



Maternal Mortality in the United States, 1935-2007:

SUBSTANTIAL RACIAL/ETHNIC, SOCIOECONOMIC, AND GEOGRAPHIC DISPARITIES PERSIST



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Figure 1: Maternal Mortality by Race, United States, 1935–2007

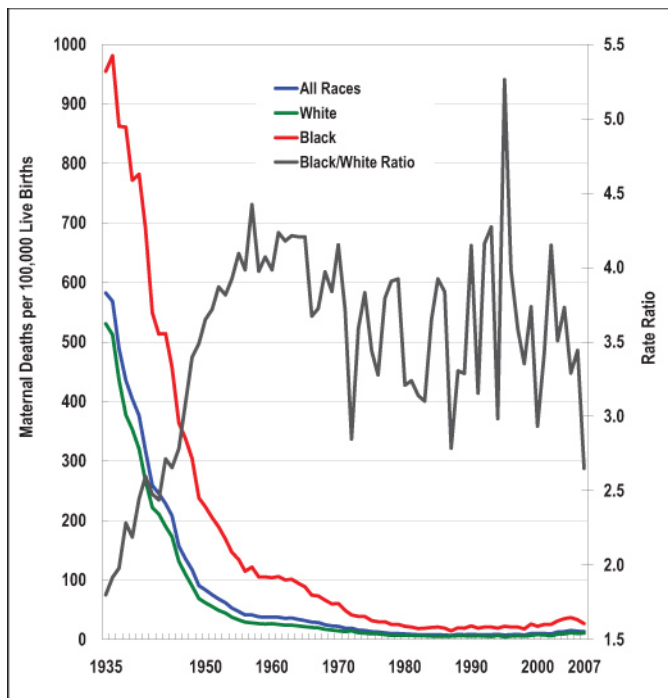
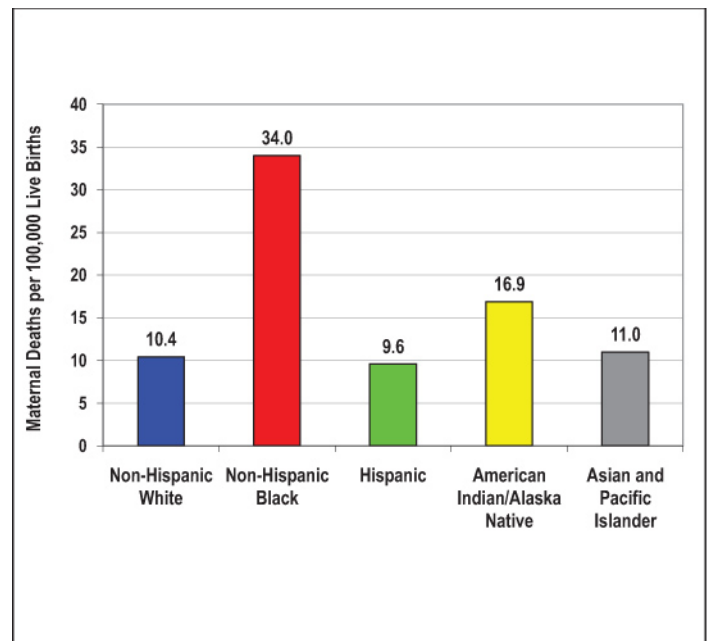


Figure 2: Maternal Mortality Rate by Race/Ethnicity, United States, 2005-2007



Maternal mortality in the United States has declined dramatically over the past century (1-4). The rate declined from 607.9 maternal deaths per 100,000 live births in 1915 to 12.7 in 2007 (1-3). However, maternal mortality in the United States has changed very little in the past 25 years (1, 3). Achieving further reductions in the maternal mortality rate is an important public health priority for the nation as the rates for certain ethnic minority and socioeconomic groups remain relatively high (3, 4, 5). A cross-national comparison of the 2005 statistics by the World Health Organization (WHO) reveals that the U.S. rate of 15 maternal deaths per 100,000 live births exceeded the rates for at least 41 other countries, including Canada, Australia, Japan, and all the Western and Northern European countries (6).

