DISPARITY IN DEATH RATE TRENDS: IMPLICATIONS FOR PUBLIC HEALTH MANAGEMENT

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ABSTRACT

Disparity in health outcomes and health status has been studied for many years. The effect of disparities in mortality is of particular interest. A significant volume of research has focused on disparity in mortality with respect to the influence of race, sex, education, occupation and geographic area of residence.

This study was conducted to evaluate death rates in Mississippi over a 10-year period of time and the disparities that are present. Comparisons were made across several causes of death with respect to the influence of race, gender and geography. Trends in disparity were studied, along with resultant implications for public health policy and practice.

Results of this study were that males have a higher death rate than females. This finding also occurred within races. Overall, Whites had a significantly higher death rate when compared to Nonwhites. When geographic area of residence was studied, a large disparity in death rates across the State was observed. Disparity was not consistent in specific causes of death, with Whites having higher deaths rates due to heart disease, malignant neoplasms, cerebrovascular disease, emphysema and pneumonia. Nonwhites had higher death rates for, diabetes mellitus, hypertension, infant mortality, neonatal mortality, and post-neonatal mortality. The observed disparities were constant over the 10-year study period.

Implications of this study include (a) disparities have not changed over 10 years, so disparity elimination programs have not succeed, (b) disparity elimination strategies must be based on creative and new approaches, and c) health policy initiatives must be developed to address the specificity of the influence of disparities on death rates.

INTRODUCTION

The rate at which people die is an issue of paramount importance to medicine, public health, and health services administration and research. Cause-specific mortality rates are determined and evaluated annually by health services organizations to provide insight to the magnitude, causality, and distribution across different diseases and conditions. Trends in death rates, over time, are evaluated to determine areas of need for health care services, health education, health promotion, and health finance.

An issue that complicates this analysis of death rates and trends is disparity. Disparity is a focus of many health care initiatives, including Healthy People 2010 (U.S. Department of Health and Human Services, 2000). Healthy People 2010 is a set of health objectives which are to be achieved over the 10 years of this century, with an overall objective of improving health. Healthy People 2010 states that one of its objectives is to eliminate health disparities. Eliminating health disparities involves mitigating differences in health and disease by gender, race or ethnicity, education or income, disability, geographic location, or sexual orientation.

Previous research has found that mortality is not equally distributed in populations by many personal attributes, including race and ethnic group, as well as place attributes (Fos and Fine, 2005). The effect of this unequal distribution has been found to have a significant influence on primary care access ad planning for public health services (Fos and Zuniga, 1999; Fos, Miller, Zuniga, and Amy, 2003). Specifically, research has focused on disparity in cancer and maternal and child health indicators. Jatoi, et al. (2003) studied survival among White and African-American patients treated for breast cancer at U.S. Department of Defense hospitals. Their retrospective

review of medical records from a twenty year period illustrated that there was a significant disparity in survival rates of Whites and African-Americans. Interestingly, they found that this disparity exhibited a widening trend over the 20-year study period. Others have found similar outcomes in breast cancer patients. African-American women have higher mortality rates then Whites across geographic areas (Grann, et al., 2006). Socioeconomic status has been shown to be correlated with race in predicting breast cancer mortality.

Most noted disparities can be traced to several factors. In an attempt to understand the disparity in breast cancer mortality, many have evaluated diagnostic and treatment protocols across Whites and African-Americans. The treatment services utilized and costs are not significantly different across race, in spite of higher mortality rates in African-American women (Du and Simon, 2005). However, it has been suggested that disparity in screening utilization may have an influence on mortality rates in African-American women (Jatoi, et al., 2005). Another plausible explanation is that African-American women are more likely to prematurely self-select to cease receiving treatment (Hershman, et al., 2005). This premature stoppage of treatment has been correlated with lower survival rates (Franks, et al., 2006). Another suggestion is that there is a difference in the distribution of insurance coverage and associated access to care between Whites and African-Americans. A study of breast cancer mortality within an insured population found that the disparity in death rates, with higher rates for African-Americans, was still present (Field, et al., 2005).

