



MATERNAL MORTALITY IN NEW YORK CITY: EXCESS MORTALITY OF BLACK WOMEN

JING FANG, MD, SHANTHA MADHAVAN, DRPH,
AND MICHAEL H. ALDERMAN, MD

ABSTRACT To assess maternal mortality in New York City, birth certificates and mortality records for New York City from 1988 through 1994 were linked and examined. During these 7 years, maternal mortality in New York City (defined by the International Classification of Diseases, 9th edition [ICD-9], as 630–676) per 100,000 live births significantly exceeded that of the country as a whole (20.2 vs. 8.2, respectively). Within New York City, an even greater variation of maternal mortality by race/ethnicity was noted, with the mortality ratio of whites, blacks, and Hispanics being 7.1, 39.5, and 14.4 per 100,000 live births, respectively. Socioeconomic characteristics such as educational attainment, marital status, and income influenced maternal mortality more in non-blacks than blacks. Analyses of cause-specific mortality revealed that, overall, ectopic pregnancy, embolism, and hypertension were the leading causes of death. However, the major factors explaining the excess maternal mortality among blacks were hypertension (mortality ratio of blacks to whites 5.57, 95% confidence interval 2.30–13.39), ectopic pregnancy (4.78, 95% confidence interval 2.40–9.51), and abortion (4.58, 95% confidence interval 1.72–12.22). These findings confirm a persisting gap in maternal death between black and white women. Indeed, if all New Yorkers who became pregnant enjoyed the survival of the city's non-Hispanic white residents, the difference in maternal mortality between the city and the nation would be eliminated.

Maternal mortality in the US has decreased dramatically during the past half century. In 1940, there were 376 maternal deaths per 100,000 live births¹; in 1960, there were 37 such maternal deaths²; in 1980, there were 9 such maternal deaths³;

The authors are from the Department of Epidemiology and Social Medicine, Albert Einstein College of Medicine.

Correspondence: Jing Fang, MD, Department of Epidemiology and Social Medicine, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Bronx, NY 10461. (E-mail: fang@aecom.yu.edu)

and in 1990, there were 8.2 maternal deaths per 100,000 live births.⁴ Throughout this time, however, New York City has maintained a substantially higher maternal mortality than the country as a whole. For example, maternal mortality in New York City from 1981 to 1983 was found to be 36 per 100,000 live births.⁵

Unfortunately, comparisons between studies are often confounded by differing definitions for maternal deaths. For example, the national data define maternal deaths as those due to complications of pregnancy, childbirth, and puerperium—code numbers 630–676 of the International Classification of Diseases, 9th edition (ICD-9). By contrast, the 1981–1983 study of maternal mortality in New York City employed a broader definition that included any deaths, for any cause, during pregnancy or within 6 months of its termination.

To overcome these difficulties and ensure comparability of national and local estimates, we have determined maternal mortality based on death and birth certificate data for New York City from 1988 to 1994, thus applying criteria previously used by the National Center for Health Statistics.³ We have also explored demographic, clinical, and socioeconomic determinants of mortality. We now present data indicating a persistent excess, compared to the nation as a whole, of maternal mortality in New York City; this excess is due largely to the experience of black mothers.

METHODS

All death and birth certificate data for New York City for the 7 years from 1988 through 1994 were obtained from the City Department of Health, to which all such events are reported. Personal identifying information was eliminated from the data files to preserve confidentiality. Both data sets included age, ZIP code and census tract of residence, educational attainment, race, ancestry, and marital status. Underlying causes of death on the death certificate were coded according to ICD-9 by a physician. Maternal deaths were defined as the deaths related to the complications of pregnancy, childbirth, and the puerperium during pregnancy and 6 months after pregnancy—for all those conditions assigned to ICD-9 codes 630–676 on the death certificate.⁴

Maternal mortality ratios were estimated using maternal deaths as numerator and live births as denominator and were expressed per 100,000 live births per year. This ratio was described further after stratification by age, race, educational attainment (less than high school, high school and above), marital status (married and not married), community income level (low, middle, and high), and cause of maternal death.

