The Impact of the Mississippi Improved Child Health Project on Prenatal Care and Low Birthweight

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Abstract: A quasi-experimental, nonequivalent control group design was used to evaluate the Improved Child Health Projects in northwest Mississippi (ICHP1 and ICHP2). Control counties were selected for each project that on average were similar to ICHP counties on racial composition, median family income in 1970 and 1980, and number of births in 1978–79. The study population comprised all resident births in the ICHP and control counties during a pre-ICHP period (1975–78) and the ICHP period (1979–81).

The percentage of women with adequate prenatal care rose between the two periods for all counties; the rise was greater for the study than for the control counties for ICHP1; the reverse was found for ICHP2. For both projects, the low birthweight rate remained constant in the pre-ICHP and ICHP periods for the study and control counties. Adjustment for changes in the childbearing characteristics between the two periods did not alter these results. Community involvement in its development and coordination may explain ICHP1's impressive rise in the use of prenatal care. (*Am J Public Health* 1986; 76:274–278.)

Introduction

The Improved Child Health Project (ICHP) was initiated by the Federal Bureau of Community Health Services (BCHS) in 1978 as part of the Child Health Strategy. Its purpose was to improve pregnancy outcomes in selected areas of states with excessive infant mortality and morbidity. Funds were to be used to develop a coordinated system of comprehensive care for high-risk mothers and infants. By the end of fiscal year 1978, $2.4 million had been awarded to nine ICHPs in eight states.[1] ICHP differed from the Improved Pregnancy Outcome (IPO) Project, also part of the Child Health Strategy, in two ways: it was targeted for selected areas within a state rather than the entire state; and, up to one-fourth of funds available annually could be used for in-hospital care.

Mississippi was awarded funds for two projects, referred to here as ICHP1 and ICHP2, in the northwest Delta area of the state. ICHP1 was begun in early 1979 in four counties in this area. The project included several important service and administrative features, some of which had been field tested earlier in the Mississippi IPO Project. In addition, although some funds were used to augment currently available services in the county health departments, ICHP1 was designed as a community-wide project; public and private patients alike were eligible for many of its services.

Through ICHP funds (ICHP1) and the National Health Services Corps (NHSC), additional staff were added to county health departments and their services were intensified (A special emphasis was placed by BCHS on recruiting NHSC staff in ICHP-designated areas). New services included maternity and pediatric clinics held by physicians and pediatric nurse practitioners, home visits to high-risk mothers and infants within a week after discharge from the hospital, tracking and outreach services, social services for maternity and postpartum patients, and transportation for indigent patients. One-fourth of ICHP funds were used annually for in-hospital costs for medically indigent and financially needy patients.

Two record systems were also implemented in ICHP1. The Hollister record system[2] was used for triaging prenatal patients to the appropriate facility for care. By fiscal year 1980, the Hollister record was used in facilities performing 86 per cent of all deliveries in the four counties. A computerized tracking system to identify and follow-up patients with missed appointments was begun in November 1979, following implementation as a manual system; it was used by many local private providers as well as the county health departments.

Most importantly, ICHP1 was a community organized project. An advisory council was formed to develop the project because of the insistence of local obstetricians that they be involved in ICHP1. In addition to the Hollister record system and the tracking system, many local providers referred patients to the county health departments for social services, when needed, and participated in quarterly conferences on fetal and infant deaths, begun in 1979. A referral center was also established to which high-risk patients, public and private alike, were referred for special care.

ICHP2 was also implemented in 1979 in four counties in northwest Mississippi. Some features of ICHP1 were established in ICHP2, including expansion of health department staff, use of social services outreach workers, and use of funds for high-risk inpatient services. Others, especially those representing community support and coordination, were not implemented until 1981, a year before the end of the projects. Then, the Hollister record system was introduced, an advisory council was named, infant death reviews were begun, and two high-risk referral centers were established. Only a manual system for tracking patients was developed in ICHP2.

This report presents the results of a study of the impact of ICHP1 and ICHP2 on use of prenatal care and on pregnancy outcomes. To date, no other evaluations of ICHP have been reported, although Peoples, *et al*,[3] recently described the results of an evaluation of the Improved Pregnancy Outcome Project in North Carolina, a project also aimed at reducing poor pregnancy outcomes and providing care to high-risk maternity patients in a rural area.