Gender and geography, both acting independently and as an interaction, have been found to affect mortality. One study closely reviewed bladder mortality in Whites and African-Americans, using Surveillance Epidemiology abd End Results data (citation). Research findings

included: a) African-Americans had more advanced bladder cancer, b) African-Americans had lower survival rates, but lower incidence rates, and c) African-Americans in metropolitan areas had lower survival rates than other African-Americans (Underwood, et al., 2006). A study of prostate cancer mortality found similar results with respect to race. African-American men had a greater mortality at every stage of prostate cancer. Surprisingly, socioeconomic status did not influence the higher death rate in African-Americans when compared to Whites (Robbins, Whittemore, and Thom, 2000).

A different study of prostate cancer in Medicare recipients which evaluated racial differences in mortality also demonstrated similar results. The research question centered on whether disparities in mortality differed by treatment. The study found that the overall mortality disparity varies across the stages of treatment, with the greatest difference in advanced treatment, including surgery (Godley, et al., 2003). Another study of prostate cancer found that socioeconomic disparity existed in mortality rates. In a large population-based cohort study results included that as socioeconomic status declines, mortality increases. Another finding was African-American men has a significantly higher rate of mortality than Whites when controlling for education (Du, et al., 2006). Mortality rates from systemic lupus erythematosus have been increasing for many years, with the largest increase observed in African-Americans. Systemic lupus mortality rates declined significantly among White males, with no decline in African-American males (Krishnan and Hubert, 2006).

This paper examines studies death rate rates over a 10-year period with emphasis on disparity across racial and ethnic groups. In addition, the influence of geography was evaluated to determine whether disparities exist.

METHODS

Data were abstracted from the Vital Statistics Report provided by the Mississippi Department of Health (Mississippi Department of Health, 1995-2004). The Vital Statistics Report contains information on live births, fetal deaths, induced terminations of pregnancy, deaths, as well as marriages, and divorces. The reporting of this information is required by state law. In Mississippi responsibility the for the completion of death certificates is jointly shared by hospitals, nursing homes and other institutions which provide care or custody, funeral homes, physicians, medical examiners, and medical examiner investigators.

The definition of death used in the data is as follows: "an individual who has sustained either (a) irreversible cessation of circulatory and respiratory functions or (b) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. A determination of death must be made in accordance with accepted medical standards" (Mississippi Department of Health, 2004).

The population numbers are those determined by the United States Census Bureau.

Data on the death rates for the following diseases and conditions were selected for this study: heart disease, malignant neoplasms, cerebrovascular disease, emphysema, nephritis, diabetes mellitus, hypertension, infant mortality, neonatal mortality, and post-neonatal mortality. These diseases and conditions were selected because of their rank according to leading causes of death in Mississippi. Cause-specific mortality rates were used in this study. For infant mortality, neonatal mortality, and post-neonatal mortality data from the number of live births were used as the denominator for calculating rates. In Mississippi, two categories for race are used when reporting vital statistics:

white and nonwhite. The category White includes: White and Hispanic or Latino. The Nonwhite category includes: African Americans, American Indian or Alaska Native, and Asian or Pacific Islander. The data were analyzed using Statistica 7.0 (Stafsoft, Inc., 2007) and comparisons were made across leading causes of death, stratified by race, gender and geography.

RESULTS

Table 1 presents mean cause-specific death rates, by race, from 1995-2004 for major causes of death that illustrate disparities. The data indicate that over the ten year study period several disparities occurred. Specifically, the total death rate over the 10-year study period was highest in Whites. This same trend was seen in death rates from heart disease, malignant neoplasms, cerebrovascular disease, emphysema, and pneumonia. The mean cause-specific death rates were higher in Nonwhites for nephritis, diabetes mellitus, hypertension, infant mortality, neonatal mortality, and post-neonatal mortality.