Maternal race/ethnicity was defined similarly on the birth certificate and mortality file. Race was categorized as white, black, American Indian, Asia/Pacific, and others. Ethnicity was defined by ancestry as Hispanic or non-Hispanic. Those from Mexico, Puerto Rico, Cuba, and/or other Hispanic and Spanish-speaking countries were categorized as Hispanic, and the others were non-Hispanics. The race/ethnicity categories in this analysis were determined as non-Hispanic blacks, non-Hispanic whites, non-Hispanic others, and Hispanics. Due to small numbers of maternal deaths among whites and Hispanics, further analysis compared blacks and non-blacks.

In the census data file, income was a group measure defined by US Census Bureau for each census tract (*Census Summary Tape Files 3*).⁶ In this study, we used the measure of annual per capita income. Then, census tracts in New York City were aggregated according to tertile of per capita income, and each tertile was specified as low (<\$10,913.70), middle (\$10,913.70–\$15,785.60), or high income (>\$15,785.60) communities. In both birth and death certificate files, census tract data was available. Based on the census tract of the maternal residential area, the aggregate income of the tract was the surrogate used to define the income status of all residents of that tract.

RESULTS

There were 192 maternal deaths in New York City over 7 years due to complications of pregnancy, childbirth, and puerperium. Maternal ages ranged from 15 to 45 years. In this age group, altogether there were 22,000 deaths for New York City females in the same period. Thus, pregnancy-related deaths accounted for 0.9% of all deaths. Of the 192 maternal deaths, 114 occurred in non-Hispanic blacks (59.4%), 43 in Hispanics (22.4%), 20 in non-Hispanic whites (10.4%), and 15 all others (7.8%).

Overall, New York City had 2.5 times the maternal mortality of the country as a whole (20.2 vs. 8.2 per 100,000 live births).⁴ In New York City, blacks had the highest maternal mortality ratio, which was more than 5 times that of whites (39.5 vs. 7.1). The maternal mortality ratio for Hispanics (14.4) was twice that of whites, but less than half of that for blacks.

Maternal death, stratified by age (<20 years, 20–34 years, and 35–45 years) for New York City overall, as well as by race, is displayed in Table I. The corresponding maternal mortality ratios stratified by age and expressed as mortality per 100,000 live births are displayed in Fig. 1. For comparison, maternal mortality for each age group for the US in 1990 is included. Blacks had the

TABLE I Maternal Mortality by Age and Race/Ethnicity, New York City, 1988–1994

	NYC	Whites	Blacks	Hispanics	Others
Total births	950,924	281,166	288,825	299,913	81,020
Total deaths	192	20	114	43	15
Deaths by age, years					
<20	15	1	9	5	0
20–34	120	11	67	28	14
35–45	57	8	38	10	1

highest and whites the lowest mortality ratio in all age groups, particularly in those aged 35 years and above. Notably, New York City white maternal mortality of those over age 20 years was less than for the nation as a whole.

Because non-Hispanic black women had the highest risk of all races for maternal death, further analysis was limited to non-Hispanic blacks and all others, defined as non-blacks, to avoid instability inherent in small numbers.

For all New Yorkers, marital status, educational attainment, and neighborhood income level all were related strongly to risk of maternal death (Table II). Married women, women with higher educational attainment, and those living in higher income communities had the lowest mortality ratios. Of these socioeconomic factors, education had the strongest association with mortality. This observation was true for New York City overall. For non-Hispanic blacks, however, the association of marital status and income with maternal mortality did not attain statistical significance. For non-blacks, residents in high-income communities compared to low-income communities had significantly lower maternal mortality.