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In the evaluation reported here, control counties were selected as comparisons for ICHP counties. As ICHP was being implemented, these counties were also experiencing some changes in the organization of perinatal services. In general, perinatal services provided by the health department in these counties consisted of prenatal care given by public health nurses in periodically scheduled clinics with little outreach or tracking of patients, and with few pediatric services. These services were also provided to patients in the ICHP counties before its development. During the ICHP period, high-risk referral centers were designated in the districts throughout Mississippi, but the other features of ICHP1 or ICHP2 were not implemented in the control counties.

Methods

The design of the evaluation of ICHP1 and ICHP2 is a quasi-experimental one conforming to the nonequivalent control group design defined by Campbell and Stanley.[4] This design includes an experimental and control group with impact measures taken in a pre-project and project period. For each project, the pre-project period was 1975–78 and the project period, 1979–81; 1975 was the first year for which computerized birth files were available.

The study population included all live births to residents in both the ICHP counties and the control counties during the pre-project and project periods. The source of data was computerized birth files for each year, 1975–81. The birth files were checked for internal consistency and missing data before sample selection and data analysis was begun. In the pre-ICHP period, approximately 5 per cent of births were excluded from analysis because of unknown data on birth weight, prenatal care, or maternal variables; this percentage was under 1 per cent in the ICHP period.

Control counties were chosen for each project from the pool of counties in the state in which neither the ICHP nor the IPO Project was implemented. They were selected using census and vital statistics data of counties with socioeconomic and demographic characteristics similar to the study counties; in descending order of priority, these were: percentage of Blacks in the population; median family income in 1980; median family income in 1970; and number of births in 1978–79.* From the pool of potential control counties, a group was selected for each project that, on average, was similar to the study counties on the four matching variables. Individual county-by-county matches as well as unique control groups for ICHP1 and ICHP2 were not possible since the ICHP areas had been selected because of excessive infant mortality and included many of the poorest counties in the state. The number of control counties selected was six for ICHP1 and ten for ICHP2. All six of the ICHP1 control counties were also included in the ICHP2 control counties, and represented about 40 per cent of all births in the ICHP2 control counties.

*Although 12 variables measuring the economic, demographic, and housing characteristics of the counties were initially chosen to match counties, this number proved too unwieldy. Earlier analyses indicated that race and median family income most strongly differentiated counties in Mississippi based on their combined economic, demographic, and housing characteristics and were highly correlated with county infant mortality rates. Both 1970 and 1980 median family income were matched to avoid differential changes during the study period in economic conditions between study and control counties. Number of births was used instead of birth rates to select controls in order to balance the control groups, on average, with the characteristics of the study group.

TABLE 1—Selected Demographic and Housing Characteristics, ICHP1 and ICHP2 Study and Control Counties

Demographic and Housing Characteristics[a]	ICHP1		ICHP2	
	Study Counties	Control Counties	Study Counties	Control Counties
% Black	62.9	60.7	59.5	55.8
MFI ($), 1980	10,108	10,820	11,911	12,157
MFI ($), 1970	3,705	4,102	4,925	4,549
Births, 1978–79	3,502	3,091	7,743	7,845
% Low Education[b]	44.4	40.0	37.1	35.3
% Poor[b]	48.6	43.6	41.2	38.2
% Poor Sewage[b]	16.7	21.1	6.3	16.6
Population Density	44	26	71	36
Number of Counties	4	6	4	10

a) The demographic and housing characteristics for each group are the weighted average for the total counties achieved by weighting the value for each county by the proportion of total births occurring in each.

b) % Low Education is defined as the percentage of the population aged 20–49 years with completed education less than 9 years; % Poor is defined as the percentage of population with 1979 incomes below the poverty level; % Poor Sewage is defined as the percentage of occupied dwellings without public sewage or septic tank.

Table 1 gives a comparison of the study and control counties on the matching variables and several additional demographic and housing variables. For both projects, the study counties were socioeconomically more disadvantaged than the control, particularly for ICHP1. The ICHP2 counties also had a greater percentage of Black population than the controls. On the other hand, the study counties were more densely populated and had less housing lacking proper sewage disposal. They also were geographically contiguous while the controls were not. The number of births in 1978–79 in the ICHP1 control counties was less than in the study counties because increasing the number of control counties from the pool of eligible counties would have raised the median family income and lowered the percentage of Blacks among the controls.

