54th-month assessments. Administrative data from the Tennessee Department of Social Services were abstracted to determine the number of months that mothers and the first-born children were recipients of Aid to Families with Dependent Children (AFDC) and food stamps from the birth of the first child through his/her fifth birthday.

At registration, women were interviewed to determine their socioeconomic conditions, mental health,²³ personality characteristics,²⁴ obstetric

histories, health-related behaviors (cigarette smoking and alcohol and illegal drug use), and social support. A variable was created to index women's psychological resources using measures of their intelligence,²⁵ mental health,²³ and sense of mastery²⁴ plus self-efficacy (with a scale developed for this study). The psychological resource variable was dichotomized using a median split.

Four women in each of treatment groups 2 and 4 formally refused further participation in the program, and 31 women in treatment group 2 and 11 in treatment group 4 experienced a fetal or infant death. Women were interviewed at the 54th month postpartum by telephone. Of those cases randomized in which there was no fetal or child death, follow-up interviews were completed on 91% of the women (443 in treatment group 2 and 203 in treatment group 4). The number and outcomes of subsequent pregnancies (including whether the children were admitted to neonatal intensive care or special care nurseries), their educational achievements, the number of months they participated in the workforce, and the number of months that they were enrolled in AFDC, food stamps, Medicaid, and the Women, Infants, and Children nutritional supplementation program from the child's 24th to 54th months of life were assessed. Data from the 24-month interviews were used to estimate the total number of months that either the mother or her child received these benefits from birth through the 24th month postpartum and then added to the results of the 54th-month interview to estimate duration of use for the 0- to 54-month period. The 54-month interviews also assessed the rates of marriage and cohabitation, whether the current male partner was the biological father of the child, and the employment histories of current male partners.

The Tennessee Department of Human Services records were abstracted in a blinded fashion for 93% of cases (455 in group 2 and 201 in group 4) to ascertain mother or child's use of AFDC and food stamps during the period from

the first child's birth through the 60th month of life. Cases were matched on the mother's and child's names, Social Security numbers, and birth dates. Summary variables were constructed to reflect the count of the months in which either the mother or child was identified as a recipient of AFDC or of food stamps from birth to 24, 25 to 60, and birth to 60 months of the child's life. We examined the differences between mothers' self-reports of AFDC and food stamp use and the administrative data for the nurse-visited and control group women and found small differences between these sources of data and no significant treatment differences in mothers' accuracy of report. For AFDC and food stamps, we used the administrative data as outcomes. Administrative data on Medicaid and Women, Infants, and Children nutritional supplementation program benefits were not available.

A variable was created based on the count of subsequent pregnancies that had short intervals (<6 months between a subsequent conception and the end of the previous pregnancy). We used the 6-month interval because this is the threshold most commonly used to designate short intervals, given the association of intervals of less than 6 months with adverse pregnancy outcomes.^{26,27}

The women's current socioeconomic status at the 54-month postpartum interview was estimated from current occupations using the Nam and Powers method.²⁸ This procedure calculates a percentile ranking for each occupation using the US Census occupational categories, and is based on the average of the median income and educational achievement associated with each occupation.

Statistical Power and Assignment Ratios

Sample size and statistical power were established from a series of power calculations for pregnancy and infancy outcomes, leading to a smaller sample required for tests of program effects on postnatal rather than prenatal outcomes. For all power calculations, we

set $\alpha = .05$, $\beta = .20$ and specified 2-tailed tests. These calculations led to a total target sample of 750 for the postnatal phase of the study, and 743 women were enrolled. It was possible to enroll fewer women in the postnatal phase because in the Elmira study treatment effects were larger for postnatal than for prenatal outcomes. These calculations also indicated that with virtually no loss of statistical power we could assign women disproportionately, with half as many assigned to the relatively

expensive nurse-visited condition. Given the sample enrolled and retained at the 5-year follow-up, assuming for normally distributed variables that 10% of the variance is accounted for by other terms in the model, we show the estimate of the smallest detectable treatment main effect for key outcomes: mean decrease in rate of subsequent pregnancy from 1.34 to 1.10, in which $SD = 1.07$; a mean increase in interval between first birth and second birth from 26.1 to 29 months, in

which $SD = 12.7$; and a mean decrease in number of months of welfare use from 34.4 to 32.2 months, in which $SD = 17.0$.

