

Health disparities and determinants of health: A glance at Healthy People 2020 goals

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Abstract

Introduction: Adverse health outcomes are often used as indicators of the health of a nation and are generally better in developed countries. According to the World Health Organization, every day, about 800 women died due to complications of pregnancy and child birth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented. Maternal mortality ratio in the United States in 2015 was 14 maternal deaths per 1000 live births, range, significantly higher than most developed countries including Sweden (4 per 1000 live births), Switzerland (4 per 1000 live births), Austria (4 per 1000 live births), Japan (5 per 1000 live births), Germany (6 per 1000 live births), Canada (7 per 1000 live births), France (8 per 1000 live births), United Kingdom (9 per 1000 live births).

Methods: Health outcomes were collected from the Centers for Disease Control and Prevention while socio-economic related indicators were extracted from the US Census Bureau. Selected health outcomes in the study are: infant and fetal mortality, maternal mortality, life expectancy and cancer. Socio-economic indicators such as poverty and health insurance coverage were also analyzed. An evaluation of health disparities among racial and ethnic groups was performed. Correlation analyses were conducted to explore the potential strength of the relationship between health outcomes and socio-economic factors in the US at the state level.

Conclusion: Health disparities are still a major public health problem in US. A strong correlation at the state level between health outcomes and poverty and health insurance coverage at the state level was identified.

Keywords: Health disparities, determinants of health, infant mortality, maternal mortality, cancer, socio-economic factors, poverty.

Introduction

Adverse health outcomes such as infant mortality, maternal mortality and life expectancy are often used as indicators of the health of a nation and are generally better in developed countries. Health disparities are variances that occur between specific population groups in the fulfilment of full health capacity that can be determined by differentiations in prevalence, mortality, burden of disease, and other unfavorable health conditions (NIH, 2014).¹ An individual's health is determined in part by access to social and economic opportunities; the resources and support available within their homes and communities; the stability within their workplace; their access to clean water, food, and air; and their social relationships within their environment (Healthy People, 2010).²

One of the main goals of Healthy People 2020's guidelines was not only to reduce health disparities, but also to attain health equity and advance the health status of all citizens. Among the underserved and disadvantaged population groups are African American and Latinos (US Census Bureau, 2018).³

According to the World Health Organization (WHO), every day, approximately 830 women die from preventable causes related to pregnancy and childbirth. Almost all of these deaths (99%) of all maternal deaths occur in developing countries. Maternal mortality is higher in women living in rural areas and among poorer communities (World Health Organization, 2018).⁴

Maternal mortality ratio in the United States in 2015 was 14 maternal deaths per 1000 live births, range [12-16], significantly higher than most developed countries including Sweden (4 per 1000 live births, range [3-5]), Switzerland (4 per 1000 live births, range [4-7]), Austria (4 per 1000 live births, range [3-5]), Japan (5 per 1000 live births, range [4-7]), Germany (6 per 1000 live births, range [5-8]), Canada (7 per 1000 live births, range [5-9]), France (8 per 1000 live births, range [7-10]), United Kingdom (9 per 1000 live births, range [8-11]) (World Health Organization, 2015).⁵

Infant death

Infant mortality is the death of an infant before his or her first birthday. The infant mortality rate is the number of infant deaths for every 1000 live births. In 2016, the infant mortality rate in the United States was 5.9 deaths per 1,000 live births (Mortality in the United States, 2016).⁶ Infant mortality rate (IMR) in the United States, in 2016, according to the National Vital Statistics Report, was approximately 5.24 infant deaths per 1000 live births; for males and female the IMR were 5.72 and 4.75 respectively. However, among Non-Hispanic black, the IMR, was 11.76, more than twice higher than in the in the general population and 2.5 higher than Non-Hispanic whites revealing 4.80 infant deaths per 1000 live births (National Vital Statistics).⁷

In addition to giving us key information about maternal and infant health, the infant mortality rate is an important marker of the overall health of a society (Centers for Disease Control and Prevention).⁸

