

Pregnancy-Related Mortality in New Jersey, 1975 to 1989

ABSTRACT

Objectives. National data are thought to underestimate pregnancy-related mortality in the United States. A multisource surveillance system for pregnancy-associated deaths in New Jersey offers an opportunity to identify the magnitude of and the trends in pregnancy-related mortality at the state level.

Methods. Data from all reported pregnancy-related deaths in the state from 1975 to 1989 were studied, and pregnancy mortality ratios were calculated.

Results. The New Jersey pregnancy mortality ratio decreased from the late 1970s to the early 1980s but began to rise in the late 1980s. The pregnancy mortality ratio for non-Whites was 3.6 times that for Whites for the 15-year period. The causes of pregnancy-related deaths changed over the 15-year period, with direct obstetrical causes playing a decreasing role. AIDS has become the major cause of pregnancy-related mortality in New Jersey. Finally, approximately 44% of the pregnancy-related deaths were considered to be preventable by the physician or patient or both.

Conclusions. New efforts must be made to combat the recent rise in pregnancy-related deaths, with special attention to preventing deaths among non-White women. (*Am J Public Health*. 1992;82:1085-1088)

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Introduction

In studying deaths of pregnant and postpartum women, one statistical measure used by the Centers for Disease Control (CDC) is the pregnancy mortality ratio, the number of pregnancy-related deaths per 100 000 live births.¹ Pregnancy-related deaths include both direct deaths (which result from complications of pregnancy, labor, or delivery) and indirect deaths (which result from preexisting medical conditions that are exacerbated by pregnancy). Nonmaternal deaths, not included in the pregnancy mortality ratio, involve pregnant or postpartum women who die of causes unrelated to pregnancy (e.g., injuries, homicides) within the specified time frame. "Pregnancy-associated deaths" is an all-encompassing term that includes direct, indirect, and nonmaternal deaths.

Progress in preventing pregnancy-related deaths in recent decades has been impressive. National vital statistics data compiled by the National Center for Health Statistics (NCHS) show a decline in the pregnancy mortality ratio from 376 per 100 000 live births in 1940² to 7.8 per 100 000 in 1985.³

Despite this progress, pregnancy-related mortality remains a significant public health issue for several reasons. There is reliable evidence that national vital statistics data based solely on death certificates understate pregnancy mortality rates when compared with rates measured by data systems that supplement vital records with other forms of surveillance.^{1,4,5} In addition, national rates are low only for Whites, with non-White rates being three times higher.^{3,6} Furthermore, upon review, one third to one half of pregnancy-related deaths are considered preventable.^{7,8,9} Finally, deaths from AIDS have

begun to increase the pregnancy mortality ratio in some areas.¹⁰

Instituted in 1974, multisource surveillance and review of pregnancy-related deaths in New Jersey provide an opportunity to more accurately estimate the magnitude and trends in pregnancy-related mortality.¹¹ Death certificates, maternity service reports, physicians, other hospital personnel, medical examiners, and, more recently, computer searches of death tapes and hospital discharge tapes are all sources for the identification of pregnancy-associated deaths, which are reportable by law to the New Jersey Department of Health. The New Jersey Medical Society's Subcommittee on Maternal Mortality has collaborated with the New Jersey Department of Health since 1974 in an annual review of all cases.

Methods

The New Jersey Department of Health maintains confidential case files—which include death certificates, hospital records, prenatal charts, and autopsy reports—on all women who died while pregnant or within 42 days postpartum. We compiled a database that included variables on demographic information, pregnancy history, social history, delivery, and fetal outcome. Cause of death, classification (direct, indirect, or nonma-

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TABLE 1—New Jersey Pregnancy Mortality Ratios, 1975 to 1989

	Whites Ratio (No.)	Non-Whites Ratio (No.)	Total Ratio ^a (No.) ^b
Five-year period of death			
1975–1979	15.3 (55)	62.1 (60)	24.7 (115)
1980–1984	12.7 (48)	29.8 (31)	16.1 (79)
1985–1989	11.9 (51)	52.4 (64)	20.3 (115)
Age group			
≤19	12.1 (11)	31.2 (24)	21.4 (35)
20–24	11.4 (32)	31.9 (32)	18.3 (64)
25–29	11.6 (49)	50.0 (40)	17.9 (89)
30–34	12.6 (35)	77.2 (36)	22.5 (71)
35–39	18.7 (15)	92.8 (15)	35.8 (30)
≥40	108.0 (12)	286.0 (8)	153.0 (20)

Note. The pregnancy mortality ratios were calculated from data collected on the whole population or entire subpopulations of New Jersey, not on a sample of the population, and thus confidence intervals are not necessary.