Statistical Models and Methods of Analysis

Data analyses were conducted and reported on all cases with an intention-to-treat approach. Dependent variables were examined to determine their distributions. Normally distributed dependent variables were analyzed in the general linear model, dichotomous outcomes, such as rates of cohabitation, in the logistic-linear model (assuming a binomial distribution), and low-frequency count data, such as the count of closely spaced subsequent pregnancies, in the log-linear model (assuming a Poisson distribution). The primary statistical model focused on classification effects for treatment groups (2 vs 4) and maternal psychological resources (high vs low), plus 2 covariates (household income and census-tract poverty level). Estimates and tests were adjusted for all covariates, classification factors, and interactions. Homogeneity of regressions was tested for all covariates on the contrasts of interest.²⁹ In the generalized case, the analysis was 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 logs of the incidence in the log-linear models. We use the term *incidence* in referring to the actual count or mean of counts over specific periods of measurement.

RESULTS

As shown in TABLE 1, the treatment groups were equivalent on background characteristics, with a few exceptions: women in treatment group 4 lived in households in which the head of the household was more likely to be unemployed and in which there was less discretionary income than for women in treatment group 2. There were no additional intervention/comparison differences for subgroups defined on the basis of the women's age,

Table 1. Background Characteristics of Sample at Randomization by Treatment Condition

Characteristic	Percentage	
	Treatment Group 2 (n = 515)	Treatment Group 4 (n = 228)
White	8	11
Married	2	1
Have partner	80	80
Current partner is father of child	91	88
Live with partner	8	7
Live with father of child	7	7
Head of household employed	57	50
Consumed alcohol in last 2 wk	4	5
Smoked cigarettes in last 3 d	10	11
Used marijuana in last 2 wk	1	1
Used cocaine in last 2 wk	0	0
Positive drug screen result	5	4
Have sexually transmitted disease*	32	37
Have syphilis (prerandomization)	4	6
Previous abortion	18	18
	Mean (SD)	
	Treatment Group 2 (n = 515)	Treatment Group 4 (n = 228)
Age, y	18.1 (3.2)	18.1 (3.3)
Education, y	10.3 (1.9)	10.1 (2.0)
Income, \$†	1671.1 (6890.5)	98.8 (6611.4)
% Census tract below poverty	34.5 (21.3)	35.8 (20.5)
Housing density	0.9 (0.5)	1.0 (0.6)
IQ	96.3 (10.1)	96.5 (10.5)
Mental health‡	100.2 (10.1)	99.2 (10.5)
Maternal self-efficacy‡	100.1 (9.9)	99.7 (10.2)
Mastery‡	100.1 (10.3)	99.4 (9.9)
Maternal psychological resources‡	100.1 (10.0)	99.3 (10.7)
Grandmother support‡§	99.9 (9.8)	101.0 (9.3)
Husband/boyfriend support‡§	100.2 (10.0)	100.3 (10.1)
No. of children wanted	1.80 (0.89)	1.79 (0.86)
No. of children borne by mother's mother	4.51 (2.60)	4.88 (3.03)

*Diagnosis of either *Chlamydia trachomatis*, *Trichomonas vaginalis*, or *Neisseria gonorrhoeae* in current pregnancy prior to randomization.

†Annual household discretionary income based on income subsistence standards for Medicaid eligibility, reported household income, and number of individuals in household at registration. The low value in treatment group 4 is accurate.

‡Standardized so that mean (SD) value of 100 (10).