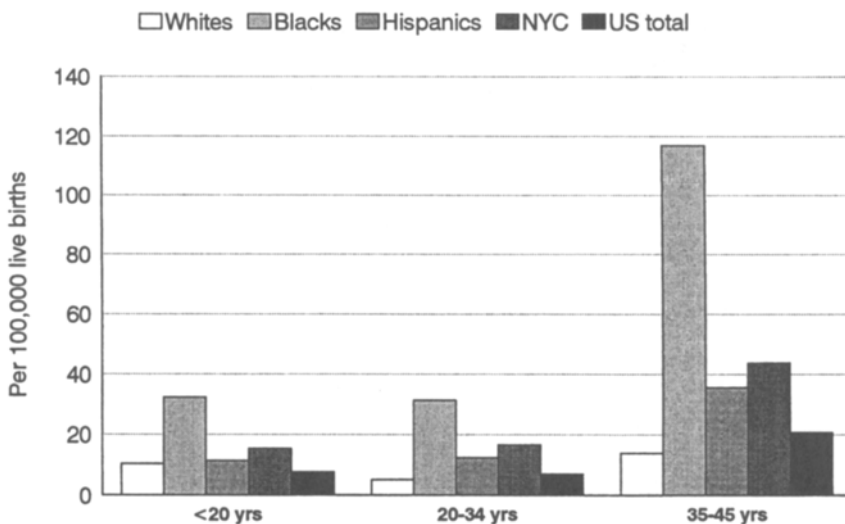
**FIGURE 1** Maternal mortality ratio by age and race, New York City, 1988–1994 and US total 1990.

TABLE II Maternal Mortality Ratio (per 100,000 Live Births) by Sociodemographic Characteristics and Race, New York City, 1988–1994

	NYC*	Blacks*	Non-Blacks*
Marital status			
Not married	28.8 (123)	41.1 (81)	18.3 (42)
Married	13.2 (69)	36.0 (33)	8.3 (36)
Relative mortality ratio†	2.19	1.14	2.20
95% confidence interval (CI)	1.63–2.94	0.76–1.71	1.41–3.44
Educational attainment			
<High School	36.4 (86)	47.4 (38)	30.8 (48)
≥High School	12.4 (84)	31.0 (61)	4.8 (23)
Relative mortality ratio‡	2.94	1.53	6.42
95% CI	2.17–3.96	1.02–2.29	3.91–10.56
Per capita income by tract			
Lowest	24.3 (100)	40.5 (68)	13.1 (32)
Middle	20.2 (51)	40.3 (34)	10.1 (17)
Highest	11.1 (21)	31.0 (7)	8.4 (14)
Relative mortality ratio§	2.18	1.31	1.56
95% CI	1.36–3.50	0.60–2.84	1.03–2.92
Relative mortality ratio	1.81	1.30	1.20
95% CI	1.09–3.01	0.58–2.93	0.69–2.33

*Numbers in parentheses are deaths.

†Married.

‡≥High school.

§Highest vs. lowest income.

||Highest vs. middle income.

There was a substantial difference in regard to the degree of association of each of these factors to the mortality between blacks and non-blacks. In general, the impact of socioeconomic factors on mortality was larger among non-blacks than blacks. For example, unmarried non-black women had a maternal mortality ratio more than twice that for married women (18.3 vs. 8.3), and non-black women with less than a high school education had more than six times the mortality ratio than did those with high school education and above (30.8 vs. 4.8). By contrast, the mortality ratio of unmarried black women was indistinguishable from that of married black mothers (41.1 vs. 36.0), and black mothers with less than a high school education had 1.5 times the mortality of blacks with at least a high school education (47.4 vs. 31.0).

The leading causes of maternal death during the 7-year period were ectopic pregnancy, embolism, and hypertension, followed by hemorrhage and abortion (Table III). The cause-specific maternal mortality ratios by race/ethnicity for

TABLE III Causes of Maternal Death, New York City, 1988–1994

	NYC	Blacks	Non-Blacks	RMR (95% CI)
Live births	950,924	288,825	662,099	
Ectopic pregnancy	37	25	12	4.78 (2.40–9.51)
Tubal pregnancy	24	17	7	
Abdominal pregnancy	3	2	1	
Abortion	18	12	6	4.58 (1.72–12.22)
Spontaneous abortion	8	3	5	
Legally induced abortion	8	7	1	
Illegally induced abortion	2	2	0	
Hypertension	24	17	7	5.57 (2.30–13.39)
Chronic hypertension	14	10	4	
Pregnancy-related hypertension	10	7	3	
Concomitant disease in pregnancy	11	6	5	2.75 (0.84–9.01)
Diabetes	1	1	0	
Anemia	2	1	1	
Drug dependence	2	0	2	
Cerebrovascular disease (except hypertension)	5	3	2	
Others	1	1	0	
Other complications of pregnancy	7	3	4	1.72 (0.38–7.68)
Hemorrhage	24	12	12	2.29 (1.03–5.10)
In early pregnancy	17	9	8	
Postpartum	7	3	4	
Obstetrical trauma	6	3	3	2.29 (0.46–11.36)
Other complications in labor	14	8	6	3.05 (1.06–8.81)
Embolism	30	15	15	2.29 (1.12–4.69)
Puerperal infection	2	1	1	2.29 (0.14–36.65)
Other complications puerperium	19	12	7	3.93 (1.55–9.98)
Total Deaths	192	114	78	3.35 (2.51–4.47)