Two variables were studied to measure the impact of ICHP1 and ICHP2. The first was an index of adequacy of prenatal care, measured by the number of prenatal visits adjusted for trimester of first visit and length of gestation.* *[3] It was defined in the analysis by the proportion of women with adequate prenatal care. The second variable, a measure of pregnancy outcomes, was the low birth-weight (LBW) rate, defined as the proportion of infants weighing 2500 grams or less. Low birthweight is a strong predictor of neonatal mortality[4] and morbidity.[5] Neonatal mortality was not investigated as a measure of the impact of the project because the number of newborns dying during the project period was small in the ICHP counties. Moreover, it was confounded by changes in the availability of neonatal intensive care and neonatal transport to specialized care hospitals in Jackson during the study period.

The characteristics of the childbearing population—including maternal age, education, race, marital status, parity, and prior pregnancy losses—were also investigated for the pre-project and project periods in the study and control counties to determine if changes in their distribution could explain any differences found.

* *When day of last menstrual period (LMP) was not known but month was known, LMP was assigned as the 15th of that month in order to estimate length of gestation.

TABLE 2—Observed Percentages with Adequate Prenatal Care by Race, ICHP1 Study and Control Counties, 1975–78 and 1979–81

County	1975–78	1979–81	Difference
All Births			
Study Counties	38.84	53.42	14.58
(N)	(6,545)	(4,994)	(12.86, 16.30)[a]
Control Counties	37.63	46.79	9.16
(N)	(5,915)	(4,798)	(9.34, 10.98)
Non-White Births			
Study Counties	28.62	44.72	16.10
(N)	(4,963)	(3,807)	(14.18, 18.02)
Control Counties	27.47	37.45	9.98
(N)	(4,284)	(3,493)	(7.94, 12.02)
White Births			
Study Counties	70.92	80.71	9.79
(N)	(1,582)	(1,187)	(6.89, 12.69)
Control Counties	64.32	71.80	7.48
(N)	(1,631)	(1,305)	(4.29, 10.67)

a) 95% confidence limits.

TABLE 3—Observed Percentage with Adequate Prenatal Care by Race, ICHP2 Study and Control Counties, 1975–78 and 1979–81

County	1975–78	1979–81	Difference
All Births			
Study Counties	44.82	48.32	3.50
(N)	(15,154)	(11,996)	(2.32, 4.68)[a]
Control Counties	45.49	54.17	8.68
(N)	(13,566)	(11,940)	(7.50, 9.86)
Non-White Births			
Study Counties	34.97	39.80	4.83
(N)	(10,948)	(8,927)	(3.50, 6.16)
Control Counties	33.46	42.07	8.61
(N)	(9,227)	(7,979)	(7.20, 10.02)
White Births			
Study Counties	70.45	73.11	2.66
(N)	(4,206)	(3,068)	(0.62, 4.70)
Control Counties	71.03	78.54	7.51
(N)	(4,339)	(3,961)	(5.79, 9.23)

a) 95% confidence limits.

The analysis of the impact of ICHP1 and ICHP2 proceeded in two steps. We first compared the proportion of women with adequate prenatal care and the LBW rate by race between the pre-project and project periods for study and control counties. We then estimated the expected proportion of women with adequate prenatal care and the expected LBW rate by race for the project period based on the distribution of maternal characteristics in the pre-ICHP period. The proportion of women with adequate prenatal care and the LBW rate were regressed on the maternal variables for the study and control counties in 1979–81 using binary variable multiple regression. From these results, the regression coefficient for each category of each maternal variable was multiplied by the proportion of women in the pre-project period with the given characteristic. These products were then summed to achieve an expected rate (the difference between the expected and observed rates was the same regardless of whether an indirect or direct adjustment was performed).

Results

Table 2 gives the percentage of women with adequate prenatal care for the ICHP1 study and control counties by race in the pre-ICHP and ICHP years. The percentage rose in the study and control counties and for Whites and non-Whites, alike. In non-White women, the rise was substantially greater for the study counties than for the control counties. Adjustment for changes in the distribution of maternal variables between 1975–78 and 1979–81 did not alter these differences. Changes in the maternal variables consisted primarily of a shift in the maternal age distribution to older ages and a shift in the maternal education distribution to more years of completed education (data available from authors).

Table 3 presents the percentage of women with adequate prenatal care in the pre-project and project years by race for the ICHP2 study and control counties. For both White and non-White, the percentage increased in both the study and control counties, but the increase was greater in the control counties. Adjustment for changes in the maternal variables reduced the magnitude of the difference in the increase but it still remained greater for the control counties. As with ICHP1, the major changes in the maternal variables in the counties were shifts to a greater percentage of births to older mothers and more highly educated women (data available from authors).