^aNumber of pregnancy-related deaths per 100 000 live births. The number of live births includes multiple births and omits miscarriages, fetal deaths, and stillbirths.

^bNumber of pregnancy-related deaths.

ternal), and preventability had been determined by consensus of the Maternal Mortality Subcommittee of the New Jersey Medical Society, and these variables were added to the database.

Pregnancy mortality ratios were calculated by year, race, age, county, insurance status, cause of death, and preventability. The denominator data (numbers of live births by year, race, age, and county) were provided by the New Jersey Department of Health's Center for Health Statistics.¹² Hispanic live births were grouped with Whites until 1989 and thus pregnancy mortality ratios could only be calculated for Whites and Hispanics combined (Whites) and for non-Hispanic Blacks, Asians, Native Americans, and all other races combined (non-Whites). The data on number of live births by insurance status for the years 1985 to 1988 were provided by the New Jersey Department of Health's Division of Health Planning and Resource Development.

Results

Of the 404 pregnancy-associated deaths reviewed by the New Jersey Medical Society, seven were not classified and 88 were classified as nonmaternal and will not be considered here. The remaining 309 pregnancy-related deaths give an overall pregnancy mortality ratio of 20.3 deaths per 100 000 live births in New Jersey for the years 1975 to 1989. The general trend in the ratio in New Jersey was downward until it began to increase after 1985, rising to a high of 33.2 in 1988. The 5-year pregnancy mortality ratio varied from 24.7 for

1975 to 1979, 16.1 for 1980 to 1984, and 20.3 for 1985 to 1989 (Table 1).

Demographic Differences

The total 15-year pregnancy mortality ratio for non-Whites was 48.0 per 100 000 live births, 3.6 times as high as the ratio for Whites (13.2 per 100 000). After a substantial decrease between the periods 1975 to 1979 and 1980 to 1985 (62.1 to 29.8), the pregnancy mortality ratio for non-Whites increased to 52.4 in 1985 to 1989, whereas the ratio for Whites continued to decline from 15.3 to 12.7 to 11.9 over the same time periods (Table 1). The non-White to White ratio of race-specific pregnancy mortality ratios changed from 4.1 for 1975 to 1979 to 2.3 for 1980 to 1984 and 4.4 for 1985 to 1989.

The pregnancy mortality ratios by age group show that the pregnancy mortality risk in New Jersey during 1975 to 1989 was far higher for women aged 40 or older (Table 1). Women aged 20 to 24 and 25 to 29 had the lowest pregnancy mortality ratios (18.3 and 17.9, respectively). Within each age group the ratio for non-Whites was higher than that for Whites.

The pregnancy mortality ratios varied considerably by county, with the highest ratios in urban counties with large non-White populations. Essex County had the highest ratio, with 38.3 pregnancy-related deaths per 100 000 live births, followed by Hudson, Mercer, and Union Counties at 31.9, 26.4, and 25.5, respectively. The county-specific pregnancy mortality ratios were correlated with county-specific non-White population percentages (Pearson correlation coefficient = .84). In 15 of

the 21 counties, the pregnancy mortality ratio for non-Whites was higher than the ratio for Whites. The remaining six counties have small non-White populations and had pregnancy mortality ratios of zero for non-Whites.

Pregnancy mortality ratios by insurance coverage could only be calculated for 1985 to 1988 because denominator data were available for only these years. Of the 97 pregnancy-related deaths that occurred during these 4 years, insurance status was recorded for 74 (73%) of them. These 74 accounted for pregnancy mortality ratios of 10.8 for those women with private insurance, 34.3 for women covered by Medicaid, and 32.7 for self-pay patients. Insurance status for live births was not available by race, so pregnancy mortality ratios by both payer and race could not be calculated.

Cause of Death

The underlying cause of death was obtained from the death certificate and presumably reflected findings on autopsy, performed in about 71% of the cases. The leading causes of pregnancy-related mortality in New Jersey changed significantly over the course of the three time periods. The cause-specific pregnancy mortality ratios for hypertension in pregnancy, thromboembolism, hemorrhage, and stroke (the leading causes of death in 1975 to 1979) all decreased in the 1980s (Table 2). The pregnancy mortality ratio for AIDS increased from 0.0 before 1985 to 2.3 per 100 000 in 1985 to 1989, the highest cause-specific ratio of that period. Other indirect causes also played an increasing role in 1985 to 1989. From 1975 to 1989, the cause-specific pregnancy mortality ratios were higher for non-Whites than Whites for every major cause of death (Table 2).