CI = confidence interval; RMR = relative mortality ratio of blacks over non-blacks, 95% confidence interval.

major causes reveal ectopic pregnancy to be the leading cause of maternal mortality, followed by embolism, hypertension, and hemorrhage (Fig. 2). Maternal mortality ratios for all causes were higher for blacks than for non-blacks. However, there was substantial variation of the maternal mortality ratio of blacks over non-blacks. For example, hypertension had the highest mortality ratio of blacks to non-blacks, 5.57 (95% confidence interval [CI] 2.30–13.39), followed by ectopic pregnancy 4.78 (95% CI 2.40–9.51) and abortion 4.58 (95% CI 1.72–12.22).

Of note, during these 7 years, there were 8 deaths of a total of 721,868 legally induced abortion in New York City, given a mortality rate of legal abortion of

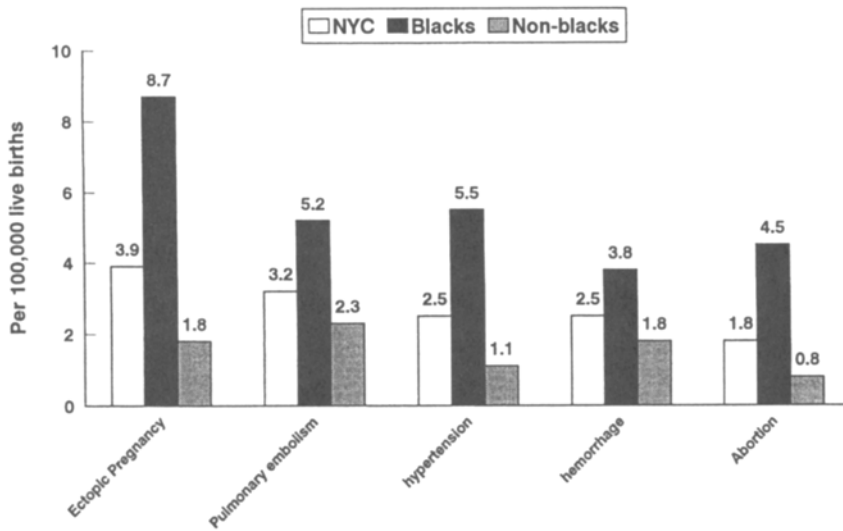


FIGURE 2 Cause-specific maternal mortality ratio, blacks and non-blacks, New York City 1988–1994.

1.1 per 100,000 abortions, about 18 times less than the overall maternal mortality ratio of 20.2 in New York City.

DISCUSSION

The principal findings here are that maternal mortality in New York City remains substantially higher than for the rest of the country; that this excess disproportionately affects blacks; and that the higher mortality ratio of black mothers is influenced strongly by hypertension, ectopic pregnancy, and abortion.

Over the past 10 years, there has been an effort by some to widen the definition of maternal mortality to include deaths from all causes occurring during pregnancy and for a period of time after the termination of pregnancy.^{7,8} The argument for this broader definition is that pregnancy may have other as yet undiscovered biological or psychosocial effects on women. For example, pregnant women may be at a greater risk for pedestrian injury because they move slowly.^{7,9} In practice, however, these deaths are not identified easily from the information available on death certificates alone. Moreover, since there is great variation in the availability of such information, it would be impossible to compare different data sources. In fact, comparison of the results here with the 1981–1983 study of New York City⁵ is confounded by differing definitions of maternal death. In the earlier study, in addition to the ICD code 630–676 on the death certificate, those decedents who were pregnant at the time of death, regardless of the cause of death, were included in the numerator.