Table 1
Mean Cause Specific Death Rates, by Race, 1995-2004

	Whites		Non-Whites	
Disease or Condition	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Total	1,064.1	30.49	890.0	67.70
Heart Disease	325.9	25.53	278.0	29.95
Malignant Neoplasms	232.4	5.12	179.4	7.67
Cerebrovascular Disease	68.2	5.29	60.5	4.69
Emphysema	58.7	6.67	19.2	1.41
Pneumonia	35.9	6.37	22.2	4.19
Nephritis	16.6	3.58	22.6	5.00
Diabetes mellitus	18.7	1.82	26.9	2.44
Hypertension	7.4	1.72	12.2	3.25
Infant mortality	6.8	0.47	14.7	0.39
Neonatal mortality	4.0	0.48	9.1	0.45
Post Neonatal mortality	2.8	0.29	5.4	0.59

Rates are per 100,000 except of infant mortality, neonatal mortality, and post neonatal mortality which are per 1,000 live births

Table 2 examines the magnitude of the disparity by comparing means death rates by race. The disparities noted above in Table 1 were all found to be statistically significant, at a level of significance of 0.05. In other words, Whites had a higher mean cause specific death rate for heart disease ($p = 0.0001$), malignant neoplasms ($p < 0.000000$, cerebrovascular disease ($p = 0.003$), emphysema ($p < 0.00000$) and pneumonia (0.0003), while Nonwhites had higher mean death rate for nephritis ($p = 0.006$), diabetes mellitus ($p < 0.00000$) , hypertension ($p = 0.0006$), infant mortality ($p < 0.00000$), neonatal mortality ($p < 0.00000$), and post-neonatal mortality ($p < 0.00000$).

Table 2
Racial Comparison of Mean Cause-Specific Death Rates by Race, 1995 to 2004

Disease or Condition	Mean Whites	Mean NonWhites	t-stat	p-value
Heart Disease	352.9	278.0	6.01	0.00001
Malignant Neoplasms	232.4	179.4	18.15	<0.00000
Cerebrovascular Disease	68.2	60.5	3.41	0.003
Emphysema	58.4	19.2	18.16	<0.00000
Pneumonia	35.9	22.2	5.44	0.0003
Nephritis	16.6	22.6	-3.09	0.006
Diabetes mellitus	18.7	26.9	-8.48	<0.00000
Hypertension	7.4	12.2	-4.10	0.0006
Infant mortality	6.8	14.7	-41.34	<0.00000
Neonatal mortality	4.0	9.15	-24.47	<0.00000
Post Neonatal mortality	2.8	5.4	-12.33	0.00000

Rates are per 100,000 except of infant mortality, neonatal mortality, and post neonatal mortality which are per 1,000 live births

Table 3 presents by death rates by race, sex and year from 1995-2004. It is interesting to evaluate whether

the differences described in Tables 1 and 2 occurred each year during the 10-year study period. In spite of varying in magnitude of the differences over the study time period, the trend in the differences is constant. This indicates that the disparity has been quite stable over the 10-year study period.

Table 3
Cause-specific Death Rates for Selected Diseases and Conditions, 1995-2004

Year and Race	Heart Disease	Neoplasms	CVD	Emphysema	Pneumonia	Nephritis	Diabetes Mellitus	Hypertension	Infant Mortality+	Noenatal Mortality+	Post Neonatal Mortality+
1995 W	384	230	69.4	48.4	40.8	12.4	16.1	7	6.9	4.1	2.8
NW	306.6	183	68.2	19.9	25.6	17.8	21.2	12	14.5	8.4	6.1
1996 W	308.8	229	64.3	48.6	37.8	10.4	15.8	4.4	7.9	4.8	3.1
NW	305.2	187	60.2	18	24.7	17.5	26.5	6.8	14.4	9.8	4.6
1997 W	382.1	232	70.5	54.1	44.1	14.4	17.4	5.5	7.1	4.4	2.7
NW	320.5	189	65.4	18.3	28.4	17.4	27	8.7	14.6	8.9	5.7
1998 W	373.3	234	65.8	54.6	45.1	13.8	19.4	6.8	6.4	3.3	3
NW	298.5	187	65.2	18.3	28.1	16	28.6	9.3	14.5	9.5	5
1999 W	367.1	243	71.1	59.8	33	18.2	18.8	7.3	6.7	4	2.7
NW	284.9	186	59.6	22	21.6	29.4	25.4	11.8	14.1	8.8	5.3
2000 W	359..5	240	76	60.1	33.4	19.4	21.3	6.9	6.7	3.9	2.8
NW	268.5	171	59.4	18.3	20.1	24.9	27.1	12	15.1	9.6	5.5
2001 W	351.3	231	72.2	62.8	31.3	19	20.3	7.9	6.9	4.2	2.7
NW	261.8	173	60.6	20.8	18.5	24.3	27.3	13.3	14.7	9.3	5.4
2002 W	346.9	232	71.5	65	32.2	17.8	18.4	8.4	6.8	4.4	2.5
NW	261.9	177	59.2	20.4	20.7	24.1	30.6	14.9	14.4	9.5	4.9
2003 W	336.4	227	62.9	67	31.4	20.5	20.1	10	6.8	3.4	3.5
NW	244.2	172	54.8	18.2	18	28.1	28.3	17.2	15.4	8.7	6.6
2004 W	319.3	228	58.2	63.9	25	20.3	19.8	9.7	6.1	3.5	2.6
NW	228.1	170	53	18.3	16.8	26.9	27.2	15.6	14.2	9	5.1