Maternal death

Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. To facilitate the identification of maternal deaths in circumstances in which cause of death attribution is inadequate, a new category has been introduced: Pregnancy-related death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death (WHO).⁹

The pregnancy-related mortality ratio is an estimate of the number of pregnancy-related deaths for every 100,000 live births. This ratio is often used as an indicator to measure the nation's health. Factors that affect the health of the entire population can also affect mortality among pregnant and postpartum women. The pregnancy-related mortality ratio fell significantly in the United States during the 20th century. This historic decline was because of medical and technological advances. Interest and concern at the local, state, and federal levels for why pregnancy-related deaths occur led to the development of systems for identifying, reviewing, and analyzing pregnancy-related deaths (UNICEF).¹⁰

Fetal death

Fetal death refers to the spontaneous intrauterine death of a fetus at any time during pregnancy. Fetal deaths later in pregnancy (at 20 weeks of gestation or more, or 28 weeks or more, for example) are also sometimes referred to as stillbirths. In the United States, State laws require the reporting of fetal deaths, and Federal law mandates national collection and publication of fetal death data. Most states report fetal deaths of 20 weeks of gestation or more and/or 350 grams birthweight. However, a few states report fetal deaths for all periods of gestation. Fetal death data is published annually by the National Center for Health Statistics, in reports and as individual-record data files (National Vital Statistics System).¹¹

Life expectancy at birth

Life expectancy at birth reflects the overall mortality level of a population. It summarizes the mortality pattern that prevails across all age groups - children and adolescents, adults and the elderly. Definition. Average number of years that a newborn is expected to live if current mortality rates continue to apply (WHO).¹²

Poverty level

The Federal Poverty Level (FPL), or the "poverty line" is an economic measure that is used to decide whether the income level of an individual or family qualifies them for certain federal benefits and programs. The FPL is the set minimum amount of income that a family needs for food, clothing, transportation, shelter, and other necessities (Census Bureau).¹³

Following the Office of Management and Budget's (OMB) Statistical Policy Directive 14, the Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty (Census Bureau).¹⁴ According to the Census Bureau, 18.5 million people reported deep poverty, which means a household income below 50 percent of their 2017 poverty threshold. These individuals represented an estimated 5.7 percent of all Americans and 46.7 percent of those in poverty.

The University of California, Davis Center for Poverty Research in its October, 2018 report *What is the current poverty rate in the United States?* revealed that historically, the official poverty rate in the United States had ranged from a high of 22.4 percent when it was first estimated for 1959 to a low of 11.1 percent in 1973. Since its initial rapid decline after 1964 with the launch of major War on Poverty programs, the poverty rate has fluctuated between around 11 and 15 percent. The same report stated that the official poverty rate is 12.3 percent, based on the U.S. Census Bureau's 2017 estimates. An estimated 39.7 million Americans lived in poverty in 2017 (Center for Poverty Research).¹⁵

Objectives/Purpose

The purpose of this cross-sectional study is to assess and increase awareness of present health disparities among racial and ethnic groups and its reflection on adverse health outcomes of the entire nation. The association between socioeconomic indicators, especially poverty, health insurance coverage and health outcomes at the state level is also explored in this study. Recent health indicators will be reported by race/ethnic groups.

Methods

Sources of data

Indicators related to health and health outcomes were selected and collected from the Centers for Disease Control and Prevention (CDC) while socio-economic related variables/indicators were extracted from the Census Bureau. Data from the year 2017 was reported. Other sources of information were used and properly identified throughout the text. The study's selected variables associated health outcomes are: infant, fetal and maternal mortality.

Socio-economic related variables such as poverty and health insurance coverage were also collected and analyzed.

Statistical Analysis

A multiple correlational analysis was conducted to explore the potential strength, direction and significant of relationship between health indicators/outcomes and socio-economic factors in the United States at the state level. Pearson correlation coefficients and 95% confidence prediction intervals were calculated. An evaluation of health disparities among racial and ethnic groups was also performed. The Statistical Package for Social Sciences (SPSS 25®) was used to analyze collected data. A level of significance of 0.05 was selected for all tests of significance.

