

EFFECT OF PRENATAL CARE ON INFANT MORTALITY RATES ACCORDING TO BIRTH-DEATH CERTIFICATE FILES

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Infant mortality has decreased nationwide; however, our national rates still lag behind those of other industrialized countries, especially the rates for minority groups. This study evaluates the effect of prenatal care and risk factors on infant mortality rates in Chicago. Using linked infant birth and death certificates of Chicago residents for 1989-1995, a total of 5838 deaths occurring during the first year of life were identified. Birth certificate variables, especially prenatal care, were reviewed. Variables were compared by stratified analysis. Pearson χ^2 analysis and odd ratios (ORs) were computed.

Infant mortality rate (IMR) in Chicago decreased from 17 in 1989 to 12.6 in 1995 ($P < .0001$). Some factors increased IMR several fold: prematurity (OR 17.43), no prenatal care (OR 4.07), inadequate weight gain (OR 2.95), African-American ethnicity (OR 2.55), and inadequate prenatal care (OR 2.03). Compared with no care, prenatal care was associated with lower IMR; however, early care was associated with higher IMR and ORs than later care. These results demonstrate prenatal care is associated with lower IMR; however, compared with late prenatal care, early care does not improve IMR. Further studies should evaluate whether improving the quality of care improves IMRs. (*J Natl Med Assoc.* 1999;91:515-520.)

Key words: prenatal care ♦ infant mortality rate

Infant mortality rates (IMRs) have been considered a measure of the general health of a population because factors that contribute to infant mortality affect everyone. Infant mortality rate is the annual number of infant deaths (from birth to 365 days of life) per 1000 live births. With improved survival of low birthweight infants, infant mortality has decreased steadily in this country. Still, the lowest national IMR ever recorded, 7.2 in 1996, ranks about 20th in the

world, below 1995 IMRs for other industrialized countries: 3.7 for Sweden, 3.9 for Finland, and 4 for Japan.¹ Moreover, although IMRs in this country have decreased in every ethnic group, African Americans still suffer a two- to threefold increased mortality rate compared with whites (14.2 versus 6).¹ At our current rates, our nation will not meet the *Healthy People 2000* objectives.² Objective 14.1 requires reduction of infant mortality by the year 2000 to no more than seven infant deaths per 1000 live births and includes rates of 11 for African Americans and eight for Puerto Ricans (two groups with high mortality).²

Although the effectiveness of prenatal care has been questioned, both the public and health-care professionals accept prenatal care as an effective intervention.^{3,4} The consensus that adverse perinatal outcomes are determined by socioeconomic factors that limit access to adequate care and services has

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Table 1. Infant Mortality Rate (IMR)* in Chicago, 1989-1995 for Selected Risk Factors

Risk Factor	Frequency (%)	IMR*	Odds Ratio	95% Confidence Interval
Prematurity	10.8	84.4	17.43	16.47-18.44
No prenatal care	3.4	48.4	4.07	3.74-4.43
Inadequate weight gain	43.9	21.9	2.95	2.79-3.12
African American (versus white)	46.6	21.0	2.55	2.35-2.77
Inadequate prenatal care	12.5	24.0	2.03	1.90-2.17
Medical complications	22.4	22.2	1.99	1.88-2.10
Short birth interval	11.5	23.3	1.99	1.86-2.13
Smoking	12.2	22.7	1.83	1.71-1.96
Reproductive loss	27.5	18.8	1.61	1.53-1.71
Parity	61.6	14.8	1.25	1.18-1.32
Adolescence	19.0	16.3	1.25	1.17-1.33
Education <12 years	38.1	14.8	1.14	1.08-1.20

*IMR=number of infant deaths/1000 live births; 14.3 during the study period.

increased prenatal care utilization and the proportion of women who begin prenatal care in the first trimester of pregnancy.⁵

The city of Chicago reported an IMR of 10.8 for 1996, a 36% reduction from the 1989 rate of 17); however, the main ethnic groups had significantly different mortality rates (ie, African Americans 17.4, Hispanics 6.7, and whites 5.5).⁶ This study evaluates the effect of prenatal care on infant mortality in Chicago.

