

Mississippi Stroke Report 2005

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Executive Summary

Stroke is the fourth leading cause of death in Mississippi, accounting for 1,632 deaths, or 5.9% of all deaths, in 2004. Much of this is premature: nearly one in five of all stroke deaths occur in Mississippians under 65 years of age. Mississippi's stroke mortality rate is the fifth highest in the nation in 2002. Stroke death rates in Mississippi are falling slightly faster than the national average, but remain 23.8% higher than the overall U.S. rate. Rates in all population groups now appear to be leveling off, but African Americans continue to have higher stroke mortality rates than whites. In 2004, rates were 59.8% higher for African American men than white men, and 59.8% higher for African American women than white women. Further decreases in the stroke mortality rates will not be achieved unless racial/ethnic disparities are reduced.

Stroke mortality rates show a wide variation from county to county - this is largely the result of environmental influences (social, economic, and cultural factors) on the incidence of, and mortality from, stroke. These influences act through unhealthy behaviors and lifestyles. Nearly nine out of ten Mississippi adults over the age of 45 have at least one of the six major cardiovascular risk factors. To reduce the prevalence of stroke risk factors in the population more Mississippians need to control their blood pressure, stop smoking, lose weight, become more active, eat a healthier diet, and lower their blood cholesterol level. Prevention must start at an early age, since the processes that lead to stroke in middle or old age begin in childhood and adolescence.

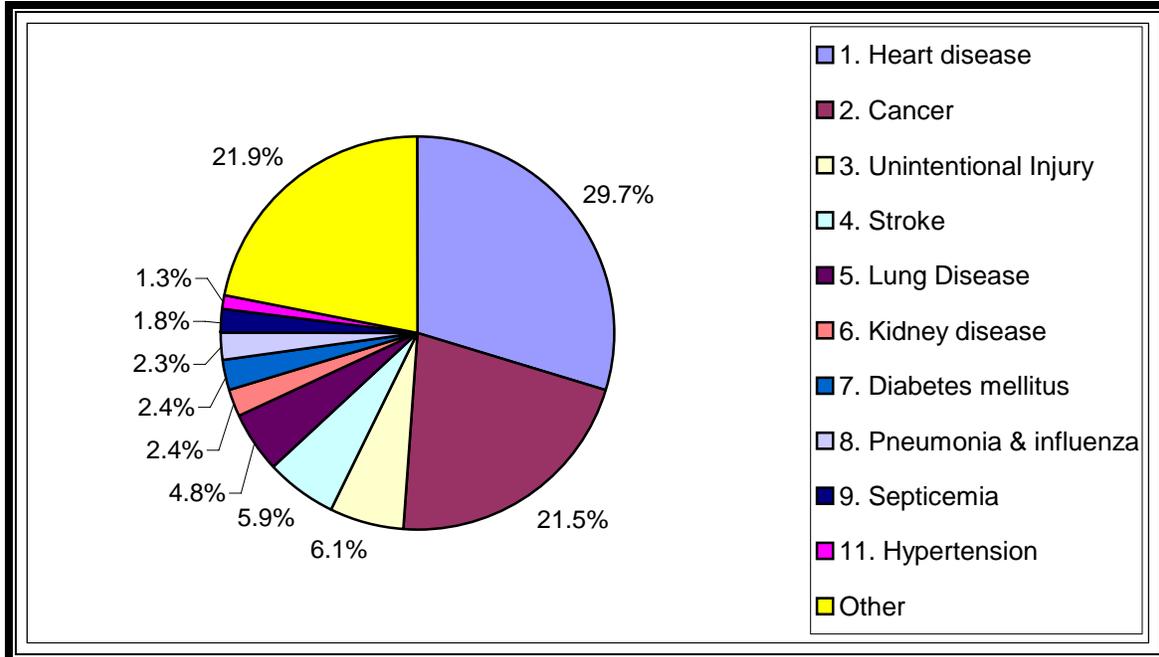
Stroke knowledge and awareness needs to be improved, and more people need to know that treatment for certain types of stroke is now possible and that rapid transfer to hospital / ER for evaluation is important. In addition, the 911 / emergency response system will need to be expanded in rural areas, and all emergency response personnel will need to be fully educated on the concept of "brain attack" and the need for rapid transfer of stroke patients to hospital/ER.

Much of the death, illness, and disability due to stroke is preventable, but stroke will not be prevented without statewide actions to create and maintain environments, policies, and norms that encourage and support cardiovascular health.

Introduction

Stroke results from obstruction of a blood vessel in the neck or brain causing the brain tissue to be starved of oxygen (the ischemic or thromboembolic variety), or from rupture of a blood vessel in the brain resulting in hemorrhage into the brain tissue (the hemorrhagic variety). In most cases, the underlying pathology involves thickening and narrowing of the arterial blood vessels in the neck and brain, a process called atherosclerosis, which begins in childhood and progresses over a lifetime. Stroke is usually manifest as sudden onset of paralysis, weakness, or numbness on one side of the body; loss of speech or difficulty talking; partial loss of the field of vision; dizziness or loss of consciousness; and it is a leading cause of death. Stroke is the fourth leading cause of death in Mississippi, responsible for 1,632 deaths, or 5.9% of all deaths, in 2004 (Figure 1). Although commonly thought of as a condition of old age, stroke is responsible for a considerable amount of premature mortality, here defined as death before age 65. It is also the leading cause of long-term disability among adults.

Figure 1. Leading causes of death, Mississippi, 2004.



Stroke incidence

The exact incidence of stroke in Mississippi is unknown, as the state has no stroke register or statewide hospital discharge data system. A very rough estimate (based on extrapolations from national data) is that more than 5,000 Mississippians suffer a first stroke each year; another 2,000 suffer a recurrent stroke each year. Eighty-five percent of strokes are of the ischemic (thromboembolic) variety and the remaining 15% are hemorrhagic. Approximately one-third of victims die, one-third become disabled, and one-third recover. At any one time, about 11,000 Mississippians have difficulty with functional limitations, activities of daily living, etc., resulting from stroke.

Stroke mortality

In 2004, the overall stroke mortality rate in Mississippi was 56.2 per 100,000 (crude) and 59.4 per 100,000 (age-adjusted to the 2000 U.S. population). Approximately 1,632 Mississippians died from stroke:

- 956 deaths among women and 676 deaths among men;
- 1,037 deaths among whites and 595 deaths among African Americans.

In 2002 (the latest year for which comparable national data are available), the state ranked fifth highest in the U.S., with a stroke mortality rate (69.6) that was 23.8% higher than the rate for the U.S. as a whole (56.2). Mississippi's stroke mortality rate is, and has been for many years, one of the highest in the nation (Table 1).

Table 1. States with the highest and lowest stroke mortality rates, 2002.

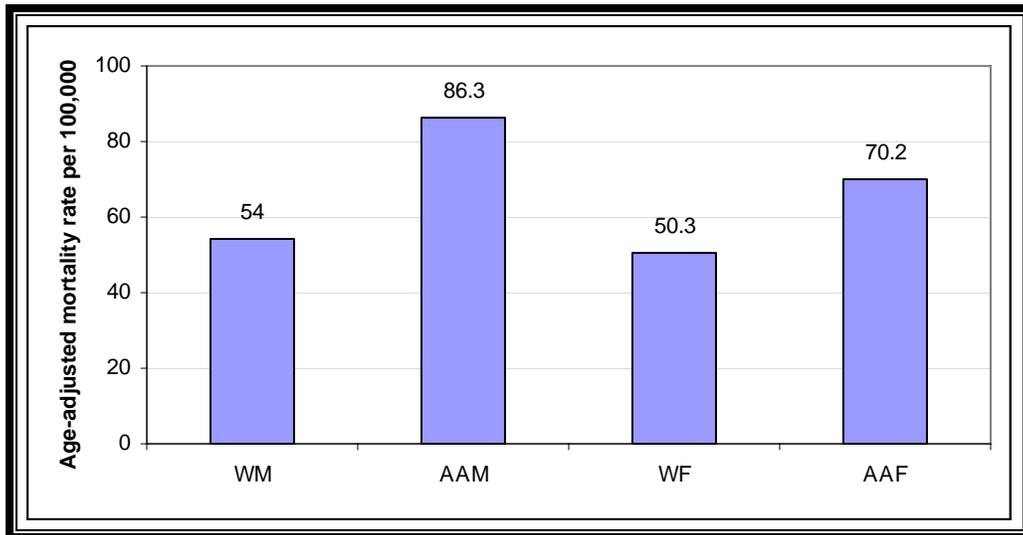
States with the highest rates in 2002	Stroke mortality rate /100,000*	States with the lowest rates in 2002	Stroke mortality rate /100,000*
Arkansas	74.5	Rhode Island	46.1
South Carolina	72.7	Connecticut	45.5
Tennessee	70.4	New Jersey	43.6
Alabama	69.7	New Mexico	41.7
Mississippi	69.6	New York	37.4

*age-adjusted to the 2000 U.S. population

Mississippi is one of eleven states in the southeast region of the U.S. known as the ‘Stroke Belt’; this region has for at least 50 years had higher stroke death rates than other U.S. regions.

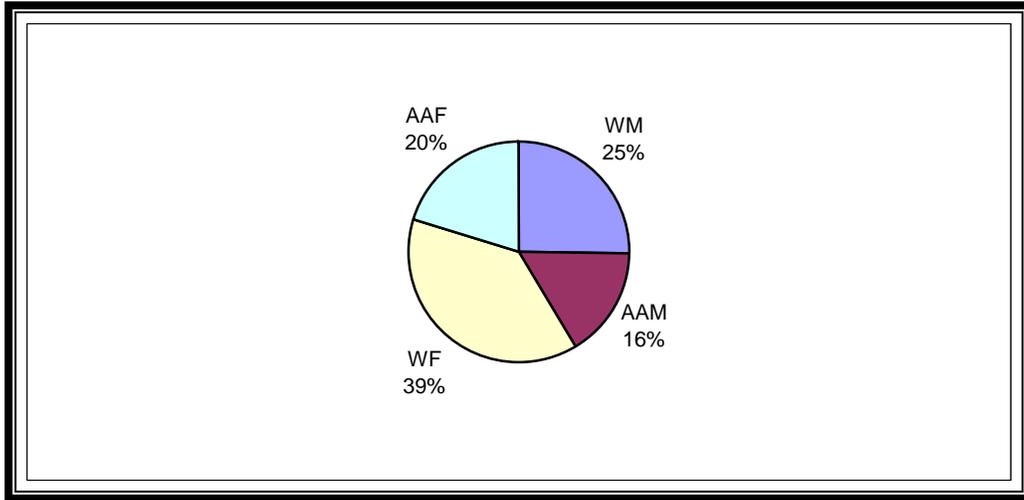
Stroke death rates differ by racial/ethnic group, gender, and age group. African Americans have higher rates than whites, and men have higher rates than women. In 2004, rates were 59.8% higher for African American men (86.3 per 100,000) than white men (54 per 100,000), and 39.6% higher for African American women (70.2 per 100,000) than white women (50.3 per 100,000) (Figure 2). The exact reasons for these disparities are unknown.

Figure 2. Stroke mortality rates by race and gender, Mississippi, 2004.



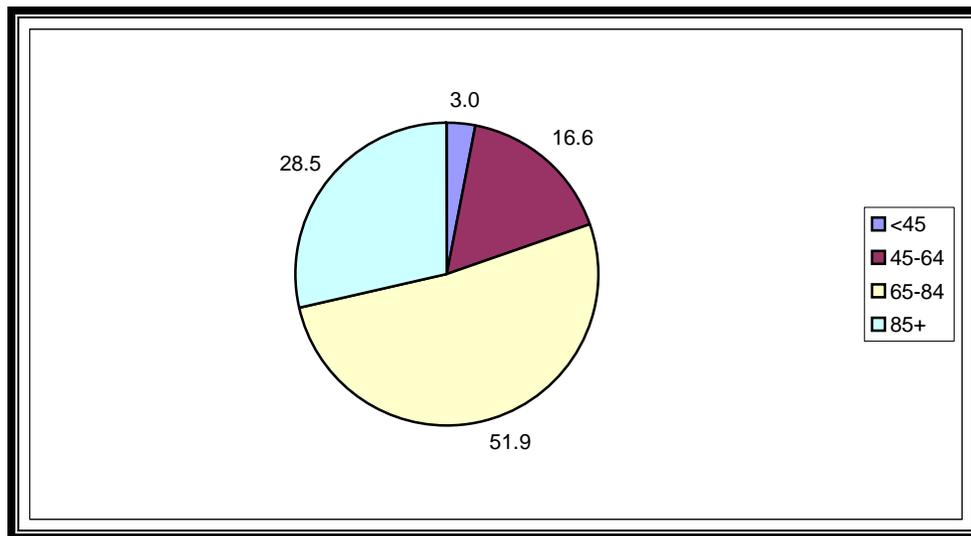
In terms of absolute numbers of deaths, however, there are more stroke deaths in females than males because more women live to older ages, when stroke is more common. In 2004, there were 956 stroke deaths among women and 676 stroke deaths among men (Figure 3).