Results

Quality of health outcomes

Infant and Fetal Mortality

Live births among African Americans represent 15% of all live births in US. However, 27% of infant deaths are among this race/ethnic group. The overrepresentation of infant deaths among African American contrasts with whites and Hispanics infant deaths are underrepresented (Figure 1 and 2).

Figure 1. Live births, US, 2017

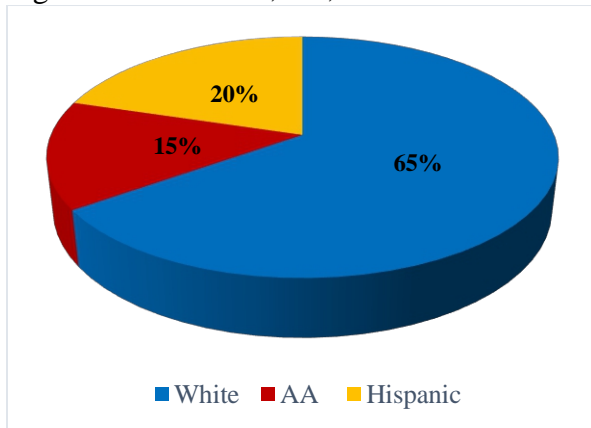
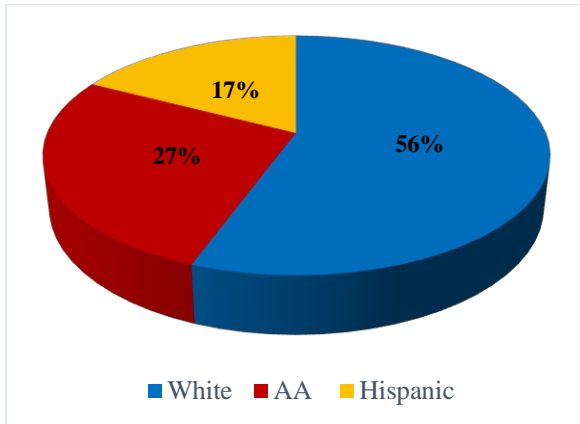


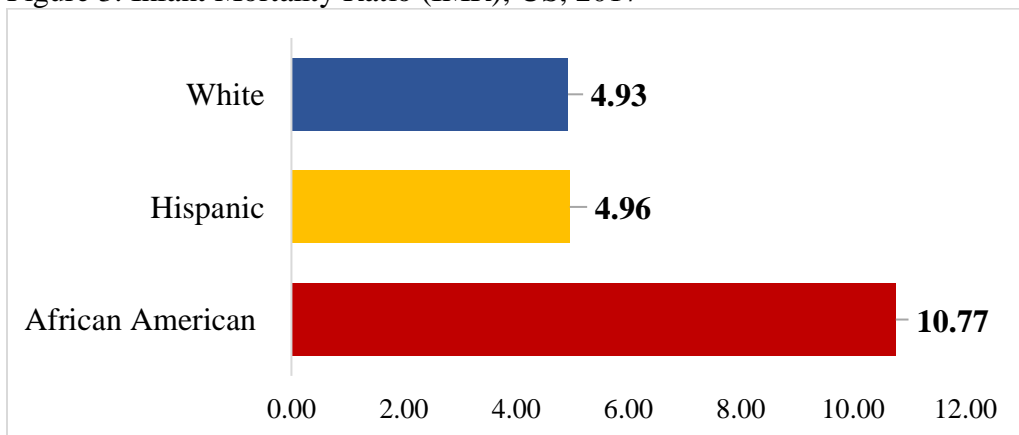
Figure 2. Infant deaths, US, 2017



Source: Centers for Disease Control and Prevention (CDC).

Health disparities is more evident when infant mortality rate is analyzed. The risk of dying of an African American infant (10.77 infant deaths per 1000 live births) is more than twice than both Whites (4.93 infant deaths per 1000 live births) and Hispanics (4.96 infant deaths per 1000 live births) (Figure 3).