Preventability

The New Jersey Medical Society's Subcommittee on Maternal Mortality assigned preventability status to all but 7% of the pregnancy-related deaths for 1975 to 1989. Of those categorized, 56% were considered to be nonpreventable, 34% were considered to be preventable by physician factors, 5% preventable by patient factors, and 5% preventable by both patient and physician factors. Thus, for all deaths for which preventability status was assigned, 44% were considered preventable by the physician or patient or both.

The pregnancy mortality ratio for preventable deaths with a component of physician responsibility decreased from

the first time period to the second but showed no further decrease in the third (ratios of 9.5, 6.3, and 6.4, respectively) (Table 3). However, for non-Whites the pregnancy mortality ratio for physician-preventable deaths increased in the second half of the 1980s, paralleling the increase in pregnancy-related deaths as a whole for that period. For the total 15-year period, the pregnancy mortality ratio for physician-preventable deaths was 4.8 times as high for non-Whites as it was for Whites (19.5 per 100 000 compared with 4.1 per 100 000).

Discussion

Several findings in this study are of particular interest. First, we found that pregnancy mortality ratios for New Jersey are higher than the national ratios described by the NCHS, the CDC, and the Maternal Mortality Collaborative.^{3,5,6,13,14} However, a comparison of New Jersey and national data may be misleading because of different systems of surveillance and different definitions of pregnancy-related mortality. Surveillance with death certificates alone leads to underestimation of pregnancy-related mortality.^{4,5,11,15} New Jersey's multiple-source surveillance system allows the state to identify pregnancy-related deaths that might not be identified by the NCHS and the CDC in other jurisdictions.

On the other hand, New Jersey uses a 42-day postpartum period in its definition, whereas the Maternal Mortality Collaborative and the CDC use a one-year postpartum period. Of the deaths reported to the Maternal Mortality Collaborative, 11% of postpartum deaths took place after 42 days postpartum.⁵ Thus New Jersey data may underestimate the number of pregnancy-related deaths when compared with the Maternal Mortality Collaborative and the CDC. A uniform methodology for identifying, defining, and classifying pregnancy-associated deaths will have to be developed for use throughout the country before meaningful comparisons can be made.

The second issue of concern is the exceptionally high pregnancy mortality ratio for non-Whites in New Jersey (48.0/100 000). This ratio far exceeds the US Public Health Service's health objective for 1990 of a maternal death rate of less than 5 per 100 000 for any ethnic group in the United States.¹⁶ Of particular concern is the high rate of physician-preventable deaths for non-White women as compared with that for White women, which sug-

Cause of Death	All Races			Whites	Non-Whites
	1975–1979 Ratio ^a (No.) ^b	1980–1984 Ratio (No.)	1985–1989 Ratio (No.)	1975–1989 Ratio (No.)	1975–1989 Ratio (No.)
Thromboembolism	2.8 (13)	2.0 (10)	1.2 (7)	1.8 (21)	2.8 (9)
Amniotic fluid embolism	1.1 (5)	1.8 (9)	0.9 (5)	0.7 (8)	3.4 (11)
Hypertension-in-pregnancy	3.7 (17)	0.8 (4)	1.6 (9)	1.1 (13)	5.3 (17)
Ectopic pregnancy	1.5 (7)	0.6 (3)	1.8 (10)	0.6 (7)	4.0 (13)
Hemorrhage	2.4 (11)	1.8 (9)	1.6 (9)	0.7 (8)	6.5 (21)
Anesthesia complication	1.9 (9)	0.8 (4)	1.6 (9)	0.8 (9)	4.0 (13)
Abortion-related	0.4 (2)	0.4 (2)	0.7 (4)	0.1 (1)	2.2 (7)
Obstetrical infection	0.9 (4)	1.0 (5)	0.0 (0)	0.5 (6)	0.9 (3)
Cerebrovascular accident	2.2 (10)	1.6 (8)	0.4 (2)	1.3 (15)	1.5 (5)
AIDS-related	0.0 (0)	0.0 (0)	2.3 (13)	0.6 (7)	1.9 (6)
Cancer	0.6 (3)	0.0 (0)	0.4 (2)	0.3 (4)	0.3 (1)
Other direct	1.5 (7)	0.8 (4)	0.9 (5)	0.5 (6)	3.1 (10)
Other indirect	4.9 (23)	3.9 (19)	6.5 (37)	3.9 (46)	10.2 (33)
Unexplained	0.9 (4)	0.4 (2)	0.5 (3)	0.3 (3)	1.9 (6)
Total	24.7 (115)	16.1 (79)	20.3 (115)	13.2 (154)	48.0 (155)

^aNumber of pregnancy-related deaths per 100 000 live births.
^bNumber of pregnancy-related deaths.