MATERIALS AND METHODS

Data on 409,280 births to women who resided in Chicago and 5838 infants born January 1, 1989-December 31, 1995 who died during the first 365 days of life were analyzed. Electronic birth certificate files from the Illinois Department of Public Health were used. The study of birth certificates has some limitations, however. Most of the information, provided voluntarily by the new mother, may not be factual or complete. Some facts can be confirmed from the medical record by the nurse or the medical record technician, eg, the trimester of initiation of prenatal care, presence of complications, and newborn characteristics. Adequacy of prenatal care received is commonly based on the trimester of pregnancy when care began and the number of visits according to the length of gestation (nine visits for a term pregnancy). This classification defines care that began in the first trimester as adequate, initiation of care in the second trimester to be intermediate, and care that began in the third trimester of

pregnancy to be inadequate.⁷

The birth certificate data of Chicago residents born between 1989 and 1995 were linked to records of deaths occurring during the first year of life. The data were grouped according to maternal and newborn characteristics. The following characteristics were included:

- maternal age (<20, 20-34, and ≥35 years),
- race or ethnicity (non-Hispanic African American, Hispanic, and non-Hispanic white),
- level of education (<12 and ≥12 years),
- smoking (yes/no),
- parity (≥1 deliveries and no previous deliveries),
- reproductive loss (≥1 abortions, miscarriages, or fetal losses and no previous losses),
- medical risk factors (≥1 factor and none),
- birth interval (<18 and ≥18 months),
- weight gain during pregnancy (<25 and ≥25 lb),
- prematurity (newborn weight <2500 and ≥2500 g),
- initiation of prenatal care (during the first, second, and third trimester of pregnancy and no prenatal care), and
- quality of prenatal care (inadequate and intermediate/adequate).

Statistical analysis was performed using SPSS MS Windows 6.1 software (Microsoft Corp, Redmond, WA). Pearson χ^2 analysis was used to evaluate the differences between the proportions. A *P* level <.05 was considered significant. Odds ratios (ORs) were

Table 2. Odds Ratios for Risk Factors for Infant Mortality in Chicago According to Prenatal Care, 1989-1995*

Risk Factor	Initiation of Care/Trimester			No Prenatal Care
	First	Second	Third	
Prematurity	20.74	11.39	6.77	10.74
Inadequate weight gain	3.04	2.10	1.20	2.69
African American (versus white)	2.59	2.10	1.64	1.80
Inadequate prenatal care	1.61	1.62	—	—
Medical complications	1.94	1.84	2.15	1.23
Short birth interval	2.05	1.68	1.48	—
Smoking	1.67	1.73	1.98	1.26
Reproductive loss	1.66	1.57	1.54	1.54
Parity	1.19	1.30	1.52	0.80
Adolescence	1.31	1.20	—	—
Education <12 years	1.15	—	—	—

*Includes significant values (95% confidence interval does not include 1).

calculated by comparing the number of deaths of infants born to women with a risk factor (per 1000 live births) with the number of deaths of infants born to women without the factor (per 1000 live births), and 95% confidence intervals (CI). The 95% CIs that excluded one were considered significant.

RESULTS

Chicago residents had an IMR of 14.3 for the period 1989-1995. Three ethnic groups comprised most of the births (95.4%) and infant deaths (98.9%) during this period. The other ethnic groups together represented only 3.5% of births during the study period, with an IMR of 4.6 (1.1% of the deaths). African Americans had 46.6% of the births and 68.5% of the infant deaths (IMR 21), Hispanics had 28.2% of the births and 18% of the infant deaths (IMR 9.1), and whites had 21.7% of the births and 12.3% of the infant deaths (IMR 8.1). Most of the deaths (68.8%) were neonatal (from birth to 28 days of life); postneonatal deaths (from 29-365 days of life) represented 31.2%. Common reasons for death included prematurity (18.3%; IMR 2.5, sudden infant death syndrome (15.9%; IMR 2.2), congenital anomalies (15.8%; IMR 2.2), other respiratory problems (9.2%; IMR 1.3), respiratory distress syndrome (7.1%; IMR 1), and other perinatal conditions (7.2%; IMR 1).⁸

Table 1 shows the frequency, IMR, and OR for the 12 factors studied. The IMR for adolescents was significantly higher compared with the other two

maternal age groups (OR 1.24 [95% CI 1.16-1.32] for 20-34 years and OR 1.37 [95% CI 1.23-1.53] for ≥35 years). However, IMRs for the second and third age groups (older women) were similar; hence, adolescents were compared with the ≥20 years group (Table 1). Compared with the other ethnic groups, African Americans displayed a significantly higher IMR (eg, compared with Hispanic women, OR 2.55 [95% CI 2.28-263]). However, Hispanics showed a similar IMR to white women (OR 1.04 [95% CI 0.94-1.15]).