In this brief report, we analyze long-term trends in maternal mortality according to race/ethnicity, socioeconomic position (family poverty level), and state and region of residence by using both historical and the latest national vital statistics data (2, 3). As shown below, despite the massive drop in maternal mortality over the long term, substantial racial/ethnic, socioeconomic, and geographic disparities remain, with many of the sociodemographic groups currently far from achieving the national goal for the year 2010 (7).

Trends in Maternal Mortality by Race

Maternal deaths are those related to or aggravated by pregnancy or pregnancy management and which occur during or within 42 days after the end of pregnancy (3). Although mortality trend data extend farther back in time for the entire United States and the birth registration area (1, 2), we chose 1935 as the start of the time trend analysis since it coincided with the inception of Title V of the Social Security Act, a national public health legislation aimed at promoting and improving the health and welfare services for all mothers and children. The maternal mortality rates in the United States showed a consistently downward trend between 1935 and 1982, decreasing at a rapid rate of 8.6% per year (Figure 1). During 1935-1982, the rate of decline in maternal mortality was significantly faster among white women than among black women. The risk of maternal mortality remained 3 to 4 times higher among black women than white women during the past 6 decades (Figure 1). The trend in maternal mortality from 1982 through 1998 was fairly stable barring yearly fluctuations, but since 1999, there appears to be an upturn in maternal mortality among both white and black women, which has partly been attributed to changes in the coding and classification of maternal deaths resulting from the implementation in 1999 of the International Classification of Diseases, 10th Revision (ICD-10) in the United States.

Figure 3: Maternal Mortality Rate by County-Level Family Poverty Rate, United States, 1969-2007

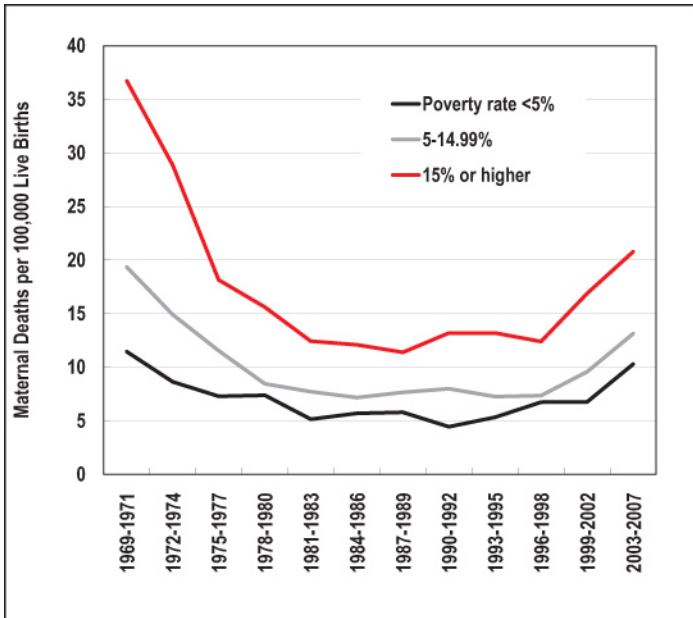
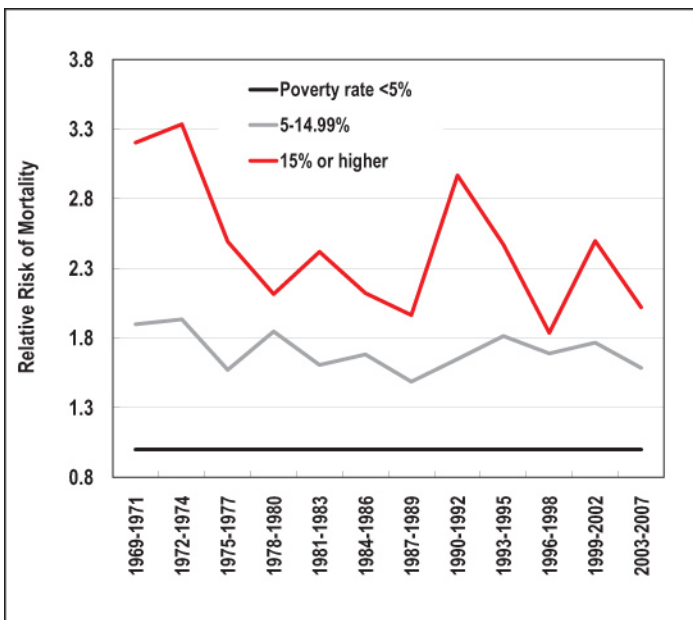