Rates are per 100,000 except of infant mortality, neonatal mortality, and post neonatal mortality which are per 1,000 live births

Table 4 presents death rates per year by race and sex. Overall, males have a higher total death rate each year than females. This is also seen when comparing White males and White females, with the exception of one year, 2002. Nonwhite males have a higher total death rate each year compared to Nonwhite females. White males demonstrated a higher total death rate than Nonwhite males each year. White females had a higher total death rate than Nonwhite females each year during the study period.

Table 4
Total Death Rates, by Sex, Race and Year, 1995-2004

Year	Male	Female	White Male	White Female	Nonwhite Male	Nonwhite Female
1995	10.9	9.2	11.1	9.9	10.5	8
1996	10.6	9.2	10.8	9.9	10.1	8.1
1997	10.8	9.6	11.0	10.3	10.4	8.4
1998	10.7	9.5	11.1	10.2	10.0	8.3
1999	10.7	9.6	11.2	10.5	9.8	8.3
2000	10.3	9.8	11.0	11.0	9.0	8.0
2001	10.1	9.7	10.8	10.7	9.0	8.1
2002	10.2	9.8	10.8	10.9	9.2	8.1
2003	10.1	9.6	10.8	10.8	9.0	7.7
2004	10	9.2	10.8	10.2	8.6	7.5

*deaths per 1,000 population

Table 5 presents the comparison of total death rates by sex and race. Males had a statistically significantly higher mean total death rate ($p = 0.000001$) than females. White males had a statistically significantly higher total death rate
Than White females ($p = 0.002$). In addition, during the study period White males had a higher total death rate than

Nonwhite males (p = 0.000006). White females demonstrated a statistically significantly higher total death rate than Nonwhite females (p < 0.000000). With respect to Nonwhites, males had significantly higher total death rates than females (p = 0.000006).

Table 5
Comparison of Total Death Rate by Sex and race, 1995-2004

	Mean Total Death Rate*	**t-Stat**	**p-value**
Males	**1,094**	**7.08**	**0.000001**
Females	**952**		
White Males	**1,090**	**3.67**	**0.002**
White Females	**1,044**		
Nonwhite Males	**956**	**6.53**	**0.00004**
Nonwhite Females	**805**		
White Males	**1,090**	**6.27**	**0.000006**
Nonwhite Males	**956**		
White Females	**1,044**	**15.54**	**< 0.000000**
Nonwhite Females	**805**		

* deaths per 100,000 population

Table 6 illustrates death rates across health districts in the State. The health districts are geographical-specific areas designed for administrative purposes. Data are collected by health districts, so they provide a reasonable geographic distribution of the State. These geographic districts are quite heterogeneous with respect to demographics and socioeconomic characteristics. For

example, District III is comprised of counties in the Mississippi Delta. This district is one of the most rural in the State, and is characterized by having the highest rate of poverty, lowest rates of education, and highest prevalence of chronic diseases, such as obesity and diabetes. Another example is District V which is comprised of the counties in and around the state capital, Jackson. This district is the largest metropolitan and most densely populated area in the State.

Interestingly, District VII, which is located in the southwestern portion of the State has the highest mean total death rate and the highest cause-specific death rates for three of the eleven leading causes of death under study. Not surprisingly, the highest mean maternal and child health death rates (infant mortality, neonatal mortality, and post-neonatal mortality) were found in District III, the Mississippi Delta. District III also had the highest mean cerebrovascular disease death rate.