Figure 3. Proportional distribution of stroke deaths by race and gender, Mississippi, 2004.



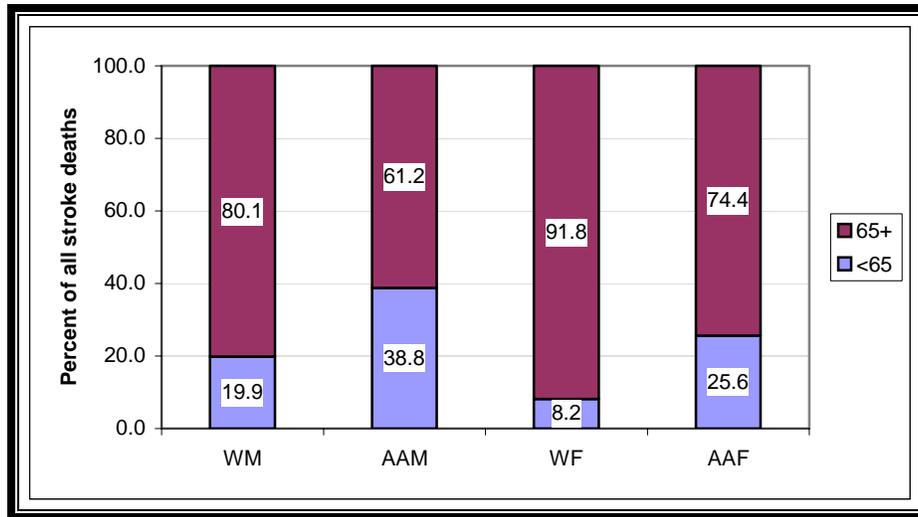
Stroke is uncommon before middle age; the risk of stroke doubles with each succeeding decade after the age of 55, and stroke death rates increase steeply from middle into old age. However, in 2004, nearly one in five of all stroke deaths in Mississippians occurred under 65 years of age (Figure 4).

Figure 4. Percentage of Stroke deaths by age group, Mississippi, 2004.



This premature mortality due to stroke is greater for men than women and for African Americans than whites. The largest amount of premature stroke mortality occurs in African American men: 38.8% of all stroke deaths in this group occurred before age 65 (Figure 5).

Figure 5. Premature stroke deaths by race and gender, Mississippi, 2004.

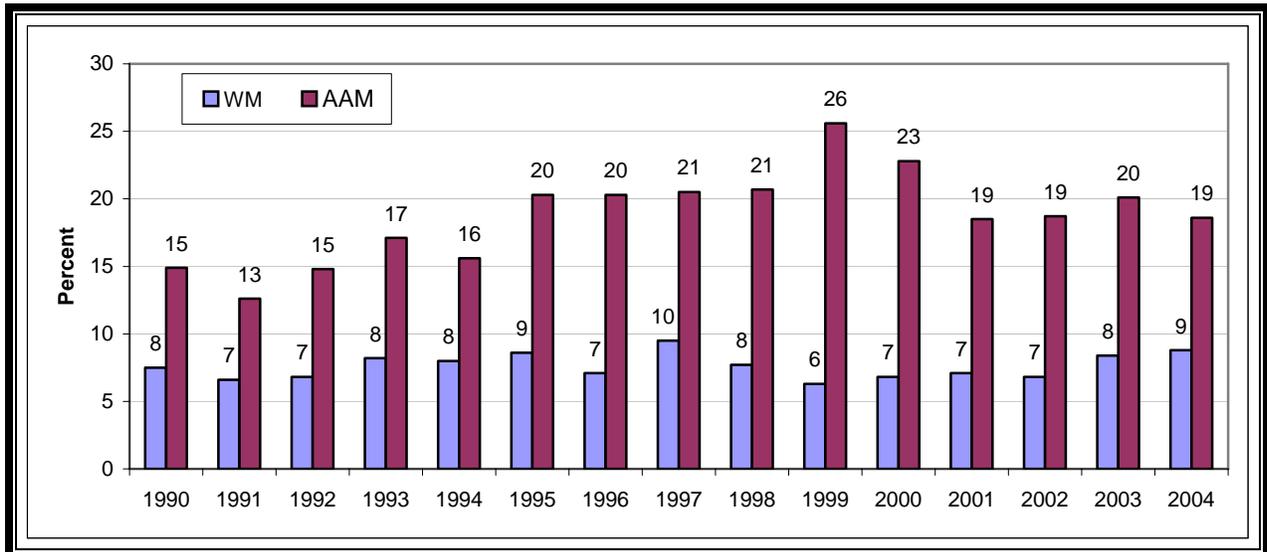


Premature stroke mortality in African-American men in Mississippi: the silent epidemic

In Mississippi, life expectancy for African-American men is about 7 years lower than that for white men, and about 1.5 years lower than the U.S. average. Much of this is likely due to premature death from cardiovascular disease (CVD), including stroke. However, little recognition is being given to this problem.

The percentage of premature stroke deaths (here defined as deaths before age 55) is higher in African-American men, and increasing, but the reasons are unclear. Overall, about 12.4% of deaths due to stroke in 2004 in Mississippi men occurred under age 55, including 36 deaths in white men and 49 deaths in African-American men. About 19% of stroke deaths in African-American men and 9% of stroke deaths in white men were under age 55. Time trend data for the period 1990-2004 show that the percentage of stroke deaths that are premature has increased in African-American men from about 15% in 1990 to about 19% in 2004, whereas the figures for white men have changed little (Figure 6).

Figure 6. Percent of stroke deaths by year, Mississippi men under age 55, 1990-2004.



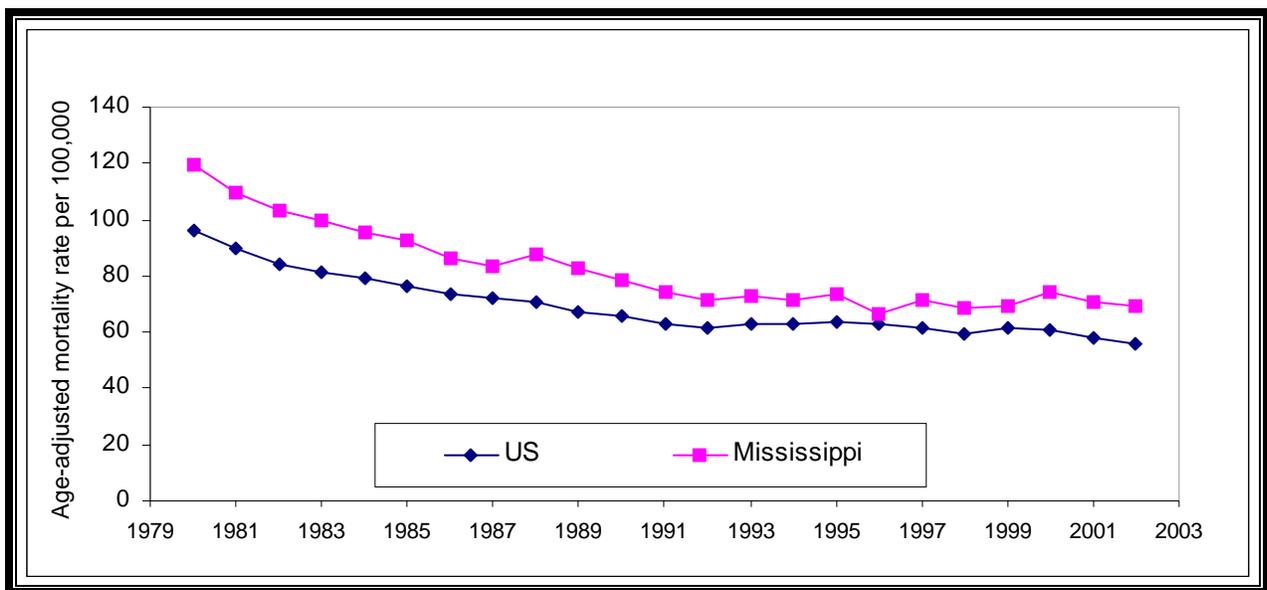
Several possible explanations must be considered for these trends. Differences in death certification / coding practices are possible but unlikely. Differences in the distribution of cardiovascular (CV) risk factors (and changing differences over time) likely play a role, but do not seem large enough to be the sole explanation. African-American men tend to have more hypertension and obesity, and slightly more clustering of risk factors (see the next section). However, no clear association exists between the time trend in mortality rates and changes in risk factors. Changes in the prevalence of controlled (by medication) high blood pressure may be important; insufficient data are available to be certain. Differences in the detection and treatment of CV risk factors and differences in stroke severity should also be considered. Related to this, differences in access to, and quality of, both primary and specialist medical care – for prevention, treatment, and rehabilitation – may also be important. Racial differences in medical care have been well documented elsewhere, but this was not addressed in this study and will require further work.

Premature mortality due to stroke is an important but not widely recognized public health problem among Mississippi African-American men.

Trends in stroke mortality in Mississippi

Stroke mortality rates in Mississippi have actually declined slightly faster than U.S. rates. Between 1980 and 2002, stroke death rates for the U.S. as a whole declined by 41.7%, an average of 2.0% per year. Mississippi's stroke death rate declined by 41.9% over the same period, an average of 2.2% per year. Mississippi's rate, however, remains 23.8% higher than the U.S. rate (Figure 7).

Figure 7. Stroke mortality rates by year, Mississippi and the U.S., 1980-2002.



Overall, the rate of decline has been similar in all population groups (Figures 8 and 9). However, since 1993, rates in African-American males, though slightly irregular, have not declined and have remained high. Rates in white males and in females now appear to have leveled off at a lower level.

Figure 8. Stroke mortality rates by year, by race and gender, Mississippi, 1980-2002.