Figure 3. Infant Mortality Ratio (IMR), US, 2017



Source: Centers for Disease Control and Prevention (CDC).

Fetal mortality is an important health indicator when assessing health disparities. The risk of dying during the fetal period is almost three times higher among African Americans (9.78 fetal deaths per 1000 live births) than among Whites (3.56 infant deaths per 1000 live births), and it is almost two times higher than Hispanics (5.19 infant deaths per 1000 live births) (Table 1).

Table 1. Fetal deaths and mortality rate, US, 2017

<i>Race of the mother</i>	<i>the Live Births</i>	<i>Percent Births</i>	<i>Live Fetal Deaths</i>	<i>Percent Fetal Deaths</i>	<i>Fetal Mortality Rate</i>
African American	654067	14.48	6394	29.54	9.78
Hispanic	918447	20.33	4769	22.03	5.19
White	2945970	65.20	10482	48.43	3.56

Source: Centers for Disease Control and Prevention (CDC).

Maternal Mortality

Maternal death is considered among experts a highly sensible indicator and a clear evidence of the significant and historical health disparities among racial and ethnic groups in US. Maternal mortality ratio among African Americans (47.2 maternal deaths per 1000 live births) is four times higher than among Hispanic (12.2 maternal deaths per 1000 live births) and close to 3 times higher than among Whites (18.1 maternal deaths per 1000 live births) (Table 2).

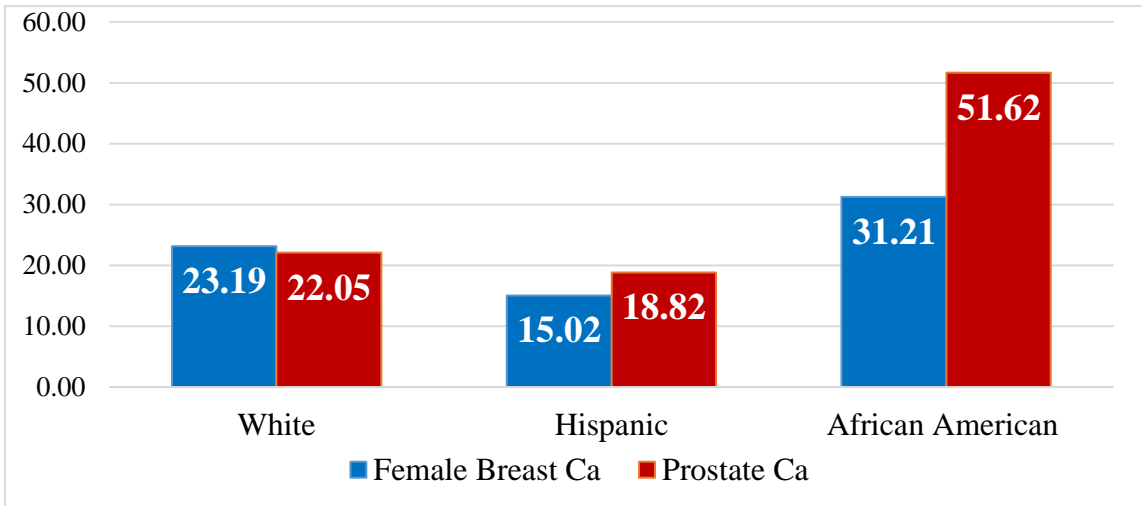
Table 2. Maternal deaths and mortality ratio, US, 2017

<i>Race of the mother</i>	<i>the Live Births</i>	<i>Percent Births</i>	<i>Live Maternal Deaths</i>	<i>Percent Maternal Deaths</i>	<i>Maternal Mortality Ratio</i>
African American	654067	14.48	761	43.5	47.2
Hispanic	918447	20.33	299	11	12.2
White	2945970	65.20	812	12.7	18.1

Source: Centers for Disease Control and Prevention (CDC).