§A scale was developed for this study that assessed the degree to which an individual provided emotional and material support to the mother.

psychological resources, gestational age at enrollment, or randomization period. Similarly, there were no additional treatment differences on prerandomization background characteristics after removing those cases for which follow-up data were not available.

By the 54th month postpartum, as indicated in TABLE 2 and TABLE 3, nurse-visited women had fewer subsequent pregnancies (1.15 vs 1.34; $P=.03$), fewer closely spaced subsequent pregnancies (0.22 vs 0.32; $P=.03$), longer intervals between the birth of the first and second child (30.25 vs 26.60 months; $P=.004$); fewer months of using AFDC (32.55 vs 36.19; $P=.01$) and food stamps (41.57 vs 45.04; $P=.005$); higher rates of living with a partner (43% vs 32%; $P=.006$) and living with the father of the child (19% vs 13%; $P=.03$); and partners who had been employed for longer durations (35.15 vs 26.45 months; $P=.04$). There were

trends for nurse-visited women to have had fewer therapeutic abortions (0.05 vs 0.10; $P=.07$), fewer neonatal intensive care unit or special care nursery admissions for subsequent births (0.14 vs 0.20; $P=.09$), and to be married more frequently at the 54-month interview (0.15 vs 0.10; $P=.09$). Overall, the effect of the program on the rates, timing, and spacing of subsequent pregnancies was concentrated on women who initially had higher levels of psychological resources, while the effect of the program on other outcomes was essentially equivalent for both high- and low-resource mothers. There were no statistically significant program effects on maternal educational achievement or employment; use of Medicaid or Women, Infants, and Children nutritional supplementation program; and rates of subsequent spontaneous abortions, still births, live births, and live births weighing less than 2500.

To estimate the program effect on use of AFDC, food stamps, and subsequent conceptions (overall and closely spaced) while the program was in operation vs the 3-year period after the program ended, these 4 variables were disaggregated into 2 periods: birth to 24 months and 25 to 60 months (or 25 to 54 months). For AFDC, the effects were virtually identical for both periods (birth to 24 months, 13.50 vs 15.13 months; $P=.02$; and 25 to 60 months, 19.05 vs 21.06; $P=.03$; data not shown). For food stamps, the effects of the program were greater in the 3-year period following the end of the program than they were while the program was in operation (birth to 24 months, 18.21 vs 18.93; $P=.20$; and 25 to 60 months, 23.36 vs 26.12; $P=.002$). For subsequent conceptions overall, the effects were concentrated in the period while the program was in operation (birth to 24 months, 0.51 vs 0.63; $P=.03$; and 25

Table 2. Adjusted Program Effects on Maternal Life-Course*

Dependent Variable	Treatment Group 2 (n = 443)	Treatment Group 4 (n = 203)	Mean Difference or Estimate	95% Confidence Interval
No. of subsequent events				
Pregnancies	1.34	1.15	0.19†	0.01 to 0.35
Live births	0.96	0.85	0.11†	-0.02 to 0.25
Pregnancies with short intervals (<6 mo from previous delivery or termination)	0.32 (-1.15)‡	0.22 (-1.52)‡	0.37§	0.03 to 0.72
Spontaneous abortions	0.12 (-2.16)‡	0.10 (-2.31)‡	0.15§	-0.38 to 0.67
Therapeutic abortions	0.10 (-2.31)‡	0.05 (-2.95)‡	0.64§¶	-0.05 to 1.32
Still births	0.02 (-4.24)‡	0.01 (-4.67)‡	0.43§	-1.19 to 2.03
Low-birth-weight newborns (<2500 g)	0.15 (-1.88)‡	0.12 (-2.11)‡	0.23§	-0.27 to 0.72
Neonatal intensive care unit or special care admissions	0.20 (-1.60)‡	0.14 (-1.99)‡	0.39§¶	-0.07 to 0.84
No. of months				
Between birth of first and second child	26.60	30.25	-3.65#	-6.12 to -1.17
Worked (0-54)	18.84	19.89	-1.05	-3.38 to 1.28
Mother or child received Aid to Families with Dependent Children (0-60)	36.19	32.55	3.64#	0.88 to 6.40
Mother or child received food stamps (0-60)	45.04	41.57	3.47#	1.07 to 5.88
Received Medicaid (0-54)	41.08	39.59	1.49	-0.88 to 3.86
Received Women, Infants, and Children nutritional supplementation program (0-54)	23.33	21.51	1.82	-0.73 to 4.36
Status				
Highest educational level	11.67	11.61	0.06	-0.18 to 0.29
Current socioeconomic status (percentile ranking by US occupational codes)	13.73	15.62	-1.89	-4.87 to 1.07