Compared to women with no prenatal care, women with some prenatal care, even inadequate prenatal care, had a better IMR (48.4 versus 12.4; *P*<.0001) (Table 1). Most of the women in this study had prenatal care: 72.4% of them early during the first trimester and 23.3% of them during the second trimester of pregnancy. One may expect that early care (more opportunities to correct deviations from normal) may be associated with lower IMR than late care. However, the IMR was similar regardless of the trimester in which prenatal care began (IMR 12.3, 12.9, and 11.0; *P*=.102).

For some factors, early prenatal care showed lower IMR for the women without the factor evaluated: prematurity (*P*<.0001) and inadequate weight gain during pregnancy (*P*<.0001) (Figure 1). Women with the specified risk factors had a higher IMR with early prenatal care: prematurity (*P*<.0001), inadequate weight gain (*P*<.0001), African-American ethnicity (*P*=.006), and short birth interval (*P*=.008)

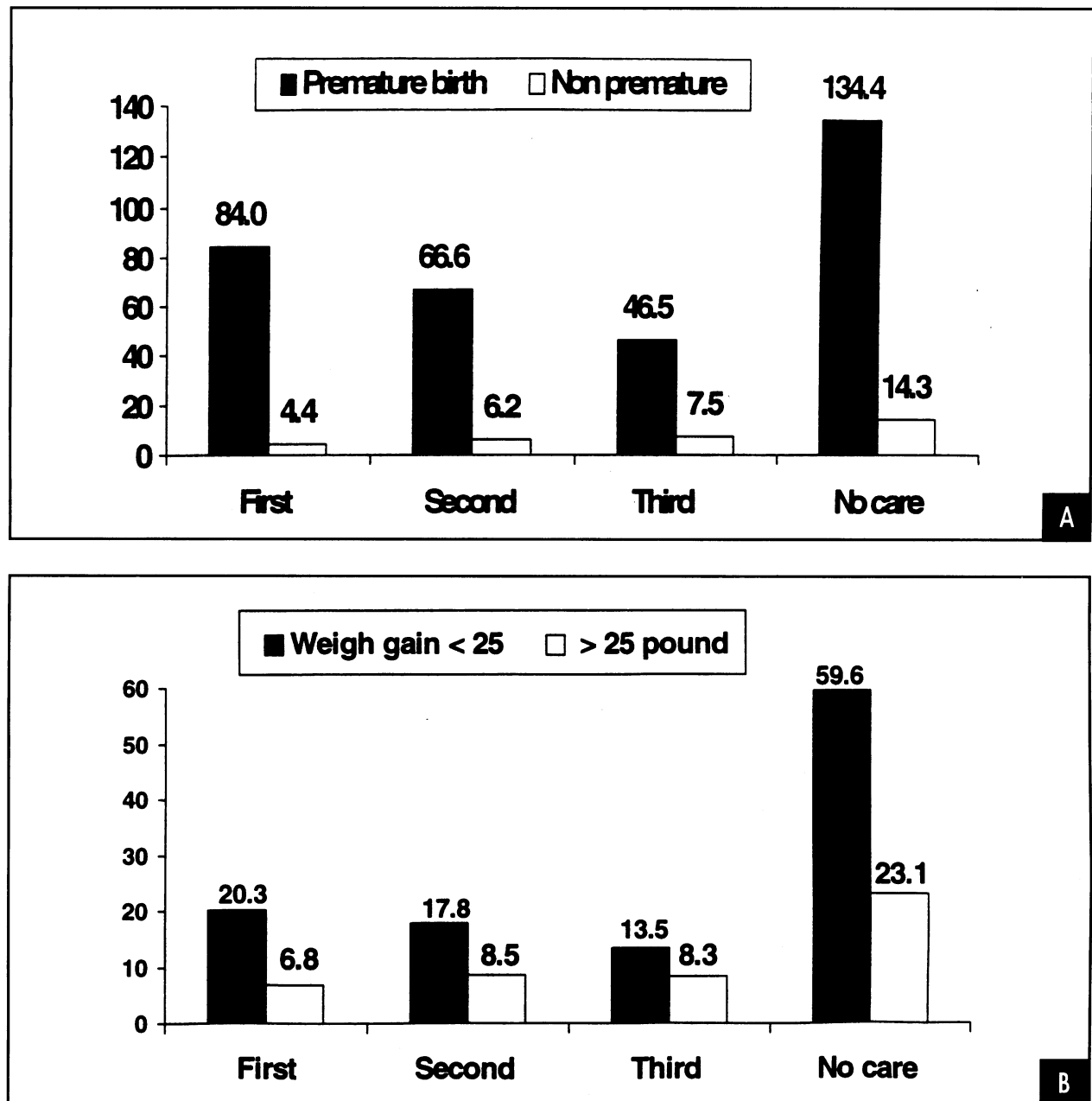


Figure 1. Infant mortality rate (IMR) according to the trimester that pregnancy care began. Women with a risk factor do not benefit from early care (higher IMR). A) Prematurity showed a decreasing trend (first versus second versus third trimester, $P < .0001$), while women without the risk factor demonstrated an increasing trend ($P < .0001$). B) Inadequate weight gain during pregnancy showed a decreasing trend ($P < .0001$), while women without the risk factor showed an increasing trend ($P < .0001$).

(Figure 2). For these factors, early prenatal care did not improve IMR. The other factors did not show an increasing or decreasing trend in relation to the trimester that prenatal care began. In general, the ORs were higher for women with risk factors who

began care during the first trimester compared with those who begin care later in pregnancy (Table 2).