Non-Communicable diseases (Cancer)

Figure 5. Female Breast Cancer and Prostate Cancer Mortality by Race/Ethnicity, US, 2017



Source: Centers for Disease Control and Prevention (CDC).
Age-adjusted mortality rates by race/ethnicity, US, 2017

The risk of dying by female breast cancer in 2017 was significantly higher among African Americans (31.21 deaths per 100,000 population) than among Whites (23.19 deaths per 100,000 population) and Hispanics (15.02 deaths per 100,000 population). Even greater disparities were found regarding prostate cancer. The age-adjusted prostate cancer mortality rate for African Americans (51.62 deaths per 100,000 population) was more than two times higher than among Whites (22.05 deaths per 100,000 population) and almost three times higher than Hispanics (18.82 deaths per 100,000 population) Figure 5.

Health Outcomes and Socio-economic factors

Multiple Correlation Analysis

A significant positive relationship between the proportion of people living below the poverty level and Infant Mortality Rate at the state level was identified from the Pearson correlation analysis, $r(51) = .604, p < 0.01$ Figure 6.

Figure 6. Correlation analysis between Infant Mortality Rate and percent of people living below the poverty level by state, US, 2017.

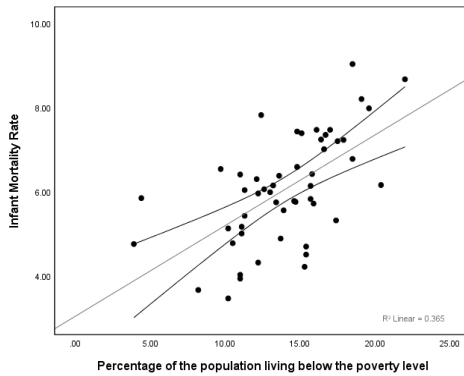
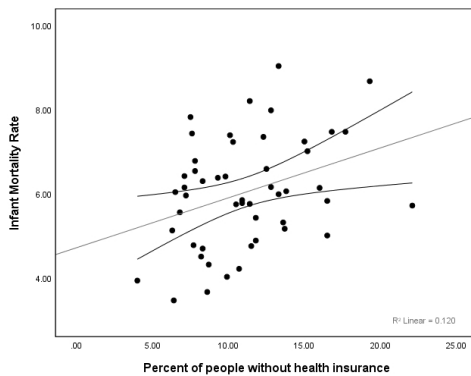


Figure 7. Correlation analysis between Infant Mortality Rate and percent of people without health insurance by state, US, 2017.



The direct association between the proportion of individuals without health insurance coverage at the state level and infant mortality was significantly evident from the correlation analysis, $r(51) = .347$, $p < 0.05$ Figure 7.

Significant positive relationship between the proportion of people living below the poverty level and Maternal Mortality Ratio at the state level was clearly identified from the analysis, $r(51) = .429$, $p < 0.01$ Figure 8. The

proportion of people in the state without health insurance coverage was also significantly associated with maternal mortality reported in the state, $r(51) = .389, p < 0.01$ Figure 9.

Figure 8. Correlation analysis between Maternal Mortality Ratio and percent of people living below the poverty level by state, US, 2017.

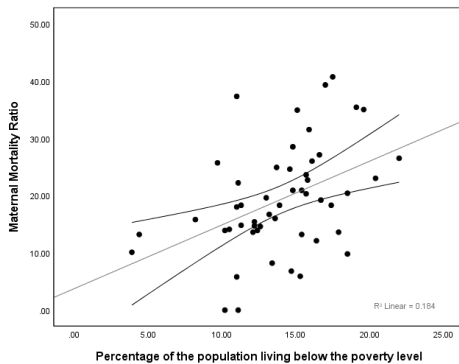
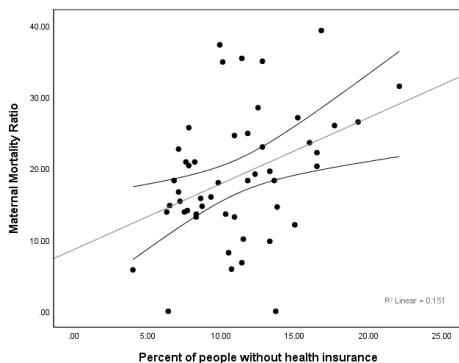


Figure 9. Correlation analysis between Maternal Mortality Ratio and percent of people without health insurance by state, US, 2017.