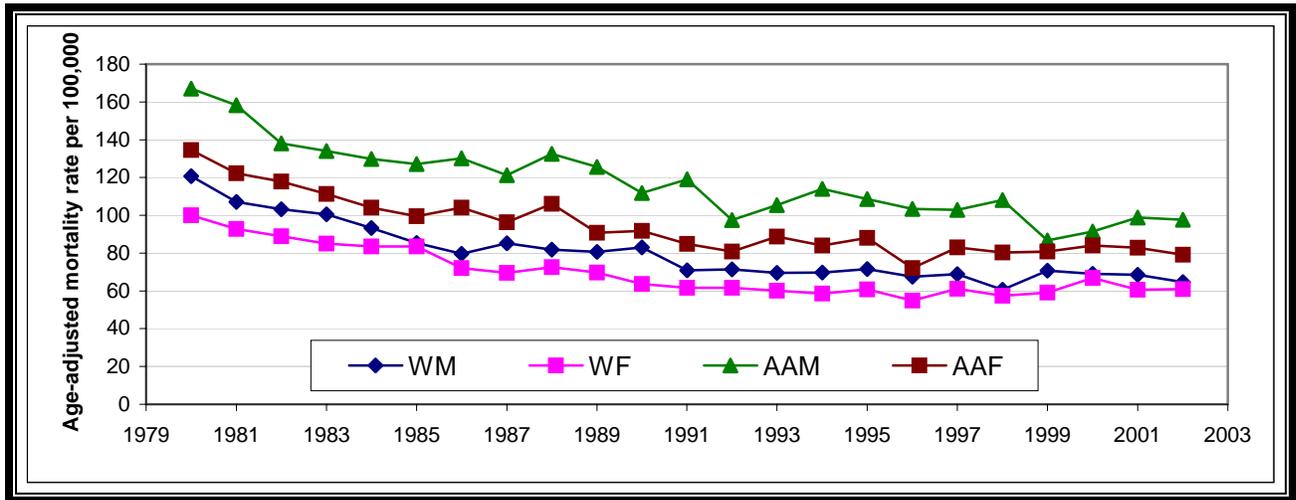
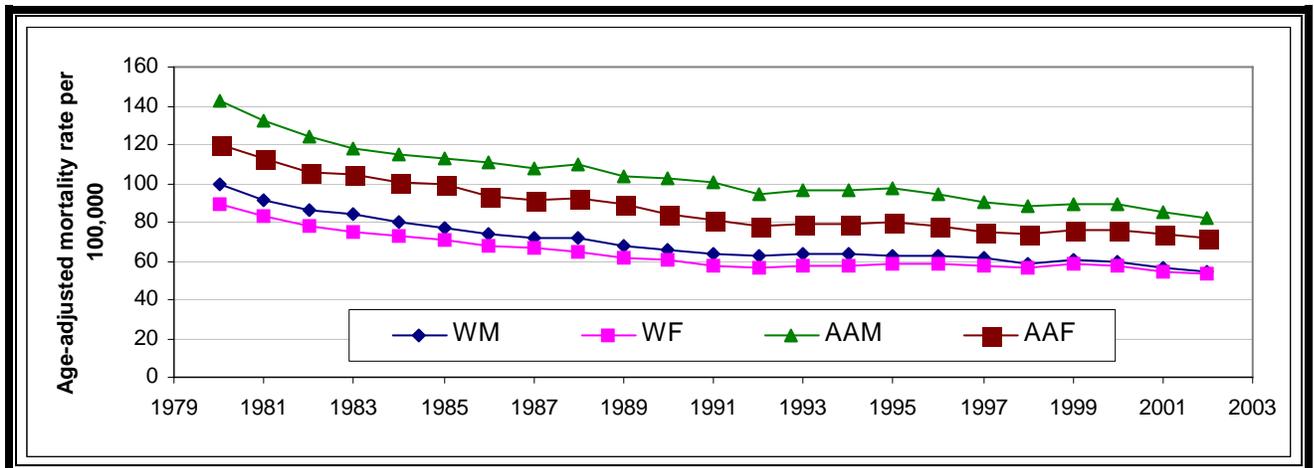


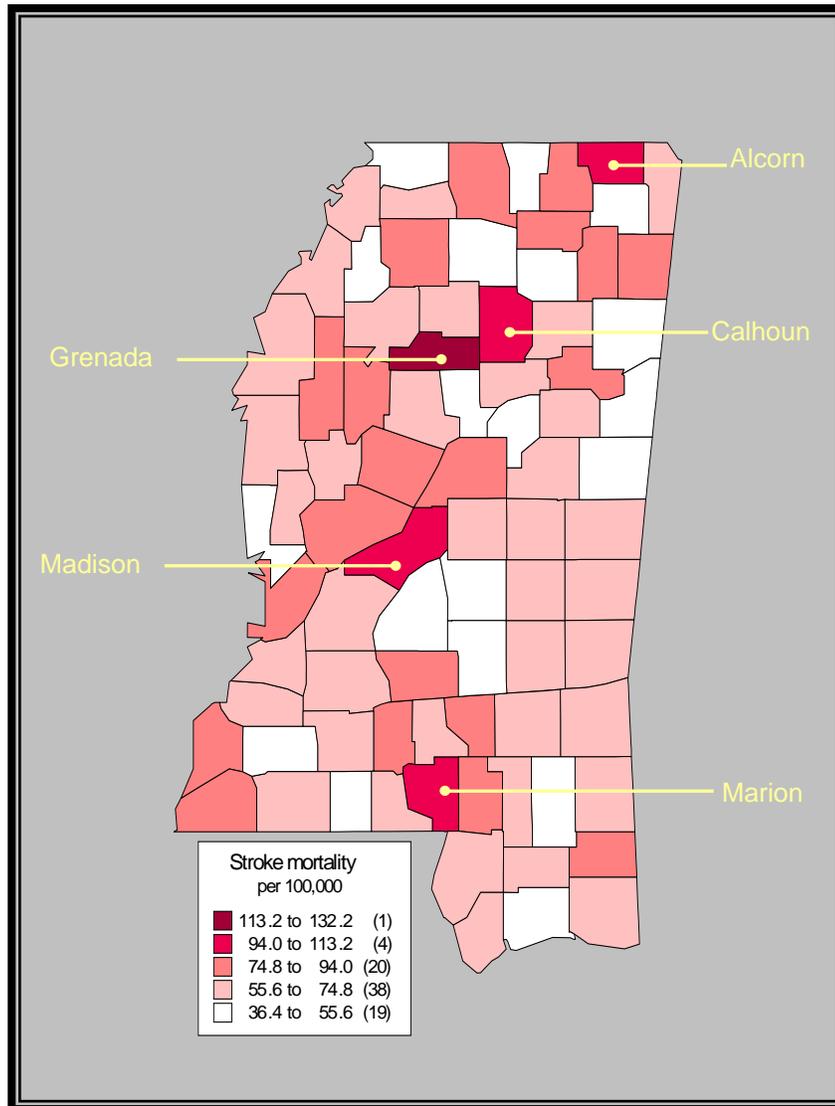
Figure 9. Stroke mortality rates by year, by race and gender, U.S., 1980-2002.



Stroke mortality statistics by county

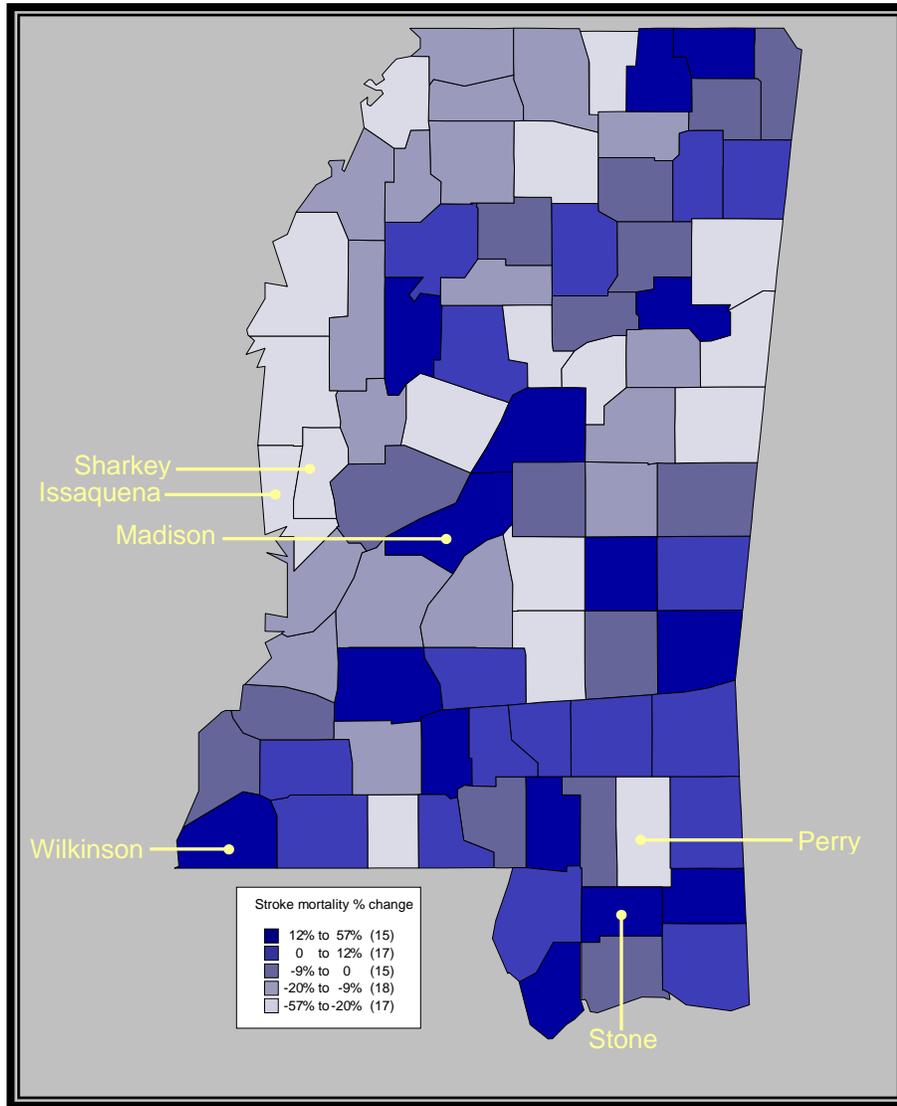
Age adjusted stroke mortality rates show a wide variation from county to county, ranging from 132.2 per 100,000 (Grenada) to 36.4 per 100,000 (Choctaw), a difference of 263% (Figure 10 and Table in Appendix C). Grenada county's rate is 142% above the state average (66.8 per 100,000). Twenty-five of the state's 82 counties have stroke mortality rates that are statistically significantly higher than the state's overall rate. The top ten counties with the highest stroke mortality rates are, in descending order, Grenada, Marion, Alcorn, Calhoun, Madison, Leflore, Wilkinson, Lawrence, Attala and Tippah.

Figure 10. Stroke mortality rates by county, Mississippi, 1999-2001.



Such wide variation in rates between counties is largely the result of environmental influences (social, economic, and cultural factors) on the incidence of, and mortality from, stroke, and emphasizes the need for prevention at all levels to reduce the rates and lessen the differences. This becomes even more urgent when trend data are examined: compared to 1995-1999, 32 counties — 8 of the top 10 plus 28 others — had stroke mortality rates in 2000-2004 that actually increased by more than the state average increase, some by up to 56% (Figure 11 and Table in Appendix C).

Figure 11. Percentage change in stroke mortality rates by county, Mississippi, 1999-2001 vs. 1996-1998.



Stroke morbidity

In 2003, 3.4% of Mississippi adults, or about 69,000 persons, reported having had a stroke (Table 2). These numbers are based on self-reported data from questions that have not yet been validated. Therefore, too much weight should not be put on trends over time. The numbers do, however, serve to give some sense of the burden of stroke morbidity in the state.

Table 2. Prevalence (%) of stroke, Mississippi, 1998-2003.

	1998	1999	2000	2001	2002	2003
Has a doctor, nurse, or other health professional ever told you that you had a stroke?	2.0	2.7	2.6	2.4	3.1	3.4

Prevalence data for 2000 are available for a limited number of other states. Out of 13 states using the CVD module of questions in 2000, Mississippi ranked 3rd highest in prevalence of stroke (Table 3).

Table 3. Prevalence (%) of stroke by state, 2000

	Prevalence (%)		Prevalence (%)
West Virginia	3.1	Delaware	2.3
Kentucky	2.8	Georgia	2.2
Mississippi	2.6	Virginia	2.1
Ohio	2.5	Iowa	1.9
Indiana	2.5	South Carolina	1.7
Pennsylvania	2.4	Oklahoma	1.7
Montana	2.3		

The average age at the time of the first stroke is about 54-55 years, with (in 2003) a lower age in women and (in all years) a lower average age in African-Americans (Table 4).

Table 4. Average age at time of first stroke, Mississippi, 2001-2003.

	1998	1999	2000	2001	2002	2003
All	n/a	n/a	n/a	55.4	53.8	56.1
Males	n/a	n/a	n/a	51.6	53.8	59.0
Females	n/a	n/a	n/a	58.6	53.9	53.7
White	n/a	n/a	n/a	58.3	57.1	56.2
African-American	n/a	n/a	n/a	50.1	50.0	54.4

*n/a=not asked

Only approximately one quarter of heart attack or stroke victims report getting some kind of rehabilitation following their CVD event (Table 5).

Table 5. Frequency (%) of outpatient rehabilitation following heart attack or stroke, Mississippi, 2001-2003.