Table 6
Death Rates by Health Districts

	District								
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**
Total	947	1030	1092	967	911	1113	1164	1018	927
Heart Disease	289	339	380.8	331.8	295.7	384.6	390.5	331.6	301.4
Malignant Neoplasms	210.9	214.9	226.1	198.7	194.9	227.9	241.7	210.6	214.6
CVD	66.2	76.6	78.8	68.0	57.9	69.9	76.3	68.3	49.4
Emphysema	40.6	53.8	38.9	37.6	36.7	48.4	50.8	47.8	44.4
Pneumonia	29.7	34.7	33.2	28.9	26.3	35.4	37.5	35.9	23.6
Nephritis	17.6	18.3	23.1	21.8	15.4	23.9	23.0	19.3	16.2
Diabetes	25.6	18.8	24.6	19.8	18.1	21.3	44.9	22.6	17.0
Hypertension	18.2	9.2	12.2	9.7	8.1	8.6	11.7	7.9	3.6
Infant mortality	11.2	9.8	12.9	10.9	10.9	11.5	9.3	8.7	8.7
Neonatal mortality	7.0	6.1	709	7.3	6.7	7.1	5.8	5.2	5.0
Post Neonatal Mortality	4.1	3.7	5.0	3.7	4.3	4.4	3.5	3.6	6.6

DISCUSSION

This study has shown that disparities do exist, over time, in death rates in Mississippi. As has been observed previously in other studies, these disparities are seen across

races, sex, and geography. Interestingly, disparity was also seen across specific causes of death in a heterogeneous manner. Some specific causes have higher death rates in Whites, while others demonstrated higher death rates in Nonwhites. For example, Whites had significantly higher death rates from heart disease, malignant neoplasms, cerebrovascular disease, emphysema, and pneumonia. Nonwhites had higher death rates from nephritis, diabetes mellitus, hypertension, infant mortality, neonatal mortality, and post-neonatal mortality.

The data indicate, not unexpectedly, that males have a higher death rate from all causes when compared to females. This trend is observed across all races and was constant throughout the 10-year study period. This indicates that the factors which influence this trend have not undergone any major modification over time. This finding is encouraging to know because the disparity between the rate of death of males and females is stable and future interventions have a promise of success.

An important finding is that in Mississippi Whites demonstrated higher overall death rate than Nonwhites, as well as males having a higher death rate than females. These findings indicate that specific interventions for prevention and treatment of the causes of death. General health education and health promotion strategies will not be successful because specific interventions must be implemented for specific causes of death will knowledge of what race, sex, or geographic area has the highest death rate. Interventions must be tailored to address racial and cultural competencies of the intended target groups.

CONCLUSIONS

Health disparities are, indeed, a challenge for public health and healthcare delivery systems. Disparities are occurring across racial groups, gender, geographic area and

within diseases and conditions. Disparities can be closely tracked by demographics and socioeconomic characteristics. This is troubling because the demographic changes that are expected over the next several decades will exacerbate the problem. The anticipated increase in the poor and uninsured in the United States over the next few decades will certainly have a negative effect in the future.

The focus on disparities must occur, as well as changes in the ways health promotion, health education, delivery and financing of health care services are conceptualized and implemented. Elimination of health disparities must be a major focus of public health management and practice. This effort will center on creating enhanced methods of preventing disease, promotion of health and healthy behaviors, health education, and delivery of healthcare services. Crucial to this enhanced elimination effort is the understanding of which groups within the population are demonstrating health disparity. The identification of high risk groups in the population is essential to the success of this effort.

The key to a successful disparity elimination strategy is creativity. This study has shown that in the case of death rates, disparity has been constant for ten years. New knowledge about what is causing the differential distribution of disease and subsequent deaths in the population must be explored. This will involve learning more about the determinants of disease, the root causes of disparities, and the identification of interventions that are more likely to succeed. The elimination effort must occur through a partnership between local, state, and national organizations, both public and private. The disparity elimination effort must be accompanied by new and creative state and national health policy initiatives.

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