Figure 4: Relative Risk of Maternal Mortality by County-Level Family Poverty Rate, United States, 1969-2007



In 2007, the maternal mortality rate for black women was 26.5 deaths per 100,000 live births, 2.7 times higher than the rate for white women (10.0). According to the 2005-2007 detailed racial/ethnic data, the maternal mortality rate per

100,000 live births was highest among non-Hispanic black women (34.0), followed by American Indians/Alaska Natives (16.9), Asian/Pacific Islanders (11.0), non-Hispanic whites (10.4), and Hispanics (9.6) [Figure 2].

Trends in Socioeconomic Disparities in Maternal Mortality

Since reliable socioeconomic data are lacking on death certificates, which are the basis for the national mortality statistics, county-level family poverty data from the 1990 and 2000 censuses were linked with county-level mortality data to compute maternal mortality rates from 1969 to 2007 in three poverty rate categories: <5% (i.e., less than 5% of families below the poverty level in a county, referred to as the low poverty group), 5-14.99% (middle poverty group), and 15% or higher (high poverty group) [3, 8, 9]. Details of the linkage methodology are provided elsewhere (10). During 1969-2002, the maternal mortality rate for women in the low poverty group declined by 41%, whereas the rate for women in the middle and high poverty groups decreased by 50.5% and 53.9%, respectively (Figure 3). The faster decline in maternal mortality among higher poverty groups contributed to the narrowing of the socioeconomic differentials in maternal mortality. Note that the maternal mortality rate increased significantly between 1999-2002 and 2003-2007 for women in all socioeconomic groups. All relative risks of mortality for the poverty groups were statistically significant. Compared to women in the low poverty group, women in the middle poverty and high poverty groups had 90% and 220% higher maternal mortality risks in 1969-1971 and 58% and 102% higher maternal mortality risks in 2003-2007, respectively (Figure 4). Higher poverty rates were associated with higher maternal mortality risks among both white and black women in each time period (data not shown). For example, in 2003-2007, black women in the high poverty group had a 35% higher maternal mortality rate than black women in the low poverty group. For white women, the corresponding relative risk of mortality was 50% higher in the high poverty group compared to the low poverty group. Moreover, within each poverty group, significant racial disparities in maternal mortality existed, with black women experiencing an approximately three times higher maternal mortality risk than white women in each poverty group (data not shown).