After you left the hospital, following your heart attack or stroke did you go to any kind of outpatient rehabilitation?	1998	1999	2000	2001	2002	2003
All	n/a	n/a	n/a	26.5	24.4	24.2
Males	n/a	n/a	n/a	31.5	26.8	22.3
Females	n/a	n/a	n/a	20.5	21.4	26.4
White	n/a	n/a	n/a	23.2	25.4	23.3
African-American	n/a	n/a	n/a	47.1	24.6	24.3

*n/a=not asked

Risk factors for stroke

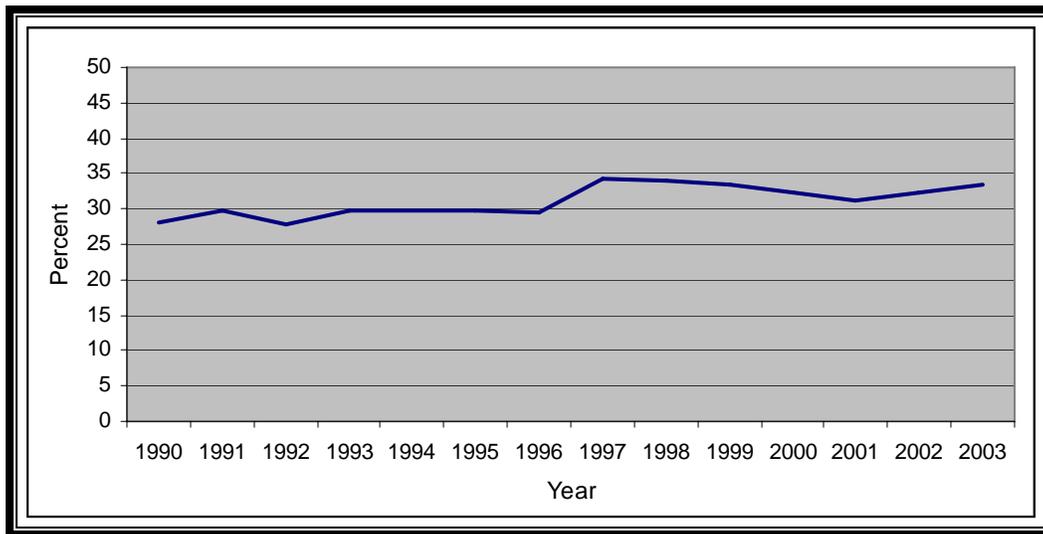
By definition, a risk factor for stroke is a condition or behavior that increases a person’s risk of developing stroke; the risk factor is often directly involved in causing the stroke, though this is not always necessary. Some risk factors are “modifiable”: in other words, the risk factor can be controlled or reduced, and the risk of developing stroke lessened. Risk factors for stroke that cannot be changed are age (stroke mortality rates increase as age increases), gender (males have higher stroke mortality rates than women), race (African Americans generally have higher rates than whites), family history of stroke at an early age, and previous medical history of stroke or ‘mini-stroke’. The main *modifiable* risk factors are high blood pressure, smoking, overweight/obesity, high blood cholesterol level, diabetes, and lack of regular physical activity. Prevalence data on these are available for Mississippi since 1990. For several risk factors (e.g., obesity and diabetes), Mississippi has the highest prevalence rates in the nation.

High blood pressure (Hypertension)

Most people have had their blood pressure (BP) checked at some time in the recent past. Only slightly less than 5% of Mississippi adults report that they have not had a BP check within the past 2 years. Between 1990 and 1996, the percentage of adult Mississippians with hypertension

remained fairly constant at 28-30%. In 1997, this figure increased to 34%, and in 2003 it was 33% (Figure 12). The Healthy People 2010 target is to reduce the prevalence of high blood pressure among adults to 16%. More than 700,000 adults in the state are now estimated to have hypertension. This number does not include the thousands who have hypertension but are unaware of it, so the total number is likely much higher.

Figure 12. Percent of Mississippi adults reporting high blood pressure, 1990-2003.



No data are available to show whether persons with hypertension are being appropriately treated or whether their blood pressures are under control. Current guidelines

(www.nhlbi.nih.gov/guidelines/hypertension/express.pdf) recommend that BP be maintained below 140/90 (below 130/80 for persons with diabetes or chronic kidney disease).

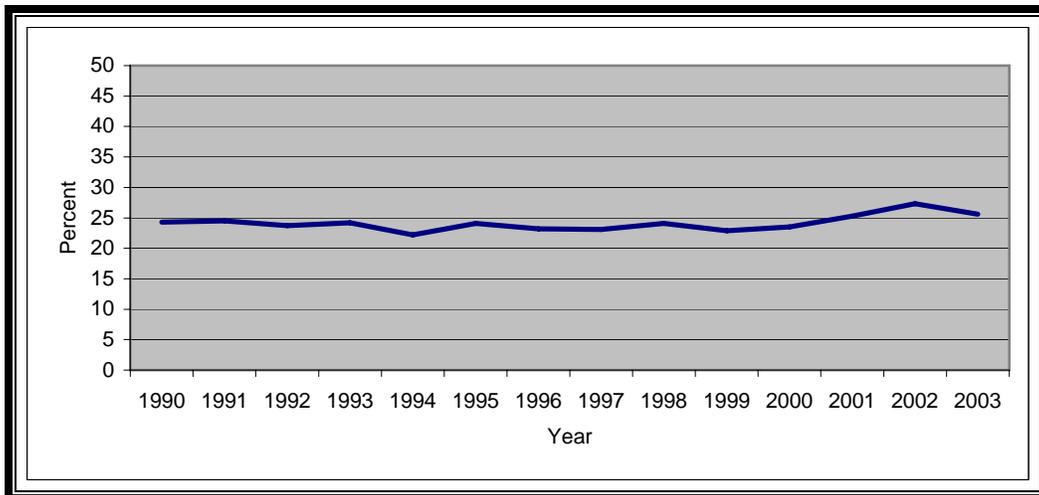
Hypertension is a major risk factor for both CHD and stroke, and the high (and rising) prevalence is very likely an important reason for the high CHD and stroke mortality rates in the state. *Every Mississippian should know his/her blood pressure.*

Smoking

Slightly more than one quarter (25.6%) of adult Mississippians were current smokers in 2003. This figure has stayed virtually constant since 1990, though it has increased slightly in recent years (Figure 13). Although this percentage has decreased considerably since the 1940s and

1950s, when 50-60% of adults smoked, further improvements may be difficult to achieve. Interventions to increase quitting rates are important and will lead to immediate decreases in the smoking prevalence rate, though this group of current smokers probably includes ‘hard-core’ smokers who are more resistant to quitting. Even more important are interventions to reduce smoking initiation rates in young people: smoking rates in teenagers are actually increasing, especially in adolescent females. In 2003, 25% of Mississippi adolescents were current cigarette smokers. Interventions to prevent the use of tobacco will not result in immediate changes in the smoking prevalence rates, and it may take decades before the impact of such preventive interventions becomes apparent. The Healthy People 2010 target is to reduce cigarette smoking among adults to 12%, and among adolescents to 16%.

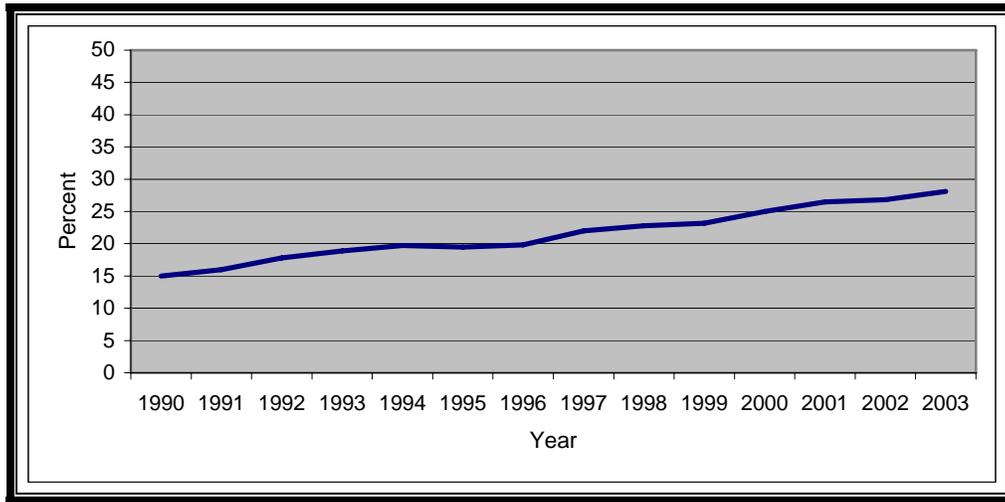
Figure 13. Percent of Mississippi adults reporting current cigarette smoking, 1990-2003.



Being overweight/obese

Mortality is 10-25% higher for persons with a BMI between 25 and 30, and 50-100% higher for persons with a BMI of 30 or more. The percentage of adult Mississippians who are obese (BMI equal to or greater than 30) has increased steadily since 1990 (Figure 14); in 2003, 28% of adult Mississippians were obese, and another 37% were overweight (BMI 25.0 - 29.9). In 2003, 16% of Mississippi adolescents were obese. The Healthy People 2010 target is to reduce the prevalence of obesity among adults to 15%, and among adolescents to 5%. *Every Mississippian should know his/her BMI (the formula for calculating BMI is given in Appendix A).*

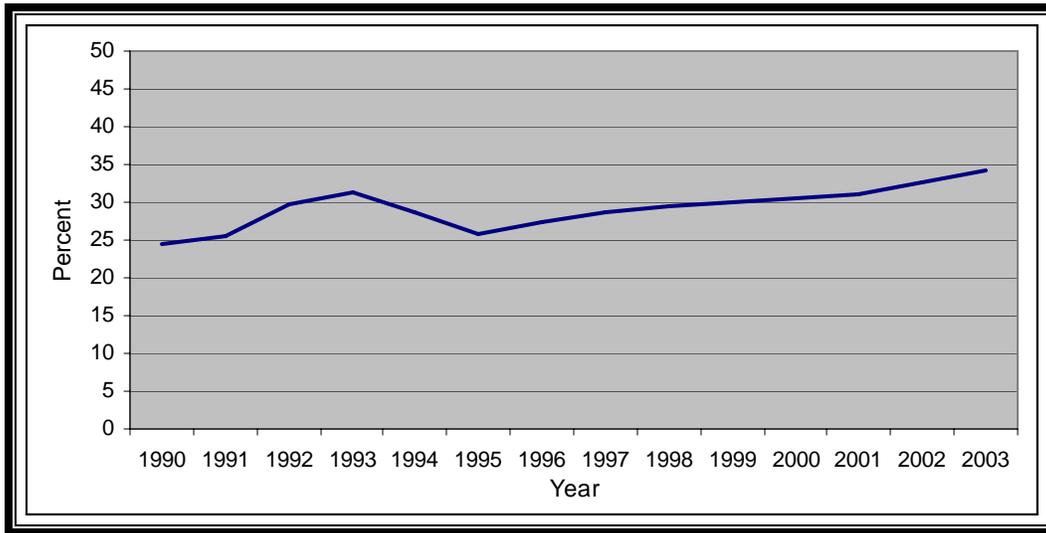
Figure 14. Percent of Mississippi adults who are obese, 1990-2003.



High blood cholesterol levels

More Mississippi adults are getting blood cholesterol checks than before, but a large proportion – 27.4% - report that they have never had a blood cholesterol check. Of those who have had a check, about 75% have had a check within the past year. The percentage of adult Mississippians reporting a high blood cholesterol level has increased since 1990 and in 2003 it stands at 34.9% (Figure 15). The Healthy People 2010 target is to reduce the prevalence of high blood cholesterol among adults to 17%.

Figure 15. Percent of Mississippi adults reporting high blood cholesterol, 1990-2003.