Table 4 presents the LBW rates for ICHP1 study and control counties by race for 1975–78 and 1979–81. The LBW rate was higher in the study counties than in the control counties for both White and non-White races in 1975–78 and remained so in 1979–81. There was virtually no change in the rates between the two periods in either group of counties and adjustment for changes in the maternal variables had no effect on the rates. However, the maternal variables were only weakly associated with the LBW rate, so that it is not surprising that the expected rates are similar to the observed rates. The very low birthweight (VLBW) rate (infants weighing 1500 grams or less) rose slightly between the two periods from 1.27 to 1.60 per cent in the ICHP1 counties and from 0.96 to 1.10 per cent in the control counties.

Table 5 shows that there also was no change in the LBW rates between the pre-ICHP and ICHP years for the ICHP2 study and control counties. Adjustment for shifts in the maternal variables had little impact on the 1979–81 rates, and, as in ICHP1, the maternal variables were only weakly associated with the LBW rate. The VLBW rate was 1.35 per cent in the pre-ICHP period and 1.29 per cent in the ICHP period for study counties, compared to 1.25 and 1.16 per cent respectively, for the control counties.

TABLE 4—Observed Low Birthweight by Race, ICHP1 Study and Control Counties, 1975–78 and 1979–81

County	1975–78	1979–81	Difference
All Births			
Study Counties	9.32	9.53	0.21
(N)	(6,545)	(4,994)	(−0.87, 1.29)
Control Counties	7.76	7.69	−0.07
(N)	(5,915)	(4,798)	(−1.09, 0.95)
Non-White Births			
Study Counties	10.54	10.85	0.31
(N)	(4,963)	(3,807)	(−1.00, 1.62)
Control Counties	9.27	9.22	−0.05
(N)	(4,284)	(3,493)	(−1.34, 1.24)
White Births			
Study Counties	5.50	5.31	−0.19
(N)	(1,582)	(1,187)	(−1.90, 1.52)
Control Counties	3.80	3.60	−0.20
(N)	(1,631)	(1,305)	(−1.57, 1.17)

a) 95% confidence limits.

TABLE 5—Observed Low Birthweight by Race, ICHP2 Study and Control Counties, 1975–78 and 1979–81

County	1975–78	1979–81	Difference
All Births			
Study Counties	9.12	9.24	0.12
(N)	(15,154)	(11,996)	(−0.57, 0.81)
Control Counties	8.58	8.50	−0.08
(N)	(13,566)	(11,940)	(−0.77, 0.61)
Non-White Births			
Study Counties	10.64	10.69	0.05
(N)	(10,948)	(8,927)	(−0.81, 0.91)
Control Counties	10.38	10.50	0.12
(N)	(9,227)	(7,979)	(−0.80, 1.04)
White Births			
Study Counties	5.16	5.02	−0.14
(N)	(4,206)	(3,068)	(−1.16, 0.88)
Control Counties	4.75	4.47	−0.28
(N)	(4,339)	(3,961)	(−1.18, 0.62)

Discussion

The results of our evaluation of the ICHP in Mississippi are mixed with regard to changes in the use of prenatal care but indicate no impact of the project on pregnancy outcomes, as measured by LBW rates. Low birthweight rates did not change much in Mississippi between 1975 and 1980[7] or in the US[8] and ICHP does not appear to have altered this trend. Peoples, *et al*,[3] also found a greater proportion of women with adequate prenatal care in the IPO counties than in control counties in North Carolina, but reported no difference in LBW rates.

A greater rise in the percentage of women with adequate prenatal care occurred in the study counties than in the control counties only for ICHP1. For ICHP2, the rise was less in the study counties than in the control counties. The rise was remarkably similar in the control counties for both projects; within racial groups, the difference in the rise for the control counties between the two projects did not exceed 1.5 percentage points. This was not due to an overlapping of the counties since only 40 per cent of the counties in the ICHP2 control group were also included in the ICHP1 control group.

The marked rise in the percentage of women with adequate prenatal care in the ICHP period for ICHP1 is likely a result of the quality of the project. It was truly a community-based project from its inception, organized and utilized by private and public providers alike. Its success was also demonstrated by the greater benefit gained by non-White women, the racial group most in need of improved prenatal care before the start of the project.