DISCUSSION

During the study period, 72.4% of pregnant

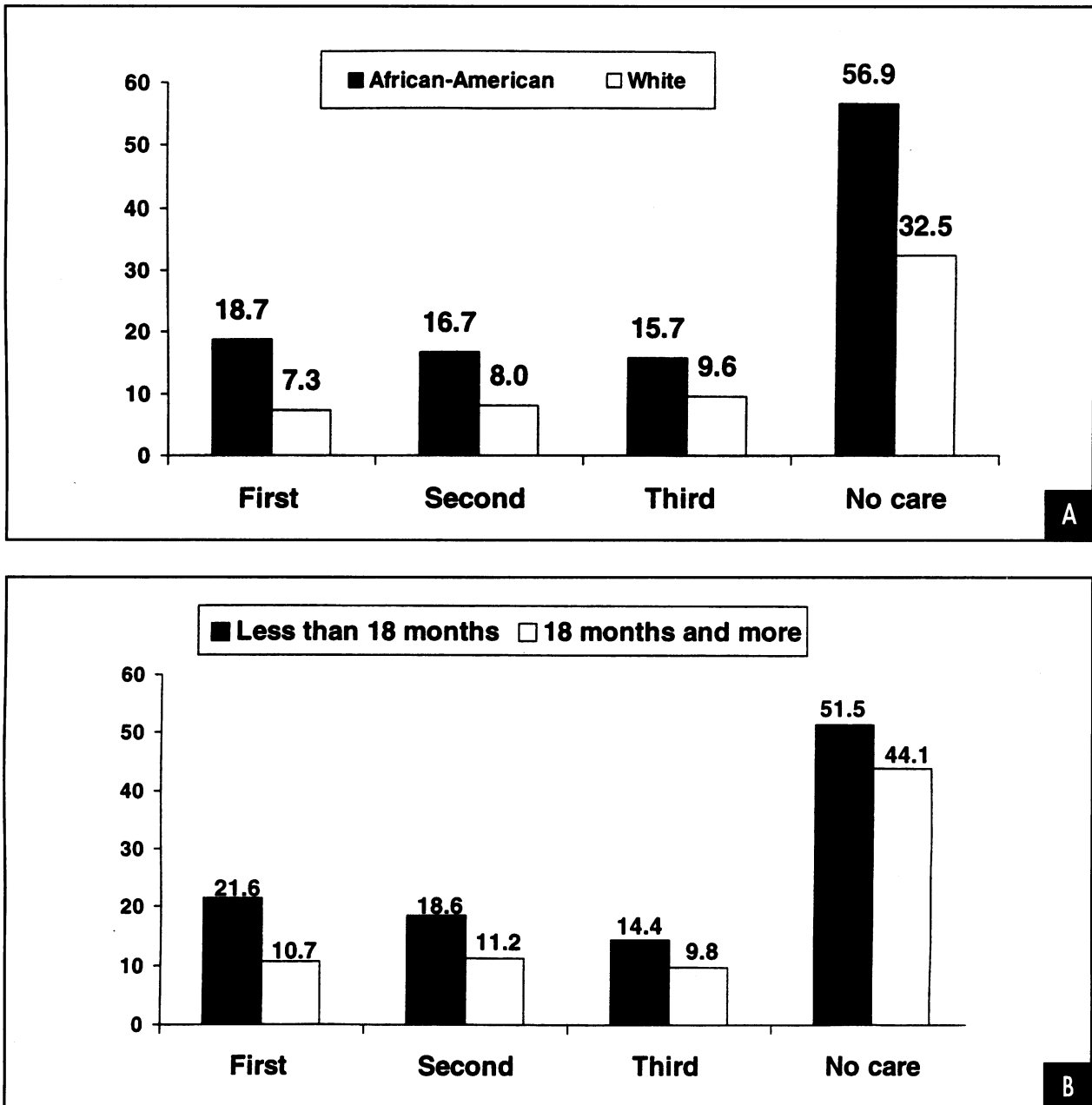


Figure 2. Infant mortality rates according to the trimester that prenatal care began. A) African Americans showed a decreasing trend ($P=.006$), while no trend was noted among whites. B) Women with an interval <18 months between births showed a decreasing trend ($P=.008$), while no trend was noted among women without the risk factor.

women in Chicago began prenatal care during the first trimester compared with 77.9% nationwide (81.3% in 1995).⁹ Of the women in this study, 12.5% had inadequate care compared with 8.9% nationwide in 1995, and 3.4% had no care compared with 1.2% nationwide in 1995.⁹ Despite better access to

prenatal care, prematurity continues to be the leading cause of infant mortality,⁴ and this rate has not shown any signs of decreasing.

This study confirms that some prenatal care, even inadequate care, results in better IMR than no care at all. Perhaps when evaluating prenatal care out-

comes, women who receive care should not be compared with women with no prenatal care because these groups are different. Women who suffer domestic violence, use drugs, or have other social problems are more likely to not seek prenatal care. These factors by themselves increase prematurity and other complications.^{10,11} Because of this consideration, we evaluated whether the trimester when prenatal care began affected IMR.

This study found that IMR was not necessarily better when prenatal care began early. When certain risk factors (eg, prematurity, weight gain <25 lb, African-American ethnicity, and short pregnancy interval) were present, IMR was higher than when the factor was absent. Still, early prenatal care showed lower IMR than late care when particular risk factors were not present (eg, prematurity, weight gain, and ethnicity). One may wonder whether a condition that induces a woman to seek early care may be associated with a higher IMR. However, the study design did not allow us to differentiate between women who initiated prenatal care early but did not continue with care and those who received continuous care throughout pregnancy.