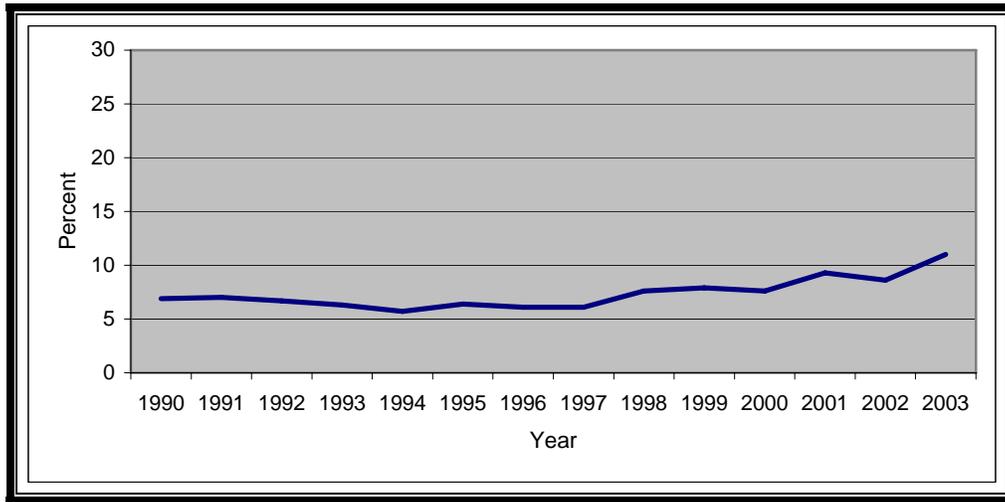


As with hypertension, no data are available to show whether persons with high cholesterol levels are being appropriately treated or whether their cholesterol levels are under control. Current guidelines (www.nhlbi.nih.gov/guidelines/cholesterol/) recommend that LDL cholesterol be below 100 for those at highest risk, below 130 for those at more moderate risk, and below 160 for everyone else. Evidence is emerging that even lower levels may be better. *Every Mississippian should know his/her blood cholesterol level.*

Diabetes mellitus

Diabetes is now recognized as a major, independent risk factor for CVD and stroke. Between 1990 and 1996, the percentage of adult Mississippians with diabetes remained fairly constant at around 6%. In 1998, this figure increased to 7.6% and in 2003 it stands at 11% (Figure 16). The Healthy People 2010 target is to reduce the overall rate of diabetes that is clinically diagnosed to 2.5%. Approximately 350,000 adults in the state are now estimated to have diabetes; one third of these have not been diagnosed. More than 400,000 Mississippi adults (22%) are at risk of developing it in the future, because they are overweight and/or physically inactive.

Figure 16. Percent of Mississippi adults reporting diabetes, 1990-2003.



Lack of regular physical activity

The current recommendations for physical activity can be found at <http://www.cdc.gov/nccdphp/dnpa/physical/recommendations/>. In 2003, only 19.3% of adult Mississippians met the recommendations for moderate physical activity, 11.1% met the recommendations for vigorous physical activity, and 11.7% met both recommendations. In 2003, 30% reported taking no leisure-time physical activity or exercise at all (Figure 17). This figure has declined fairly steadily since 1992, when it was 48%, but over the past 5 years the decrease has been small, despite repeated health education messages and recommendations in the news media that people become more active. The Healthy People 2010 target is to reduce the prevalence of no leisure-time physical activity among adults to 20%.

More and more studies are showing the many benefits of regular, moderate physical activity - 30 minutes or more each day on five or more days each week. Moderate activity includes brisk walking, yard work, and so on; intense aerobic exercise in a gym is not necessary to achieve health benefits. The Healthy People 2010 target is to increase the prevalence of regular, moderate physical activity among adults to 30% (the current prevalence in Mississippi is 19%).

Figure 17. Percent of Mississippi adults reporting no exercise in the past month, 1990-2003.



Ideally, regular exercise habits need to begin in childhood. However, surveys in Mississippi public schools show that this is not happening. In 2003, the percentage of students who attended physical education class daily was 23% (the Healthy People 2010 target is 50%). The percentage of students who participated in moderate physical activity during the past week was 18% (Healthy People 2010 target: 35%) and the percentage of students who participated in vigorous physical activity during the past week was 53% (Healthy People 2010 target: 85%). The percentage of students who watched 2 or fewer hours of TV on an average school day was 46% (Healthy People 2010 target: 75%).

How many Mississippi adults have clustering of CV risk factors, and how many are risk-free?

As previously described, there are marked and growing disparities in CVD mortality rates between white and African-Americans in Mississippi. These differences are not fully explained by corresponding differences in the main cardiovascular (CV) risk factors, as currently measured. To try to explain this apparent inconsistency, it may be more useful to determine how many persons are risk-free, that is, have no risk factors, and how many persons have multiple risk factors.

In 2003, analysis of the Mississippi BRFSS data showed that, for adults 45 years of age and older (see Table 6):

- 87% of Mississippi adults (94.2% of African-American women) had at least one of the six major CV risk factors;
- more than one half (61%) of Mississippi adults had two or more CV risk factors;
- 74% of African-American women had two or more risk factors; 49% had three or more; and
- African-American women had much more frequent clustering of (four or five) CV risk factors (Figure 18).

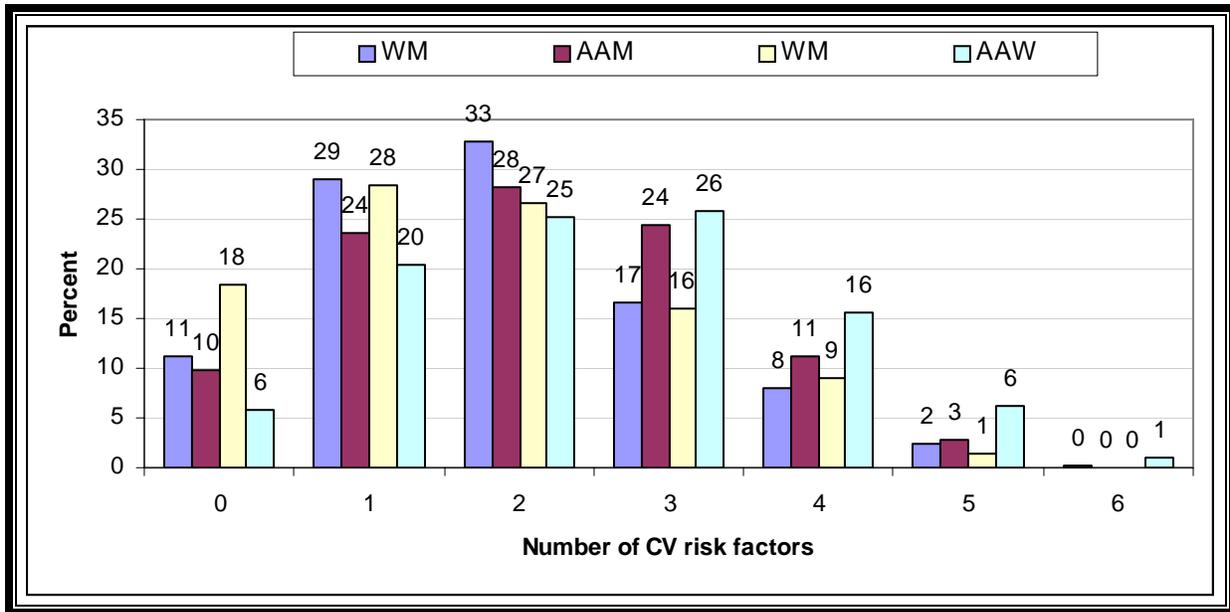
Table 6. Percentage of respondents (45 years of age and older) at each level of CV risk factor clustering, by sex and race, Mississippi, 2003.

No. of risk factors	White Men		African-American Men		White Women		African-American Women		Total	
	%	Cum. %*	%	Cum. %	%	Cum. %	%	Cum. %	%	Cum. %
0	11.1	-	9.8	-	18.5	-	5.8	-	13.0	-
1	29.1	29.1	23.6	23.6	28.5	28.5	20.4	20.4	26.6	26.6
2	32.9	61.9	28.1	51.7	26.6	55.1	25.3	45.7	28.9	55.4
3	16.5	78.4	24.4	76.2	15.9	71.0	25.8	71.5	18.7	74.2
4	7.9	86.4	11.3	87.4	9.0	80.0	15.6	87.1	10.1	84.3
5	2.3	88.7	2.7	90.2	1.4	81.4	6.1	93.2	2.5	86.8
6	0.2	88.9	0.0	90.2	0.1	81.5	1.0	94.2	0.2	87.0
“Deadly quartet”	2.65		4.69		2.25		8.2		3.5	

*Cum.%=cumulative %

All percentages are weighted

Figure 18. Percent of Mississippi adults with each level of CV risk factor clustering, Mississippi, 2003.



Particular attention needs to be paid to the “deadly quartet” (also known as the metabolic syndrome), that is, clustering of high BP, high blood cholesterol, diabetes, and obesity in the same individual:

- 3.5% of Mississippi adults (8.2% of African-American women) had the “deadly quartet” of CV risk factors (Table 6);
- in all groups, the presence of the “deadly quartet” was strongly associated with a history of stroke (Table 7).

Table 7. Percentage of respondents (45 years of age and older) self-reporting clustering of four “deadly quartet” CV risk factors and history of stroke, by sex and race, Mississippi, 2003.

		Ever told had stroke
All	Have “deadly quartet”	21.9%
	Do not have “deadly quartet”	5.7%
White men	Have “deadly quartet”	16.8%
	Do not have “deadly quartet”	5.8%
African-American men	Have “deadly quartet”	25.5%
	Do not have “deadly quartet”	5.7%
White women	Have “deadly quartet”	25.9%
	Do not have “deadly quartet”	5.6%
African-American women	Have “deadly quartet”	22.2%
	Do not have “deadly quartet”	5.0%

All percentages are weighted

Awareness of stroke symptoms, signs, and risk factors: the Stroke Awareness Study

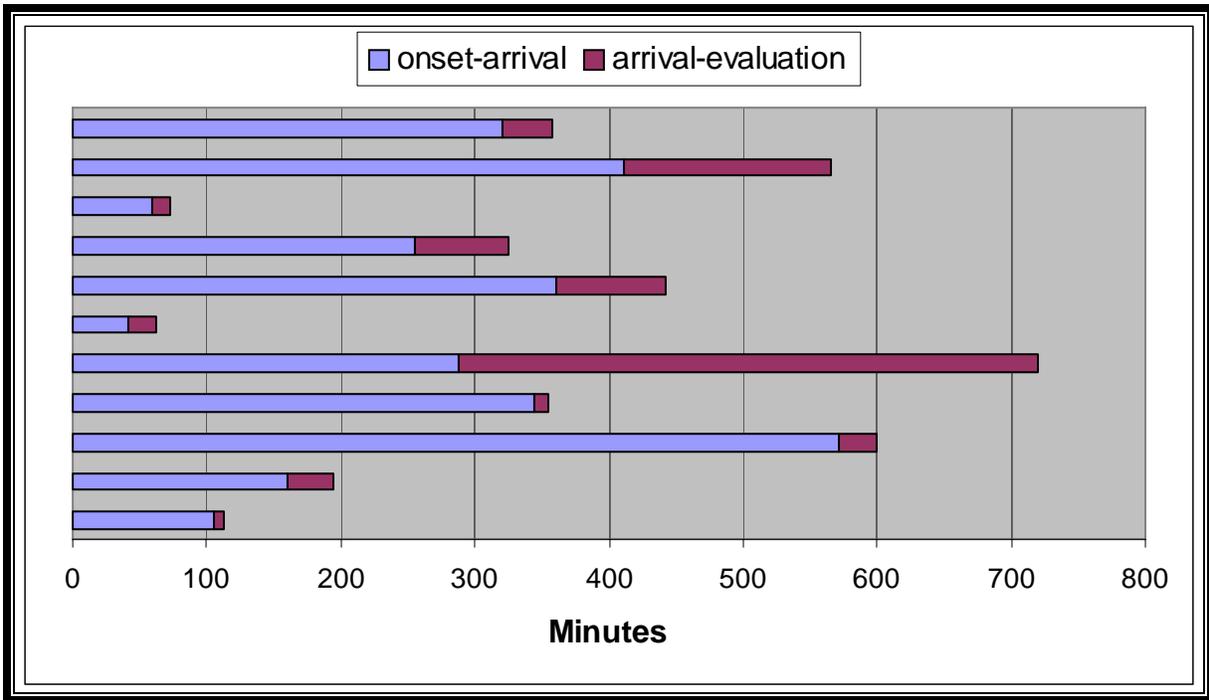
Surveys elsewhere have shown that awareness of stroke risk factors and prevention measures is low. There is also a lack of awareness of stroke-related symptoms and signs and the appropriate response to an acute stroke. In 2002, a two-part pilot study (a collaboration between Jackson State University and MDH) was undertaken in Warren County, MS. The first part consisted of a random phone survey in Warren County to obtain baseline information on knowledge of stroke risk factors, stroke-related signs and symptoms, and action to be taken in the event of a stroke or suspected stroke. Part 2 comprised a chart review of stroke patients in Vicksburg Regional Medical Center to estimate the amount of time it takes for individuals to arrive at medical treatment facilities after the onset of stroke signs and symptoms. The results are summarized below:

- Most people (65%) have never had stroke-related information provided by a health care provider.
- High blood pressure was the risk factor most often reported; however, nearly half of respondents did not report high blood pressure.