The failure of the ICHP2 project to affect prenatal care may be due to problems of implemention, symptomatic of problems that antedated ICHP. ICHP2 could not emulate the model implemented in ICHP1 nor designate a referral center for high-risk maternity patients until 1981, a year before the end of the project. Moreover, from reports of admissions to antepartum nursing services, we estimated that about two-thirds of women in the ICHP1 counties used the health department for prenatal care compared to only one-third in the ICHP2 counties in the ICHP and pre-ICHP periods. In the ICHP period, these percentages were 63 per cent in the ICHP1 control counties and 56 per cent in the ICHP2 control counties; in the pre-ICHP period, they were less than 50 per cent in both control counties.

We do not know why the large rise in the use of care had no impact on LBW rates. Peoples, *et al*,[3] explained similar results in North Carolina by noting that adequacy of care does not assess quality of care. Yet, given the success with which ICHP1 was implemented, especially with regard to patient risk-rating, triage, and follow-up, it seems likely that quality as well as quantity of care were affected. The emphasis of ICHP1 was to get women into care early, keep them in care, and refer them to a perinatal center, if needed. It did not, however, concentrate on interventions, per se, such as smoking cessation, stress reduction, or early detection and monitoring for preterm labor. It is possible that prenatal care, as routinely practiced, does not reduce LBW rates, and that more aggressive treatments must be used such as interventions to delay premature labor.[9] Moreover, the possible benefits of prenatal care on less tangible measures—such as reduction of anxiety during pregnancy, maternal health, or maternal infant interaction—cannot be dismissed, but they were not studied in our evaluation.

Another possible explanation for the lack of impact of ICHP on LBW rates is related to the source and quality of the data used in our evaluation. Our evaluation was constrained by the fact that it was designed at the time of the implementation of the projects and, in order to compare a pre-ICHP and ICHP period, our evaluation was restricted to the use of routinely collected data. Thus, our study was limited in the choice of impact measures and confounding variables to those available on vital records. Medical risk, an important variable associated with use of prenatal care and LBW rates, could not be measured from the data available.

The coverage of births, especially for low birthweight infants, may be less complete in the poor counties represented in our study sample than elsewhere in the state. The LBW rates are lower than would be expected, given the extent of poverty in the sample counties. The quality of the reported data improved during the study period, as measured by the percentage of cases with unknown values. These improvements results largely from development of a computerized query system by the Department of Health Statistics.[7] It is unknown whether this query system impacted on coverage of births, but it was not developed for this purpose. The consistency of the differences in LBW rates between study and control counties in the two periods (2.56 and 2.84 per cent for the pre-ICHP and ICHP periods, respectively, for ICHP1, and 0.54 and 0.74 per cent for the respective periods for ICHP2) suggests consistency in the reporting of births. Yet, possible coverage errors represent a limitation of our evaluation.

Nevertheless, our evaluation of ICHP in Mississippi offers a model for evaluating community-based perinatal projects. It improves on most previous evaluations of similar projects[3,10]: 1) it provides by design a comparison of a pre-project and project period, and permits adjustment for changes in the distribution of the confounding variables; and 2) it utilizes census data to select control counties that were similar to study counties on economic and social characteristics so that some variables, not collected on vital records, could be controlled. In addition, the use of census data reduces bias in the choice of controls in that the variables studied to evaluate the impact of ICHP, dependent and confounding variables alike, were not utilized to select the control group.

ICHP1 did appear to improve the use of prenatal care among women in its catchment area. If we assume that increasing the use of prenatal care is a goal in its own right, then our results suggest that community involvement in the

organization, coordination, and delivery of perinatal services may be an important means to reaching this goal.

ACKNOWLEDGMENTS

Many members of the staff of the Mississippi State Board of Health were helpful to the authors in completing this research. Dr. Earl Fox, Dr. David Lohrisch, Doris Barnett, and Terry Beck were especially helpful and supportive of our work, and we wish to acknowledge them here. An earlier version of this paper was presented at the 112th annual meeting of the American Public Health Association in Anaheim, California, November, 1984. This research was supported by Grant #MCJ-240421-05-1 from Maternal and Child Health Research, Bureau of Health Care Delivery and Assistance, US Department of Health and Human Services.

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The second annual meeting of the International Society for Technology Assessment in Health Care will be held May 30–31, 1986, at the National Academy of Sciences in Washington, DC. The meeting, being held in cooperation with the World Health Organization, will feature:

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