Time Period	Total Physician-Preventable Ratio ^a (No.) ^b	Whites Physician-Preventable Ratio (No.)	Non-Whites Physician-Preventable Ratio (No.)
1975–1979	9.5 (44)	5.0 (18)	26.9 (26)
1980–1984	6.3 (31)	4.2 (16)	14.4 (15)
1985–1989	6.4 (36)	3.3 (14)	18.0 (22)
Total	7.3 (111)	4.1 (48)	19.5 (63)

^aNumber of pregnancy-related deaths per 100 000 live births.
^bNumber of pregnancy-related deaths.

gests a possible discrepancy in the quality of obstetrical care provided to Whites and non-Whites. Special efforts must be made to improve obstetrical care, access to prenatal care, and family planning services in order to reduce the number of pregnancy-related deaths among non-White women.

Also of concern are the high pregnancy mortality ratios for women on Medicaid or without any health insurance coverage. The pregnancy mortality ratios by payer calculated for 1985 to 1988 underestimate the true ratios for this period because of the exclusion of several pregnancy-related deaths for which insurance status was not known. In addition, we could not analyze the payer data by race. The interaction between race, health insurance status, and poverty should be studied in greater detail in an attempt to separate individual effects.

The data also show that indirect causes of pregnancy-related death, such

as AIDS, are replacing direct obstetrical causes in New Jersey. This trend has implications for the practice of obstetrics and the design of regional perinatal systems. Perinatal providers must now involve other medical personnel, such as infectious disease specialists, in the management of pregnancy in order to reduce mortality from indirect causes such as AIDS. Toward this end, perinatal systems will have to include a wider base of consultants to care for pregnant women with underlying disease. In addition, obstetricians and other health providers, through pre-conception counseling, must emphasize the danger of pregnancy when a significant underlying disease exists and help provide access to contraceptive services. □

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References

1. Ellerbrock TV, Atrash HK, Hogue CJR, Smith JC. Pregnancy mortality surveillance: a new initiative. *Contemp Ob/Gyn*. June 1988;23-24.
2. *Vital Statistics of the United States, 1940, Part II*. Washington, DC: Bureau of the Census; 1943.
3. Advance report of final mortality statistics, 1985. *Monthly Vital Stat Rep*. Hyattsville, Md: National Center for Health Statistics; 1986;36(suppl):41.
4. Smith JC, Hughes JM, Pekow PS, Roach RW. An assessment of the incidence of maternal mortality in the United States. *Am J Public Health*. 1984;74:780-783.
5. Roach RW, Koonin LM, Atrash HK, Jewett JF. Maternal mortality in the United States: report from the Maternal Mortality Collaborative. *Obstet Gynecol*. 1988;72:91-97.
6. Kaunitz AM, Hughes JM, Grimes DA, Smith JC, Roach RW, Katrissen ME. Causes of maternal mortality in the United States. *Obstet Gynecol*. 1985;65:605-612.
7. Gibbs CE, Locke WE: Maternal deaths in Texas, 1969 to 1973. *Am J Obstet Gynecol*. 1976;126:687-692.
8. Sachs BP, Brown DAJ, Driscoll SG, et al. Maternal mortality in Massachusetts. *N Engl J Med*. 1987;316:667-672.
9. Hansen GF, Noone TA. Maternal deaths in New Jersey. *NJ Med*. 1988;85:1020-1022.
10. Koonin LM, Ellerbrock TV, Atrash HK, et al. Pregnancy-associated deaths due to AIDS in the United States. *JAMA*. 1989;261:1306-1309.
11. Ziskin LZ, Gregory M, Kreitzer M. Improved surveillance of maternal deaths. *Int J Gynaecol Obstet*. 1979;16:281-286.
12. *New Jersey Health Statistics*. Trenton, NJ: New Jersey Department of Health, Center for Health Statistics; 1975-1989.
13. Advance report of final mortality statistics, 1978. *Monthly Vital Stat Rep*. Hyattsville, Md: National Center for Health Statistics; 1980;29(suppl):37.
14. Advance report of final mortality statistics, 1980. *Monthly Vital Stat Rep*. Hyattsville, Md: National Center for Health Statistics; 1983;32(suppl):35.
15. Rubin G, McCarthy B, Shelton J, Roach RW, Terry J. The risk of childbearing re-evaluated. *Am J Public Health*. 1981;71:712-716.
16. *Promoting Health/Preventing Disease: Objectives for the Nation*. Atlanta, Ga: US Public Health Service; 1980.

Erratum

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In Table 1, the confidence interval for prenatal care should have read “.21-.63.” In Table 2, the confidence interval for hypertension should have read “1.99-14.28,” and the confidence interval for prenatal care, “.22-.89.”