*Values are expressed as means unless otherwise indicated. Estimates were adjusted for psychological resources, discretionary household income, and poverty level of census tract.

†The mean difference value was calculated by subtracting the mean value for treatment group 4 from the mean value for treatment group 2.

‡Values are expressed as incidence (log incidence).

§The estimate value was calculated by subtracting the log incidence for treatment group 4 from the log incidence for treatment group 2.

|| $P<.05$.

¶ $P<.10$.

$P\leq.01$.

Table 3. Adjusted Program Effects on Partner Relationships and Father's Care of the Child*

Dependent Variable	Treatment Group 2 (n = 443)	Treatment Group 4 (n = 203)	Odds Ratio (95% Confidence Interval)	P Value
Married	10	15	1.56 (0.94 to 2.59)	.09
Living with partner	32	43	1.64 (1.15 to 2.32)	.006
Living with father of child	13	19	1.68 (1.06 to 2.67)	.03
No. of months current partner employed	26.45†	35.15†	-8.70 (-17.20 to -0.19)‡	.04

*Values are expressed as percentages unless otherwise indicated. Estimates adjusted for psychological resources, discretionary household income, and poverty level of census tract.

†Values are expressed as means.

‡The mean difference (95% confidence interval) was calculated by subtracting the mean for treatment group 4 from the mean for treatment group 2.

to 54 months, 0.45 vs 0.50; $P = .41$). For closely spaced subsequent conceptions, the effect was not statistically significant for birth to 24 months (0.17 vs 0.20, $P = .14$), but was significant for 25 to 54 months (0.06 vs 0.12, $P = .02$).

COMMENT

This program of prenatal and infancy home visitation produced enduring effects on the lives of urban black women. While these effects tended to be smaller than those achieved with whites in a semirural setting,¹⁴ they are consistent in many respects with those produced in the earlier trial. In interpreting these findings, it is important to acknowledge their limitations.

Some of the outcomes were based on maternal self-report and they often covered long intervals for recall. Nevertheless, it is important to note that analyses of the AFDC and food stamp data produced virtually identical results irrespective of whether maternal report or administrative data were used as outcomes. This increases our confidence in the mother's ability to report other outcomes for which we did not have administrative data to check the accuracy of self-report.

It also is important to note that the 3- to 4-month reduction in use of AFDC and food stamps is about the same effect size observed in Elmira (a nonsignificant 2.7-month reduction) for low-income, unmarried women for the same period.¹⁴ The substantial effect of the Elmira program on welfare use did not emerge until after the children entered school.^{5,30} In comparing effects of the program on welfare benefits between

Memphis and Elmira, it is important to keep in mind that welfare benefits are substantially greater in New York State than in Tennessee. If differences do not emerge over time as expected in Tennessee, it may be attributable to the relatively smaller amount of benefits provided in Tennessee, leading women to seek employment rather than trying to subsist on welfare.