- High cholesterol and smoking (the second and third most important stroke risk factors, respectively, after high blood pressure) each were reported only by one-fifth of respondents.
- The majority of people could name one stroke symptom or sign.
- The majority of phone survey respondents said they would call 911 / ambulance after stroke onset; however, a large percentage said they would go directly to hospital / ER or call the doctor's office. According to the chart review, though, most people came directly to the hospital / ER, using private transport; only 4% called 911.
- The time of arrival at hospital was recorded in nearly all cases, and time of evaluation in just over half of the cases; but in most cases time of stroke onset was not recorded in the chart. Therefore, in most cases, time between stroke onset and arrival at hospital / ER was not known, nor was the time between stroke onset and physician evaluation.
- In the 16 cases where onset/arrival times were available, the mean time between onset and arrival was nearly seven hours and the median time about five and a half hours.
- In the 11 cases where onset/evaluation times were available, the mean/median times between onset and evaluation were nearly six hours.
- In many cases, time of physician evaluation was not recorded, therefore, time between arrival and physician evaluation was not known.
- In the 47 cases where evaluation times were available, the mean time between arrival and evaluation was about one hour and the median time three-quarters of an hour.

Based on the limited time information in the charts, it appeared that little delay occurred after the patient arrived at the hospital / ER. Delay between onset and evaluation largely occurred in getting to the hospital / ER after onset of stroke, and in most cases was longer than the window of opportunity for thrombolytic treatment (Figure 19). Thrombolysis is an effective treatment in selected types of stroke but needs to be undertaken within 3 - 6 hours of onset of symptoms. Factors causing delay in presentation to hospital, such as ignorance of stroke symptoms and signs and the need for immediate assessment, are, therefore, important barriers to effective thrombolytic treatment and likely contribute to unnecessary stroke death.

Figure 19. Distribution of times between onset of symptoms, arrival at hospital, and evaluation by physician.



What is the best approach to improve this situation? Certainly, stroke knowledge and awareness needs to be improved, and more people need to know that treatment for certain types of stroke is now possible. However, this alone will not suffice; people need to recognize the importance of rapid transfer – preferably by ambulance – to hospital / ER for evaluation and possible treatment. In turn, the 911 / emergency response system will need to be expanded in rural areas, and all emergency response personnel will need to be fully educated on the concept of “brain attack” and the need for rapid transfer of stroke patients to hospital/ER.

CVD risk-lowering behaviors and counseling by health care providers

The percentage of Mississippi adults who have changed their eating behaviors to lower CVD/stroke risk has not increased over the past 5 years (Tables 8a and 8b), despite widespread public health education and repeated messages in the media. However, more Mississippians are physically active than before. More Mississippians are also taking aspirin to reduce their chances

of heart attack or stroke, although this practice is not (yet) an official medical recommendation for persons without CVD.

Table 8a. Prevalence (%) of CVD risk-lowering behaviors by Mississippi adults, 1998-2003.

<i>Denominator: All adults</i>	1998	1999	2000	2001	2002	2003
To lower your risk of developing heart diseases or stroke, are you:						
- eating fewer high fat or high cholesterol foods?	62.9	61.8	61.3	52.4	58.9	62.8
- eating more fruits and vegetables?	n/a	n/a	n/a	73.4	73.1	70.6
- more physically active?	51.7	62.1	49.2	61.3	69.7	64.8
Do you take aspirin daily or every other day (persons 35 and older only):						
- to reduce the chance of a heart attack?	18.2	19.9	22.5	22.4	25.4	29.2
- to reduce the chance of a stroke?	14.4	16.5	18.3	17.4	22.6	24.9

Table 8b. Prevalence (%) of CVD risk-lowering behaviors among adults with CVD, Mississippi, 1998-2003.

<i>Denominator: Adults who have been told they had any CVD (heart attack, angina, CHD, or stroke)</i>	1998	1999	2000	2001	2002	2003
To lower your risk of developing heart diseases or stroke, are you:						
- eating fewer high fat or high cholesterol foods?	69.9	69.3	72.9	65.4	72.5	75.7
- eating more fruits and vegetables?	n/a	n/a	n/a	85.7	79.5	77.9
- more physically active?	52.3	59.8	46.7	58.9	59.5	52.2
Do you take aspirin daily or every other day (persons 35 and older only):						
- to reduce the chance of a heart attack?	50.0	46.3	50.5	55.0	58.3	61.7
- to reduce the chance of a stroke?	34.9	33.9	39.5	42.1	50.2	55.3

Counseling by health care providers about CVD risk-lowering behaviors remains at a low level among the general population, but is considerably better among persons with CVD (Table 9). However, there is room for significant improvement.

Table 9. Frequency of counseling about CVD risk-lowering behavior by health care providers, Mississippi, 1998-2003.

Within the past 12 months, has a doctor, nurse, or other health professional told you to:						
<i>Denominator: All adults</i>	1998	1999	2000	2001	2002	2003
- eat fewer high fat or high cholesterol foods?	31.1	33.7	30.6	21.8	23.6	21.9
- eat more fruits and vegetables?	n/a	n/a	n/a	32.6	32.7	28.9
- be more physically active?	35.0	45.5	36.8	30.9	34.4	29.2
Denominator: Adults who have been told they had any CVD (heart attack, angina, CHD, or stroke)						
- eat fewer high fat or cholesterol foods?	66.2	65.0	66.0	49.4	54.9	42.0
- eat more fruits and vegetables?	n/a	n/a	n/a	n/a	n/a	n/a
- be more physically active?	56.3	70.5	63.9	55.1	59.6	46.0

Social and environmental determinants of CVD/stroke

Behavioral and lifestyle factors such as regular physical activity or exercise and a ‘heart-healthy’ diet are important individual-level risk factors for preventing the development of, and mortality from, CVD/stroke. However, social and environmental determinants of CVD/stroke are also important, such as the availability of:

- public (non-paying) parks, bike paths, and walking trails ;
- exercise and recreational facilities;
- restaurants with ‘heart-healthy’ (fat-free, low cholesterol) choices on the menu; and
- smoke-free restaurants (or restaurants with smoke-free areas).

Lack of availability of such facilities may be important barriers to cardiovascular health.

Additional barriers include:

- the widespread availability of fast-food facilities, which offer inexpensive, high-fat food;
- lack of available, affordable ‘heart-healthy’ foods in shops and supermarkets.

Over the past two years, staff of the Epidemiology Office, MDH with the help of students from

the School of Public Health, Jackson State University have carried out a number of surveys of these social and environmental determinants of CVD in the Jackson metro tri-county area. Surveys of public parks, bike paths, walking trails, and exercise / recreational facilities in the tri-county metro area have been completed, the distribution of fast-food facilities has been mapped, and a survey of restaurants for ‘heart-healthy’ menu choices and smoke-free areas has been conducted. In addition, a pilot study of availability and cost of Dietary Approaches to Stop Hypertension Diet (DASH) foods has been completed. The results are summarized below.

I. The distribution of public parks, exercise and recreational facilities, and fast-food facilities All fast-food facilities (n=148) and exercise and recreational facilities (n=44) and 49 (92%) of 53 parks were located, surveyed, and mapped. Parks, exercise and recreational facilities, and fast-food facilities are not distributed evenly across the metropolitan area (Figures 20 and 21). Figure 20. The distribution of fast-food restaurants by block group in the tri-county area, Jackson, Mississippi, 2000.

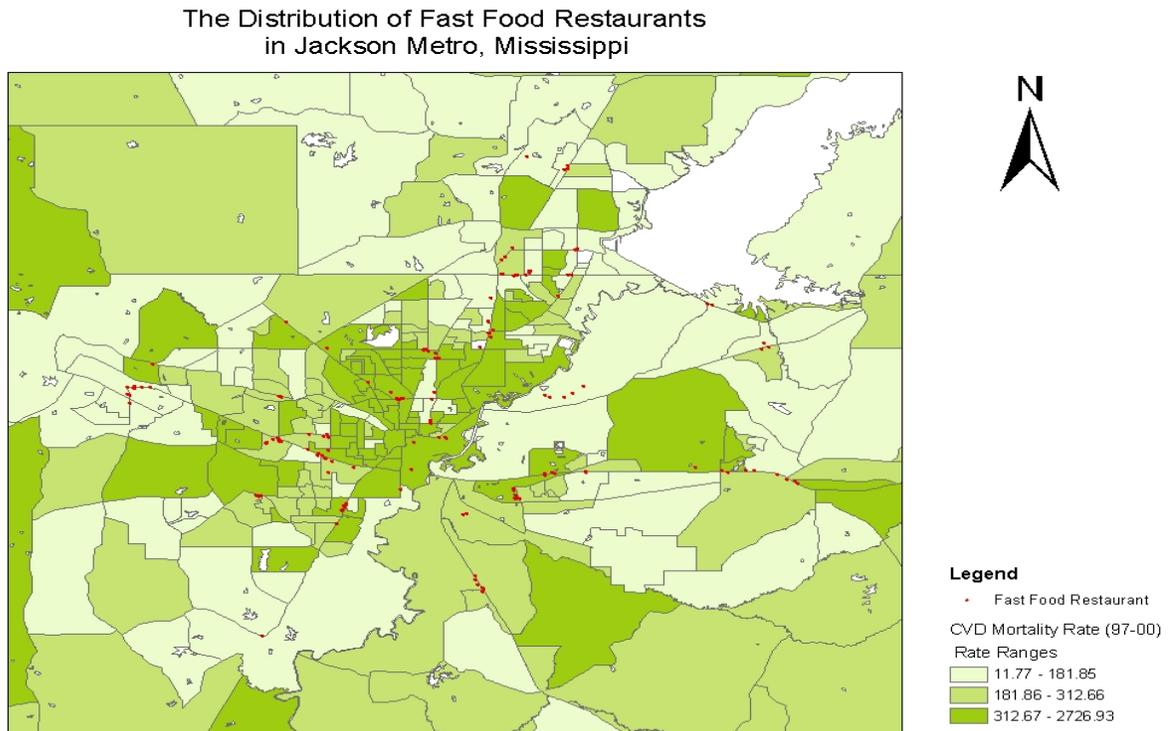
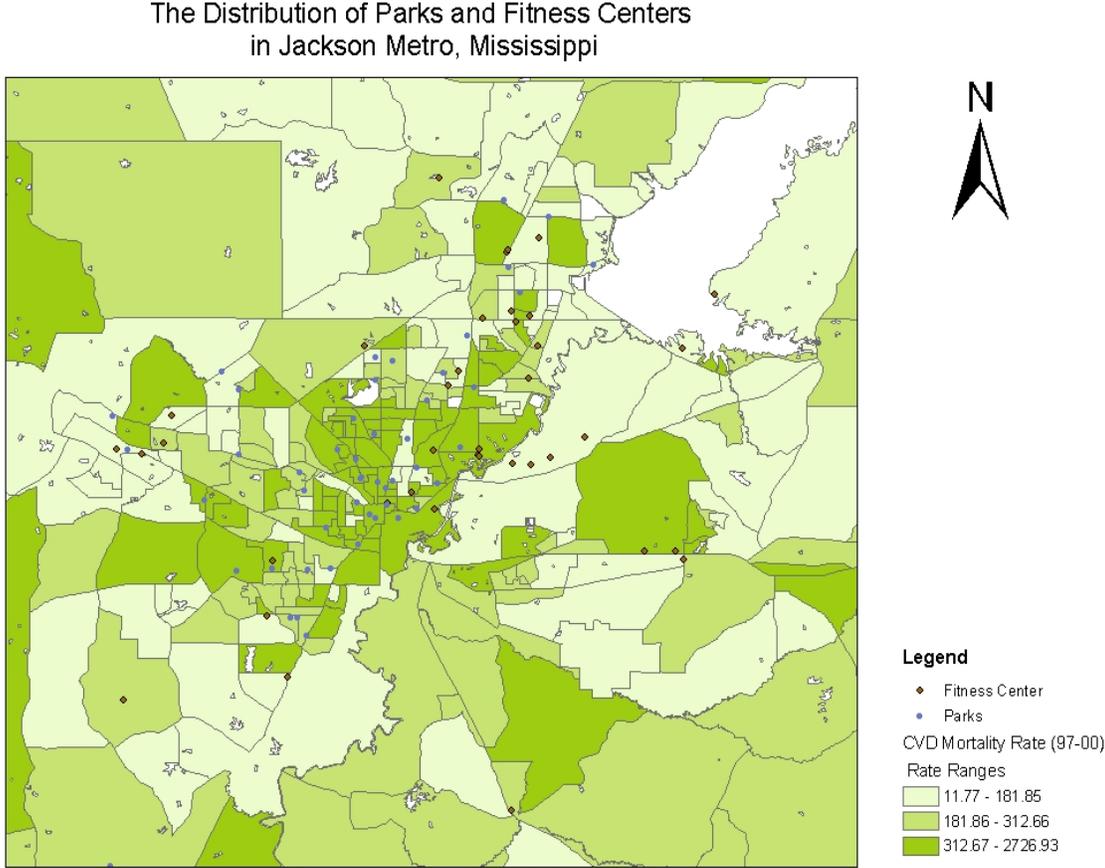