Figure 5: Maternal Mortality Rate per 100,000 Live Births, 2003-2007

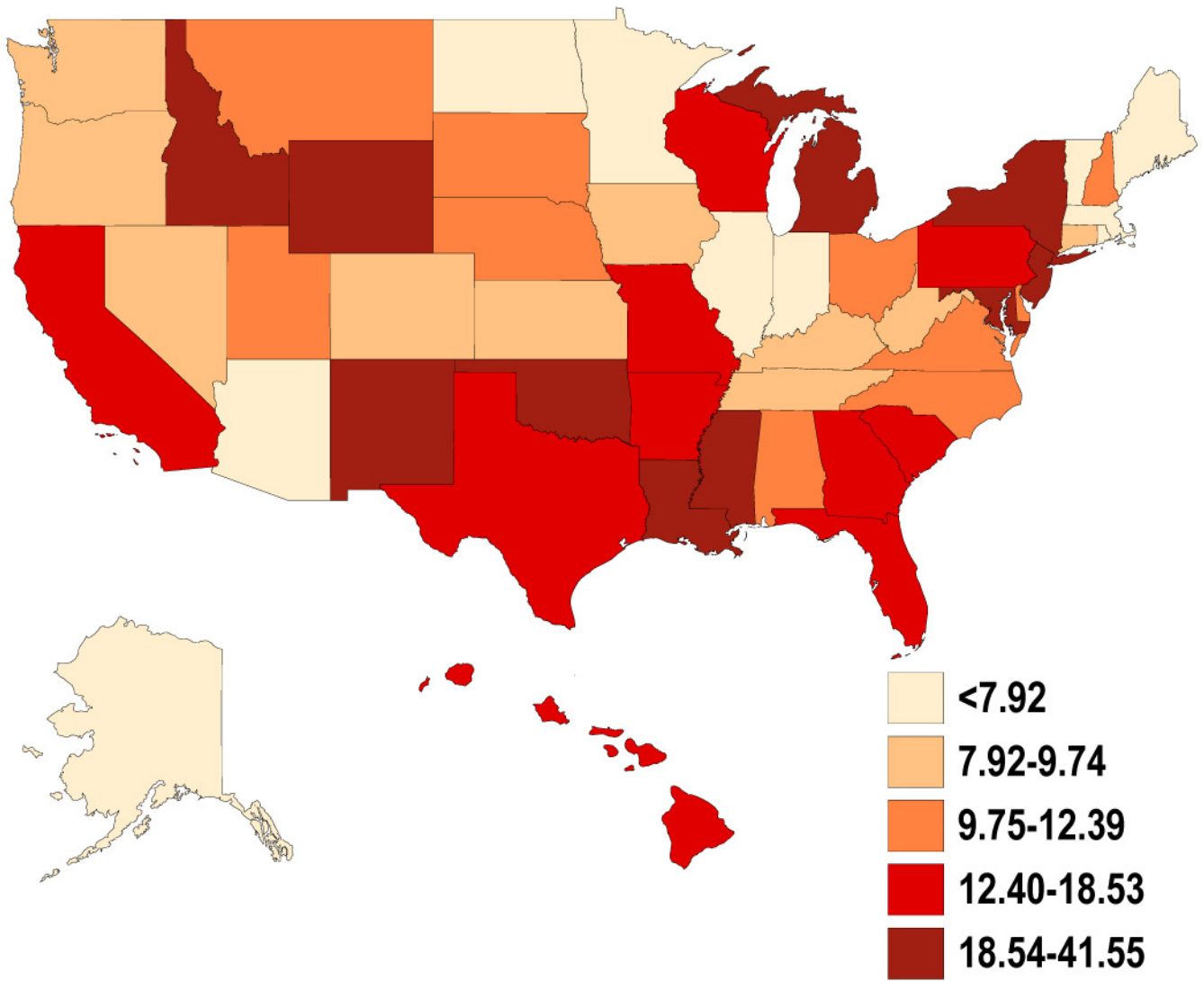
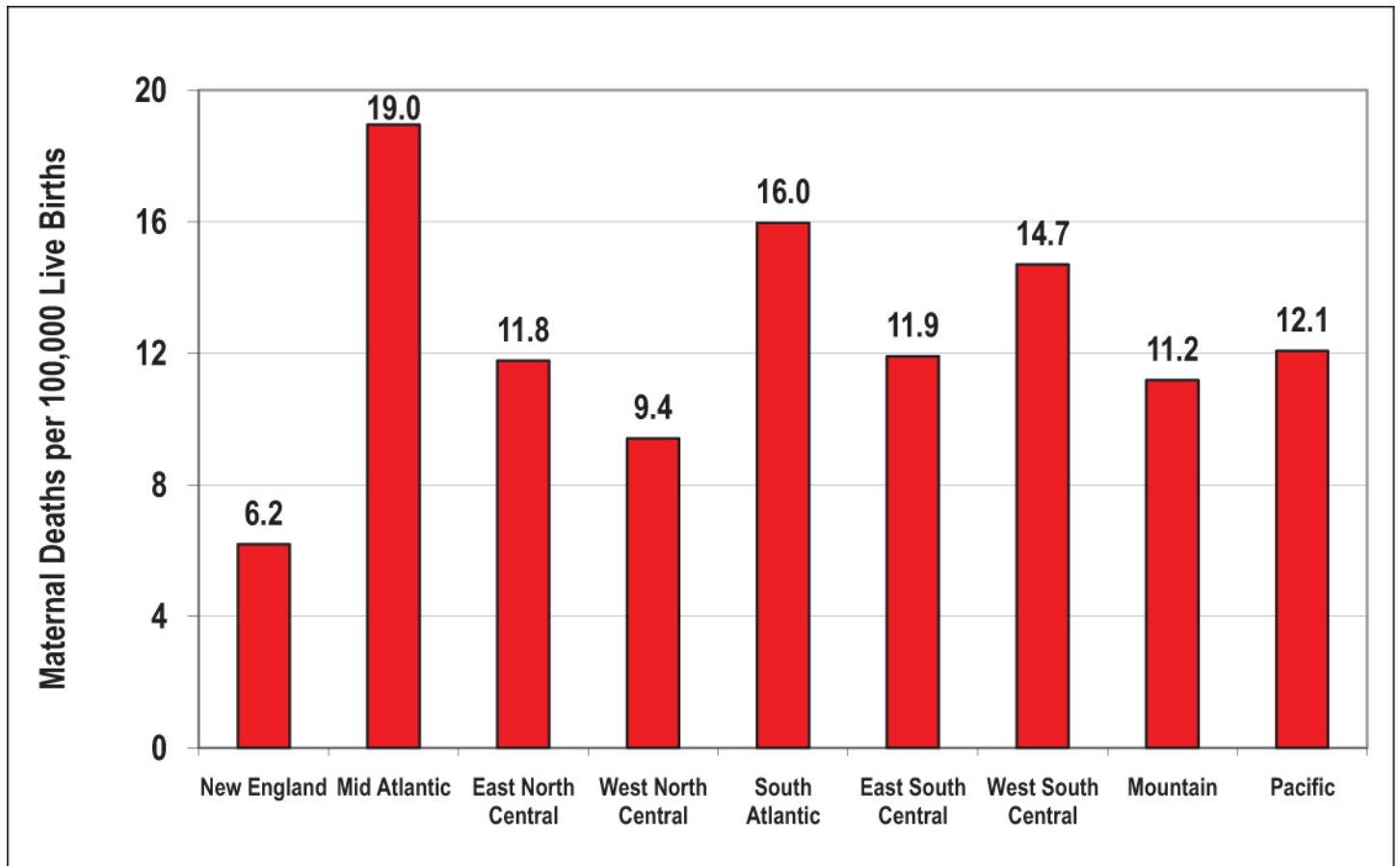