The effect of the program on use of food stamps increased after the program ended while it remained the same for AFDC. The differential timing of the program's effect on these 2 outcomes is not surprising given that AFDC income-eligibility requirements are more stringent than are those for food stamps. Improved household income would make a person ineligible for AFDC in a relatively short period, but ineligibility for food stamps would require substantially more income than the upper limit for AFDC (25% more for a family of 3 in Tennessee). Such a substantial increase in earnings would more likely occur after the woman and her partner had worked for some time.

The 14% reduction in rate of subsequent pregnancy and the 4-month greater interval between first and second births observed in the current trial are smaller than the corresponding effects in the Elmira study (43% reduction in subsequent pregnancy and a 12-month increase in interbirth intervals) for low-income, unmarried women.¹⁴ The 34% reduction in rate of closely spaced subsequent pregnancies in Memphis, nevertheless, is similar to the 36% nonsignificant reduction in short pregnancy intervals observed in the

Elmira study among low-income, unmarried women (0.14 vs 0.22). The reduction in short intervals between pregnancies is important because of its implications for the improved outcomes of subsequent pregnancies^{26,27} and for parents' abilities to become economically self-sufficient.²

The program effects on therapeutic abortions and admissions to neonatal intensive care units and special care nurseries for subsequent births in Memphis, while only marginally significant, are consistent with the reduction in subsequent pregnancies (and especially those spaced closely together) found in the current study, and likely to be real. Moreover, unpublished analyses of the Elmira data show program effects on therapeutic abortions among low-income, unmarried women at the 15-year follow-up (0.12 vs 0.26; $P = .07$) that are consistent with those observed in Memphis. (Data on neonatal intensive care unit and special care nursery admissions for subsequent births were not gathered in Elmira.) This increases the likelihood that the observed effects of the program on abortions and neonatal intensive care unit and special care admissions in Memphis are valid. The clinical and economic significance of the reduction in abortion and newborn intensive care is substantial. The implications of the reduction in closely spaced subsequent pregnancies for parents' care of their children and ability to become economically self-sufficient will be evaluated in future follow-up assessments.

The concentration of the program's impact on fertility-related outcomes among women with initially higher levels of psychological resources is consistent with program effects observed while the program was in operation,¹⁹ and may be related to differences in economic opportunities experienced by women possessing differing levels of psychological resources. The moderation of program effects by women's coping resources will be examined in greater detail in the future.

The smaller effect of the Memphis program on maternal fertility outcomes and absence of effect on mater-

nal employment compared with low-income, unmarried women in the Elmira program at corresponding periods may be due to the social and economic isolation experienced by many minority families living in inner-city neighborhoods in poverty.³¹ It may also have to do with the higher rate of staff turnover in the Memphis program due to a nursing shortage that coincided with the conduct of the trial.¹⁹

The impact of the program on the involvement of biological fathers, mothers' relationships with men, and partners' employment is also consistent with effects observed in the Elmira trial,¹⁴ including significant program effects on the stability of the mother's relationship with her child's biological father during the preschool period³² and the duration that the mother's current partner had been employed at the 15-year follow-up in Elmira.³⁰ Even though the effect of the pro-

gram on marriage was only marginally significant for this low-frequency outcome in Memphis, it is consistent with the effect of the program on partner and father involvement overall and is therefore likely to be a real program effect. Given the absence of program effect on women's duration of employment, it is reasonable to hypothesize that part of the influence of the program on women's use of welfare may be due to their greater rates of cohabitation, marriage, and involvement with men who had been employed for longer durations. We will examine the role of fathers and other factors that have contributed to women's reduced use of welfare in the future.

Since the effect of the program on the rate of subsequent pregnancies was reduced after the program ended, it is possible that the long-range effects of the program on maternal life course will not endure beyond this 3-year period after

the end of the program, as it did in Elmira. The effects of the program on closely spaced subsequent pregnancies, on partners' duration of employment, and on fathers' presence in the household, on the other hand, provide an alternative set of mechanisms through which the program may promote family economic self-sufficiency for periods beyond the current follow-up.

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