Figure 21. The distribution of public parks and fitness facilities by block group in the tri-county area, Jackson, Mississippi, 2000.



Certain patterns and trends are apparent which are reasonably consistent. There are more fast-food facilities and public parks and fewer fitness centers in lower socioeconomic areas (Figures 22-24).

Figure 22. The density of fast-food restaurants by block group median household income, Jackson metro tri-county area, 2000.

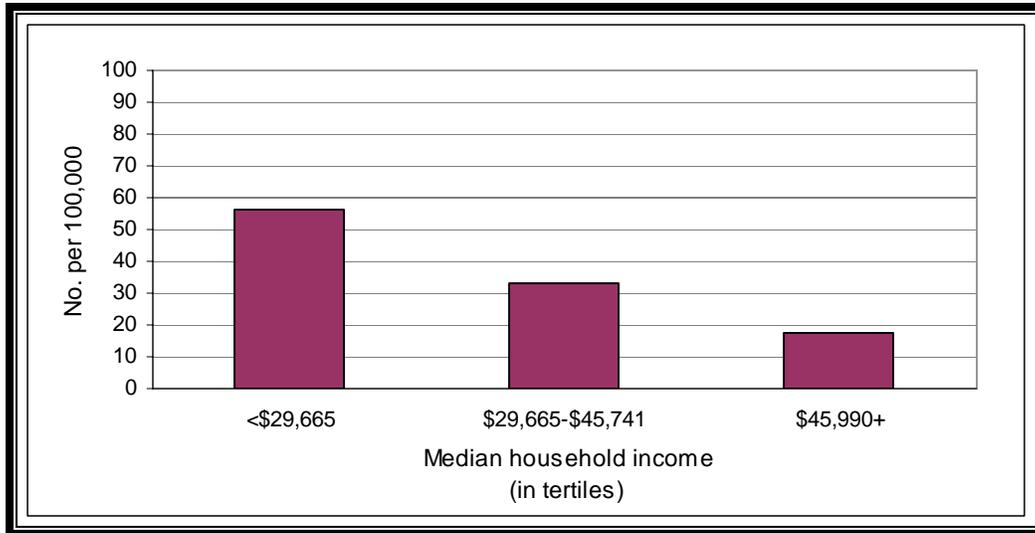


Figure 23. The density of public parks by block group education level, Jackson metro tri-county area, 2000.

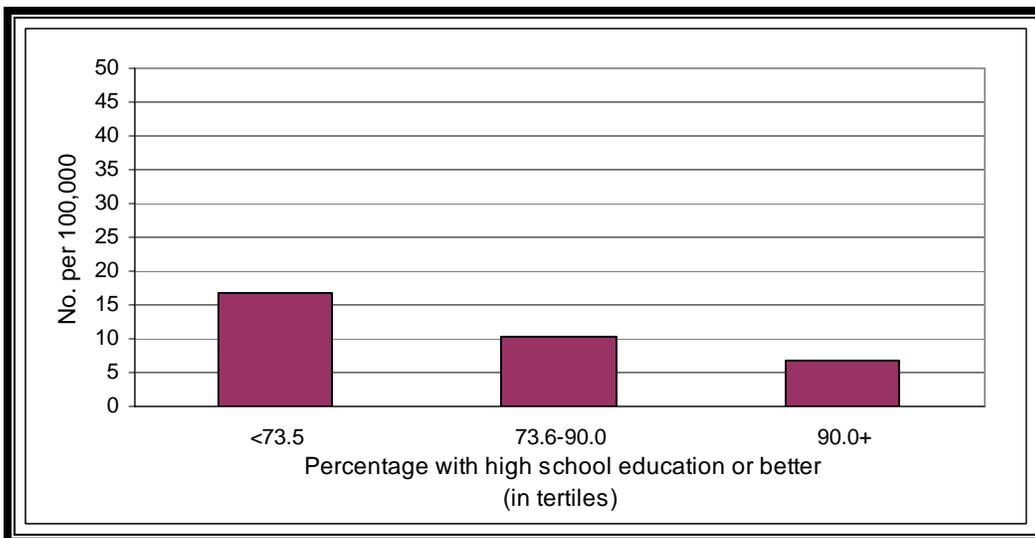
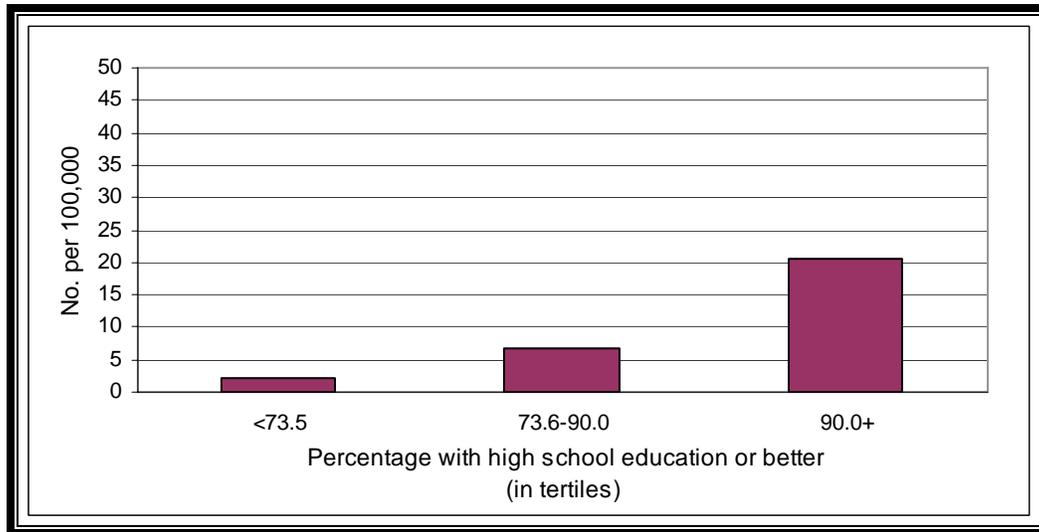


Figure 24. The density of fitness facilities by block group highest education level, Jackson metro tri-county area, 2000.



Many parks were found to be small, poorly maintained, and not suitable for jogging, running, or biking. Only one-third (16/49) had a concrete or asphalt path for walking, jogging, running, or biking; in ten this was a 0.5 mile loop, and in the other six this was a 1.0 mile loop. Three quarters of the parks with paths (12/16) had lighting that was considered poor or fair; only one quarter (4/16) had good or adequate lighting. There was a direct relationship between CVD mortality rates and the concentration of fast-food facilities and parks, with the highest concentration of fast-food facilities and parks being found in areas with the highest CVD mortality rates (Figures 25-26). There was no clear trend in the relationship between CVD mortality rates and the concentration of fitness facilities (Figure 27).

Figure 25. The density of fast-food restaurants by block group CVD mortality rate, Jackson metro tri-county area, 2000.

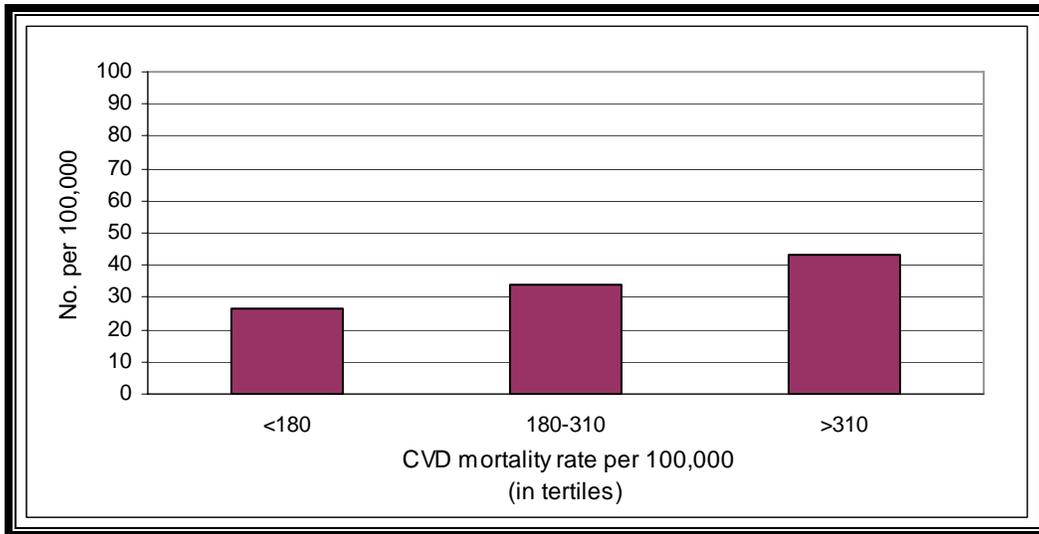


Figure 26. The density of public parks by block group CVD mortality rate, Jackson metro tri-county area, 2000.