Figure 6: Maternal Mortality Rate by Geographic Region, United States, 2003-2007



Geographic Disparities in Maternal Mortality

During 2003-2007, the maternal mortality rate varied considerably by state of residence, ranging from a low of 4.3 deaths per 100,000 live births for Indiana to a high of 41.6 for the District of Columbia and 26.0 for Michigan (comparison based on only those states where a total of at least 16 maternal deaths occurred during 2003-2007) [Figure 5]. The states with at least 50% (and statistically significantly) higher maternal mortality rates than the national average include the District of Columbia, Michigan, Oklahoma, Idaho, New Jersey, Maryland, New York, and Mississippi. Maine, Alaska, North Dakota, Indiana, Massachusetts, Illinois, Minnesota, and Rhode Island had at least 50% (and statistically significantly) lower maternal mortality rates than the national average (Figure 5). Women in all regions had significantly higher risks of maternal mortality than women in New England (Figure 6). Compared to women in New

England, the risk of maternal mortality was 3.1 times higher among women in the Mid-Atlantic region, 2.6 times higher in the South Atlantic region, 2.4 times higher in the West South Central region, and 2.0 times higher in the Pacific region. Excess maternal mortality risks in the Mid-Atlantic, Southern, and Pacific regions existed among both white and black women (data not shown).