Life expectancy

The life expectancy is inversely and significant related to both the proportion of people living below the poverty level, ($r(51) = -.676, p < 0.01$. Figure 10), and proportion of people without health insurance coverage at state, $r(51) = -.454, p < 0.01$ Figure 11.

Figure 10. Correlation analysis between Life Expectancy at birth and percent of people living below the poverty level by state, US, 2017.

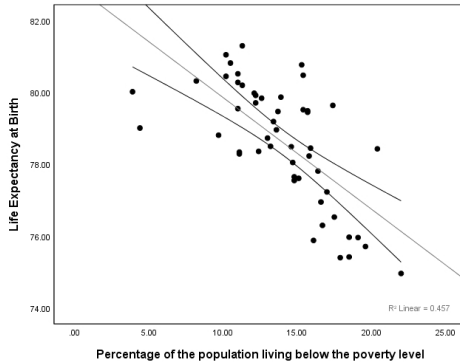
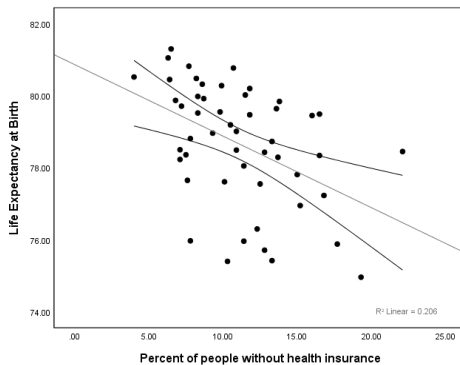


Figure 11. Correlation analysis between Life Expectancy at birth and percent of people without health insurance by state, US, 2017.



Discussion

Quality of health outcomes

Infant and Fetal Mortality

This study found that the risk of dying of an African American infant is more than twice than both Whites and Hispanics. The Center for American Progress, in the article *Exploring African Americans' High Maternal and Infant Death Rates* published in February 2018, reported that African American infants are 3.2 times more likely than non-Hispanic white infants to die from complications related to low birth weight. The authors also stated that higher rates of preterm births and low birth weights have been reported among African American women. Similarly, infants in the United States have

a 76 percent higher risk of death compared with infants in other wealthy nations (Center for American Progress, 2018).¹⁶

The Newsweek article, *Black and White Infant Mortality Rates Show Wide Racial Disparities Still Exist*, published in July 2017, based on data from the Centers for Disease Control and Prevention (CDC) and published in *JAMA Pediatrics*, quoted that “there has been limited progress in reducing the infant mortality rate among the non-Hispanic black population; suggesting that mortality rates for white infants are at least 50 percent lower than for blacks.” The same article stated that “sustained progress in reducing infant mortality among black infants since 2005 has stalled in the past few years. This has led to increases in the absolute inequality in infant mortality between black and white infants during the past three years” (Newsweek, 2017).¹⁷

The Population Reference Bureau, in the article *The Growing Color Divide in U.S. Infant Mortality* published in October, 2007 reported that the infant mortality rates were at least three times higher for black than for white newborns in four states: Colorado, Hawaii, New Jersey, and Wisconsin. In the District of Columbia, the rate was four times higher for black infants” (Population Reference Bureau, 2007).¹⁸

Fetal mortality is an important health indicator when assessing health disparities. The risk of dying during the fetal period is almost three times higher among African Americans than among Whites, and it is almost two times higher than Hispanics. The New York Times article, *Why America’s Black Mothers and Babies Are in a Life-or-Death Crisis: The answer to the disparity in death rates has everything to do with the lived experience of being a black woman in America*, published in April 2018, stated that black infants in America are now more than twice as likely to die as white infants (11.3 per 1,000 black babies), compared with 4.9 per 1,000 white babies, according to the most recent government data. The reporters stated that this is a racial disparity that is actually wider than in 1850, 15 years before the end of slavery” (New York Times, 2018).¹⁹