Therefore, we chose to limit maternal mortality to the definition used by the

National Center for Health Statistics. They categorize maternal deaths as those assigned to complications of pregnancy, childbirth, and puerperium (category numbers 630–676 of ICD-9).⁴ In this way, although unable to compare our data to an important earlier New York City study, we can compare it to current US experience. Thus, we are confident that the ratio of maternal mortality of New York City accurately reflects its relative excess compared to the nation as a whole.

On this basis, despite continuing long-term overall decline in maternal deaths, the disturbing racial disparity in risk of death from pregnancy persists. Nationwide, black women continued to die from maternal causes at a rate approximately three times that of white women.¹⁰ Regrettably, in New York City, the disparity is even greater, with the ratio of blacks to whites exceeding five-fold. In fact, 1 of every 2,500 black women in New York City who becomes pregnant dies. The similar figure for white women is 1 in 14,000.

Although the available data do not provide sufficient basis for explaining the differences in maternal deaths, they do provide important clues that may help to explain the variation. Controlling for other factors, it would appear that a higher incidence of hypertension, ectopic pregnancy, and abortion are associated preferentially with death in black women than with others. This was seen almost two decades ago in terms of ectopic pregnancy.¹¹ There remains uncertainty about the treatment of hypertension in pregnancy, and the available data do not describe either treatment or blood pressure levels. Variation in care in these conditions might work to the disadvantage of black women.

These data again confirm the safety of abortion. Indeed, mortality associated with legal abortion in New York City (1.1/100,000 procedures) is substantially less than maternal mortality (20.2/100,000 live births). However, it is disturbing that, despite legalization, abortion, although not currently a major cause of pregnancy-related deaths, is an important contributor of increased mortality among black women. Of particular concern is that there were 2 deaths due to illegal abortion, which could be accurate, a misreport, or an under-report. Assuming that the deaths due to illegal abortion are reported accurately, and that the mortality rate was 100 times (110 per 100,000) that of legal abortion (1.1 per 100,000), perhaps as many as 1,800 illegal abortions might have taken place in New York City during these 7 years. If this were the case, it raises the disturbing possibility that considerable serious morbidity, known to be common when abortion is performed illegally, may have also occurred.

We have also seen here that women disadvantaged by low educational attainment, who were not married, or who lived in communities with low average income had higher maternal mortality ratios than others more favored. This

effect was greater for non-black than black women. Apparently, socioeconomic factors are less important determinants of maternal mortality among black women than are clinical factors. Thus, better health care for black pregnant women, including, for example, better control of blood pressure or more careful abortion technology, might have an important effect on maternal mortality of black women even in the absence of a change in overall socioeconomic status.

This study was limited by reliance on vital statistics data. Both death and birth certificate data are known for their inaccuracies. However, in this large data set, there is no reason to believe that systematic bias regarding race/ethnicity could affect the results. In addition, it has been shown that maternal death identified by death certificate data underestimates the maternal mortality ratio.¹² This probably contributes, in part, to the lower maternal mortality ratios found here compared with the 1981–1983 New York City report.⁵ Nevertheless, our findings are consistent with the earlier study in that they reflect a higher mortality in New York City overall compared to the US as a whole, and that this excess falls disproportionately on black New Yorkers.⁵ Strengths of the current study is the large database, standardized methodology, and the fact that New York City, unique among US metropolitan areas, collects its own vital statistics. The advantage of relying on the definition used by the National Center for Health Statistics is, of course, meaningful comparison with national data.

In summary, we have found that maternal mortality in New York City remains sharply higher than for the country as a whole. Moreover, this excess mortality is almost entirely the result of the experience of non-Hispanic black women. Indeed, if all New Yorkers experienced the mortality of its white women, the rates for the city would be indistinguishable from the country as a whole. While socioeconomic factors seem related to maternal mortality, the data here would suggest that marital status, income, and education are not the dominant explanation for excess mortality of black women. Instead, this analysis suggests that these outcomes might be responsive to targeted interventions. Specifically, more effective prenatal care that emphasizes better blood pressure control and safer abortion might narrow sharply the wide black-white gap in maternal mortality.

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