In a state-level ecological analysis, higher levels of poverty rates, percentage of immigrant population, and cesarean rates were independently associated with higher maternal mortality rates. Specifically, states, in which poverty rates exceeded 18%, immigrant population exceeded 15%, and cesarean rates exceeded 33%, had 77%, 33%, and 21% higher risks of maternal mortality, respectively, than states with lower rates of poverty, immigration, and cesarean deliveries (data not shown).

Discussion

Reducing the overall maternal mortality rate as well as the associated racial/ethnic and socioeconomic disparity is an important health objective for the nation (7). The long-term trend from 1935 to 1982 indicates a dramatic decline in the U.S. maternal mortality rate. However, the recent trend appears to indicate a substantial increase in maternal mortality rates, some of which could be attributed to recent coding and classification changes (1, 3). With the implementation of ICD-10 effective with mortality statistics in 1999 and thereafter, additional deaths due to indirect maternal causes of death have begun to be included in the official mortality statistics, which would not have otherwise been classified as maternal deaths in the previous ICD revisions (1, 3). In addition, a number of states have, in recent years, started using a pregnancy checkbox item on death certificates, which has led to an increase in the identification of maternal deaths (1, 3). As of 2007, there were 34 states and the District of Columbia with a separate item on the death certificate indicating pregnancy status of the decedent (3).

It is important to note that the maternal mortality statistics analyzed in this report are those compiled by the National Center for Health Statistics in accordance with the WHO regulations and, therefore, exclude late maternal deaths occurring more than 42 days after the end of the pregnancy and deaths of pregnant women from external causes such as unintentional injuries, homicides, and suicides (1, 3). In 2007, for example, 548 deaths were reported to have occurred due to maternal causes during or within 42 days of pregnancy termination and 221 deaths were classified as late maternal deaths from direct or indirect causes occurring more than 42 days but less than a year after termination of pregnancy (3).

The leading causes of maternal deaths in the United States are hemorrhage, pregnancy-induced hypertension, embolism, infection, and other chronic medical conditions

(3, 4). In pregnancies with abortive outcomes, ectopic pregnancy is the leading cause of maternal death (3, 4). While maternal mortality from hemorrhage, pregnancy-induced hypertension, and embolism has declined during the past two decades, maternal deaths due to other medical conditions, including cardiovascular and neurological problems, appear to have increased (4). The rising trend in cesarean rates may have also contributed to the apparent increase in maternal mortality during the past decade. The cesarean delivery rate in the United States has risen by more than 50% during the past decade, from 20.7% in 1996 to 31.8% in 2007 (11). Complications of cesarean sections have been associated with increased maternal mortality, and a recent study indicates 8 to 10 times higher maternal mortality risks for cesarean delivery compared with vaginal birth (12). Our ecological analysis showing increased maternal mortality rates for states with higher cesarean rates is consistent with this finding.

Despite the dramatic reductions in overall maternal mortality between 1935 and 2007, black women, women in lower socioeconomic groups, and women in several states continue to experience substantially increased risks of maternal mortality. These marked social disparities pose an important challenge for the U.S. health care system, as they may indicate important inequities in access to high-quality obstetric care. Currently, the maternal mortality rates for most states as well as for all racial/ethnic groups fall short of the Healthy People 2010 goal – which is set at 4.3 deaths per 100,000 live births (7). While none of the major racial/ethnic groups in 2007 met the 2010 target, the 2005-2007 maternal mortality rates for American Indian/Alaska Native women and non-Hispanic black women were 4 and 8 times higher than the 2010 target, respectively. During 2003-2007, women in all states except Indiana, North Dakota, Alaska, and Maine had higher maternal mortality rates than the Healthy People 2010 target. In fact, during this time period, there were 10 states with a rate of 20 or more maternal deaths per 100,000 live births.

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