A Health News report from National Public Radio (NPR), *How Racism May Cause Black Mothers To Suffer The Death Of Their Infants*, reported that rate of black infant deaths is more than double than white infant deaths. The article also referred that “scientists and doctors have spent decades trying to understand what makes African-American women so vulnerable to losing their babies. Now, there is growing consensus that racial discrimination experienced by black mothers during their lifetime makes them less likely to carry their babies to full term” (Health News, 2017).²⁰

Maternal Mortality

The researchers found that in 2016, maternal mortality ratio among African Americans is four times higher than among Hispanic and close to 3 times higher than among Whites.

The Washington Post report, *A shocking number of U.S. women still die of childbirth. California is doing something about that*, initiated the article noting that “over the past three decades, the world has seen a steady decline in the number of women dying from childbirth. There has been a notable outlier: The United States.” The author, Michael Ollove, argue that in the nation “the maternal mortality rate has been climbing, putting the United States in the unenviable company of Afghanistan, Lesotho and Swaziland as countries with rising rates” (Washington Post).²¹

The article, *Maternal deaths in childbirth rise in the U.S.*, publish in the in 2014, stated that “United States has one of the highest maternal mortality rates in developed and developing countries, and that maternal deaths related to childbirth in the United States are nearly at the highest rate in a quarter century” (Health & Science, 2014).²²

According to the Centers for Disease Control and Prevention (CDC), since the *Pregnancy Mortality Surveillance System* was implemented, the number of reported pregnancy-related deaths in the United States steadily increased from 7.2 deaths per 100,000 live births in 1987 to 18.0 deaths per 100,000 live births in 2014. Similar to our findings, the Centers for Disease Control and Prevention (CDC), in the 2018 *Pregnancy Mortality Surveillance System*, reported a considerable racial disparity in pregnancy-related mortality exist. During 2011-2014, the pregnancy-related mortality ratios were: 12.4 deaths per 100,000 live births for white women, 40.0 deaths per 100,000 live births for black women and 17.8 deaths per 100,000 live births for women of other races. (CDC/ *Pregnancy Mortality Surveillance System*, 2018).²³

According to 2015 data from the World Health Organization, each year approximately 60,000 women in the U.S. experience near-fatal complications during pregnancy or birth. Statistically, this puts the country in the same category of developing nations such as Afghanistan, Belize and South Sudan. In last year’s March of Dimes Premature Birth Report Card, the U.S. earned a “C” grade due to widening differences in prematurity rates across different races and ethnicities” (Newsweek, 2017).¹⁷

According to the Center for American Progress “women in the United States are two to three times more likely to die than Canadian women in the maternal period—from the start of pregnancy to one year after delivery or termination. Disaggregating data by race reveals that higher rates of maternal and infant death among African American women drive the United States’ mortality crisis” (Center for American Progress, 2018).²⁴

In the article *The Health Care System and Racial Disparities in Maternal Mortality*, published by The Center for American Progress, reported

that “African American women remain at higher risk for maternal and infant mortality. Indeed, one study showed that after controlling for income; gestational age; and maternal age and health status, the odds of dying from pregnancy or delivery complications were almost three times higher for African American women than they were for non-Hispanic white women. The article also cited a report which found that black women are at least twice as likely as non-Hispanic white women to have unintended pregnancies” (Center for American Progress, 2018).²⁴

Non-Communicable diseases

Disparities in cancer goes past race or ethnicity. Cancer specific disparities are comprised of differences across socioeconomic position (such as education and income), insurance status, and marital status. Cancer health disparities change in the frequency, pervasiveness, mortality, or burden of cancer and cancer-related undesirable effects that exist within specific populations (Singh & Jemal, 2017).²⁵