This controversial finding may be related to the quality of prenatal care these women received. The Expert Panel on the Content of Prenatal Care Report in 1989 provided detailed guidelines for six procedures and seven types of counseling.¹² The recommended procedures included history and physical examination; weight, height, and blood pressure measurements; blood and urine tests; and cervical cytology. The recommended counseling relates to nutrition, maternal weight gain, vitamin use, smoking, alcohol and drug use, and breast feeding.¹² A report found only 56% of women received recommended procedures during the first two visits, only 32% received recommended counseling during the pregnancy, and private offices were significantly less likely to provide adequate care compared with state-funded clinics.¹² These results emphasize that we must work collectively, not only for access to prenatal care, but also for access to quality care.

Moreover, counseling young women to delay pregnancy may decrease the significance of some risk factors. If the first pregnancy occurs after the age of 20, for instance, education may improve, and

birth intervals may be longer. Planning a pregnancy may improve access to a mutually satisfying health provider and may favor prepregnancy counseling, screening, and improved conditions (eg, healthy genital flora, diet and weight, and the avoidance of smoking, alcohol, and drugs).

CONCLUSION

The birth of a healthy child to a healthy family, with the potential of reaching productive full life expectancy, represents the goal of health-care endeavors. We must continue to study the reasons for excessive IMR and attempt to modify some factors.

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