Disparities are not restricted to cancer; they are also comprised of circumstances that precede the development of cancer and the effects of these circumstances on the quality of life and mortality. In the United States, prostate cancer is the most frequently diagnosed cancer for males and the second primary cause of death linked to cancer for men over the age of 40 in the United States (Jackson, Owen, Friedman, & Hebert, 2014).²⁶

Even though the prevalence of prostate cancer is diminishing, the overall prostate cancer related mortality continues to rise for African America. In addition, African American men are more often diagnosed with more advanced and aggressive forms of prostate cancer (Bhardwaj, Srivastava, Khan, et al. 2017).²⁷

The findings from our study regarding female breast cancer and prostate cancer disparities are supported by a study conducted by Lee et al. (2018); they were exploring health disparities among men who received prostate cancer treatment and found that compared to Whites, African Americans were less likely to receive treatment (95% vs. 87%) and more likely to receive unnecessary procedures (1% vs. 20%). Furthermore, Hispanics were more likely to receive treatment from low-quality providers than Whites (17% vs. 2%). Therefore, improving access to evidence-based care for all male patients regardless of race and/or socioeconomic status may decrease health disparities in prostate care (Lee, Zhao, Huang et al., 2018).²⁸

Another prostate cancer study performed by Smith, Eggen, and Murphy in 2017, found that compared to European-American men, African American men had significantly higher rates of cancer severity (33 vs 13%) and adverse pathology (7% vs. 20%). This health disparity may be related to a large proportion of African American men who are uninsured (62%),

compared to European-American men. This finding may also be related to poverty level, educational level, and mistrust in the healthcare system among African Americans. (Smith, Eggener & Murphy, 2017).²⁹

On the other hand, Ojinnaka, Luo, Ory, McMaughan, and Bolin in 2016 examined breast cancer health disparities in Texas and discovered that residents of racially segregated areas were less likely to receive treatment for breast cancer (OR 0.56; 95% CI, 0.36-0.88). In addition, racial disparities in treatment increased with increasing racial segregation. (Ojinnaka, Luo, Ory, et al., 2017).³⁰

In a fourth study of 4,364 women by Dialla et al. (2015), it was found that socio-economic deprivation was associated with disease stage at diagnosis. Women, aged 50 to 74 years who lived in deprived areas, were more often diagnosed with advanced cancer stages, compared to those living in wealthy areas (OR 1.27, 95% CI, 1.01–1.60). Relative survival rates were also lowest in women living in deprived areas (88.4% vs. 92.6%) (Dialla et al.2015).³¹

Life expectancy

Life expectancy at birth was found, in our study, significantly and inversely proportionally related to poverty and health insurance coverage at the state level. In 2017, life expectancy at birth was 78.6 years for the total U.S. population—a decrease from 78.7 years in 2016, according to data released Thursday by the Centers for Disease Control and Prevention’s National Center for Health Statistics (NCHS). For males, life expectancy changed from 76.2 in 2016 to 76.1 in 2017. For females, life expectancy remained the same at 81.1.

According to a February, 2016 report from National Vital Statistics, as an average in US, whites live (78.9) more than three years longer than blacks (75.5). The live expectancy at birth for Hispanics was reported as 81.9 years. (Murphy, Xu, Kenneth et al., 2018).³²

Socio-economic factors

We have identified in our study that there is a significant correlation between health indicators and socio-economic factors such as poverty and lack of health insurance in the U.S. population. Similarly, a study from the Center for American Progress reported that infants in the United States have a 76 percent higher risk of death compared with infants in other wealthy nations. (Center for American Progress, 2018).²⁴

According to the World Health Organization (WHO) “U.S. has some of the most sophisticated medical care, yet the country still lags far behind in the area of maternal and infant health care” (Newsweek).¹⁷ The article, *Poverty and Inequality Pervasive in Two-Fifths of U.S. Counties*, published in

November, 2016 by the Population Reference Bureau stated that over the past two decades, inequality and poverty have both become more pervasive in U.S. counties (Population Reference Bureau, 2016).³⁴

Conclusion

Health disparities are still a major public health problem in US. A strong correlation at the state level between health outcomes and poverty and health insurance coverage at the state level was identified.

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