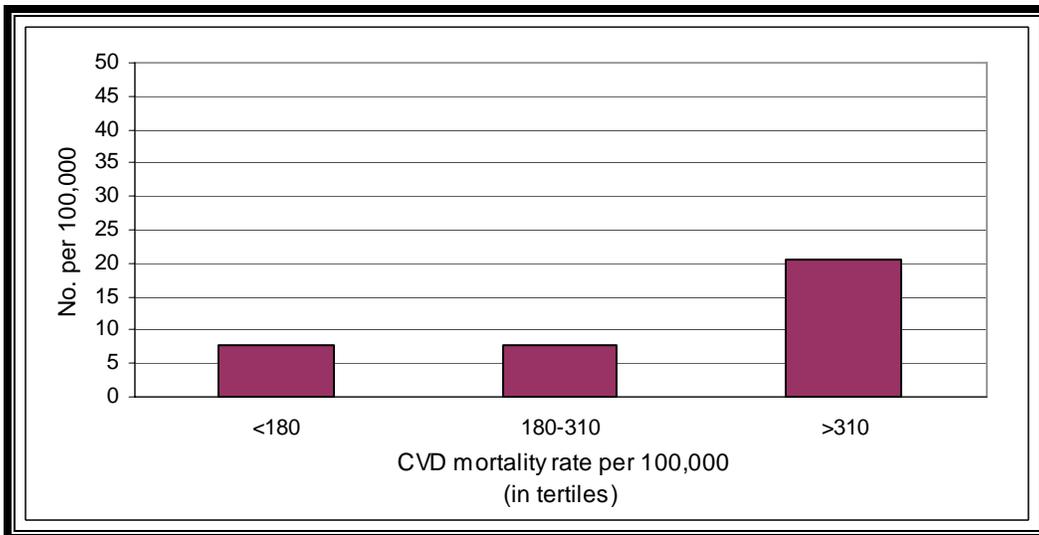
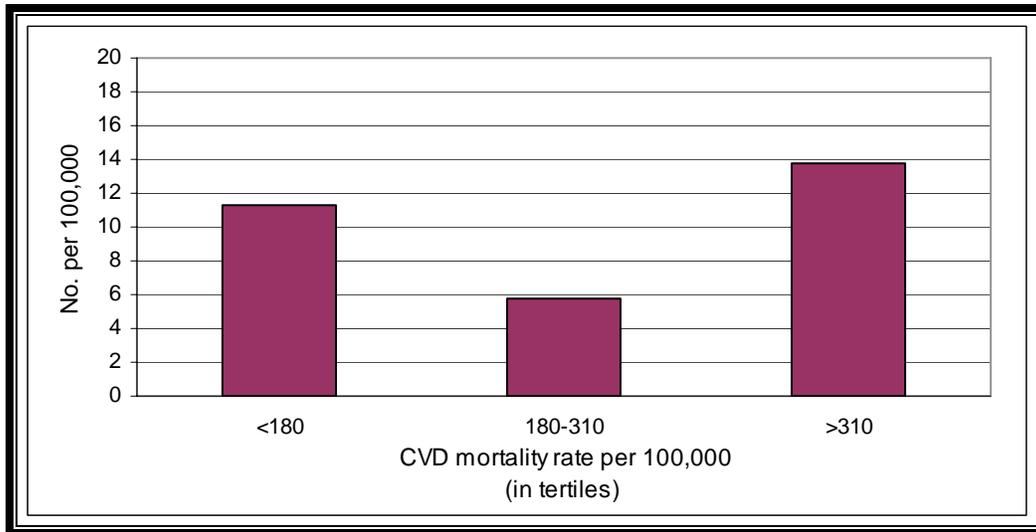


Figure 27. The density of fitness facilities by block group CVD mortality rate, Jackson metro tri-county area, 2000.



II. Knowledge, attitudes, and behavior of restaurant owners with respect to smoke-free dining and heart-healthy menu choices

A random sample of 60 restaurants was selected from the 135 restaurants in the tri-county area that were considered “sit-down” or “tablecloth” restaurants (fast-food facilities were excluded). After phone calls and visits to each restaurant, 37 (62%) agreed to participate. In each restaurant, the restaurant manager/owner was asked a number of questions about smoking and health, provision of smoke-free seating, diet and health, and whether heart-healthy (fat-free / low cholesterol) choices were offered on the menu. Most owners/managers said that they believed in the association between smoking and heart disease. However, this did not always translate into action – about 60% (22/37) of the restaurants in this sample allowed smoking. In those restaurants with non-smoking sections, many (41%) did not have a partition (even though this is of questionable value). The large majority of restaurant owners/managers (17 of 22 (77%) allowing smoking) did not plan to increase the smoke-free area within one or two years. The reason for not planning to increase the smoke-free area within one or two years did not seem to be a belief that fewer customers would come, since only 7/17 (41%) thought that this would happen.

Almost all owners/managers were aware of the association between foods high in saturated fat/cholesterol and heart disease. In many cases, however, heart-healthy choices are not offered or marked on the menu. Even when heart-healthy choices were said to be offered, usually this could not be confirmed when a sample menu was examined. Also, even among restaurant owners/managers there was ignorance about the saturated fat/cholesterol content of certain foods (for example, liver and shellfish). Restaurant owners/managers could benefit from better health education about nutrition and health, and educated on the importance of offering (and clearly marking) heart-healthy choices on the menu. Furthermore, many studies have shown that making an establishment completely smoke-free does not lead to a decrease in customers and a decline in revenues – in fact, the opposite may occur. This needs to be made clear to owners/managers who are concerned about losing customers.

III. The availability and cost of DASH Diet foods: a pilot study

Widespread adoption of the DASH (“Dietary Approaches to Stop Hypertension”) Diet (an eating plan low in total fat, saturated fat, and cholesterol, and rich in fruits, vegetables, and low-fat dairy products) could lead to a population downshift in average BP levels and consequent reductions in the prevalence of hypertension and the mortality from stroke and heart disease, which are high in Mississippi. Important barriers to adopting the DASH diet may be the availability and cost of the foods, particularly for persons of low socioeconomic status (SES).

Using a standard list of DASH diet foods, fourteen supermarkets were non-randomly selected and visited on three occasions at one week intervals to get an average price per food item; prices were summed to give a total cost for each supermarket. The relative cost of the foods was calculated by dividing total cost by the median household income of the block group in which the supermarket was located. The availability and cost of DASH Diet foods varied considerably across the metro area. In particular, three of the supermarkets did not stock a large number of items (11, 15, and 17 items, respectively, out of a total of 37 items on the food list). Relative costs varied inversely with SES when median household income was used as a measure of SES: relative cost was higher in low SES areas and vice versa.

Recommendations for social and environmental change

Health education and promotion policies and interventions to prevent CVD must take into account the availability and accessibility of fitness/recreational facilities, parks, and walking trails, etc. in communities. The availability of such facilities to the public is a necessary component of, and important stimulus to, individual behavior change, and lack of such facilities is an important barrier to individual behavior change. This is particularly important in lower SES areas, where the prevalence of CVD risk factors is higher. Health education and promotion messages encouraging regular physical activity/exercise will not work if suitable facilities are not available in the community.

The widespread availability of fast-food in all SES areas should also be considered in public health nutrition messages and policies to prevent CVD. In a free-market system, the distribution of fast-food facilities probably cannot be controlled, but public health policies should ensure that ‘heart-healthy’ foods are made equally available (and affordable) in all communities. Ways to encourage this should be explored.

More attention should be given to the availability and cost of DASH Diet foods (and ‘heart-healthy’ foods in general). Health education and promotion policies for CVD and interventions to prevent hypertension and CVD must take into account the availability and cost (both absolute and relative) of such foods. People will not change their dietary behaviors if these foods are not available and affordable. This issue is particularly important in lower SES areas, where CVD mortality and the prevalence of CVD risk factors are higher. Health education and promotion messages encouraging the adoption of the DASH Diet (or the consumption of ‘heart-healthy’ foods in general) will not work if these foods are not available in the community at prices appropriate to the average income level in that community.

People eat and drink what is affordable and available to them.

Summary and Conclusions

This report summarizes the most recent information available on stroke and associated health risk behaviors in Mississippi. Stroke mortality rates in the state have been declining but remain significantly higher than U.S. rates, and rates in all population groups now appear to be leveling off or even increasing again. There is a wide variation in mortality rates between counties, and in some counties they have actually increased. Marked racial disparities exist in the rates, and a considerable amount of stroke mortality is premature, especially in African American men.

Why are stroke death rates higher in Mississippi than elsewhere? This cannot be fully explained with the available data. A mortality rate reflects both incidence of disease (the rate of development of new cases) and survival after disease has developed (which in turn reflects the severity of the disease and the effect of treatment). Changes in either or both of these will affect mortality. It is not known whether the higher stroke mortality rates in Mississippi are due to higher incidence (more new cases of stroke), more severe disease, poorer survival of persons with stroke, or some combination of these factors. Stroke mortality rates have been declining in Mississippi and the U.S. for most of this century, particularly since the 1950s. The decline has occurred in all age and racial/ethnic groups and both genders, and is presumably due, at least in part, to healthier lifestyles, a lower prevalence of stroke risk factors such as high blood pressure and smoking in the population, and improvements in medical care.

Whatever the gaps in our knowledge, it remains clear that further falls in stroke mortality rates will not be achieved unless racial/ethnic and geographic disparities are reduced. Further work is needed to identify and quantify differences in the availability of, access to, and quality of medical care for persons with stroke, and to identify and (if possible) eliminate any barriers. Also, much of the death and disability due to stroke is preventable. Primary prevention needs to be emphasized very strongly, to reduce the prevalence of stroke risk factors in the population: more Mississippians need to control their blood pressure, stop smoking, lose weight, become more active, eat a healthier diet, and lower their blood cholesterol level. Prevention must start at an early age, since the processes that lead to stroke in middle or old age begin in childhood and

adolescence. Control of blood pressure is particularly important in view of the findings of a recent study that public awareness of the dangers of high blood pressure has declined.

Much of the death, illness, and disability due to stroke is preventable, but stroke will not be prevented without statewide actions to create and maintain environments, policies, and norms that encourage and support cardiovascular health. Stroke - like heart disease - is a “mass” disease and requires “mass” intervention.

Useful web sites

American Heart Association (AHA): <http://www.americanheart.org>

American Stroke Association: <http://www.strokeassociation.org>

Mississippi Department of Health: <http://www.MDH.state.ms.us>

Mortality data: <http://wonder.cdc.gov>

BRFSS: <http://www.cdc.gov/nccdphp/brfss>

NHLBI: <http://www.nhlbi.nih.gov>

NHLBI Report of the Workshop on Research in Coronary Heart Disease in Blacks:

http://www.nhlbi.nih.gov/health/prof/heart/other/r_chdbl.htm

The DASH Eating Plan: <http://www.nhlbi.nih.gov/health/public/heart/hbp/dash>

Hypertension guidelines: <http://www.nhlbi.nih.gov/guidelines/hypertension/express.pdf>

Cholesterol guidelines: <http://www.nhlbi.nih.gov/guidelines/cholesterol>

Appendix A: methods, definitions, and abbreviations

Methods

Stroke mortality numbers and rates for 1996-2001 are based on death certificate data provided by the Office of Health Informatics, Mississippi Department of Health (MDH). Stroke mortality rates for 1980-2000 were obtained from the National Center for Health Statistics (NCHS) via CDCs WONDER system at <http://wonder.cdc.gov>. The most recent year for which the U.S. stroke mortality rates were available was 2000. See Table 10 in Appendix B for the ICD-9 and ICD-10 codes which were used.

Crude mortality rates are calculated using number of deaths as the numerator and the appropriate mid-year population estimate for the state from the U.S. Census Bureau (www.census.gov) as the denominator. Crude rates are age-adjusted by the direct method using the 2000 U.S. population as the standard. The estimated annual percent change (EAPC) in rates, referred to in this report as the average change per year, was calculated by fitting a regression line to the natural logarithm (Ln) of the rates (R) using calendar year as a regressor variable, i.e. $y = mx + b$ where $y = \text{Ln } R$ and $x = \text{calendar year}$. The $\text{EAPC} = 100(e^m - 1)$. This calculation assumes that the rates changed at a constant rate over the entire time interval.

In Table 2, county rates are compared to the state rate using a z-test with a significance level of 0.05. The source of the formula for the test and the standard error of an age-adjusted rate was the NCHS, CDC (Monthly Vital Statistics Report, volume 45, number 11(S)2, June 12, 1997, p.77).

Risk factor estimates are based on self-reported data from the Mississippi Behavioral Risk Factor Surveillance System (MS-BRFSS). The MS-BRFSS is a continuous, statewide, random-digit-dialed telephone survey of a representative sample of the Mississippi civilian non-institutionalized adult population (18 years of age and older). The overall sample size for 1990-97 varied between 1,578 and 1,599 persons; in 1998, the sample was increased to 2,307 persons and in 2002 was 4,085. The MS-BRFSS collects data on a number of health risk behaviors,

including smoking, high blood pressure, high blood cholesterol, diabetes, and physical activity/exercise patterns. Respondents are also asked to report weight and height, from which body mass index (BMI) can be calculated.

Note on race categories

The two categories of race used in this report are “white” and “African American.” In Mississippi, the population distribution by race is approximately 63% white, 36% African American, and 1% other races (largely Asian/Pacific Islander and American Indian). The number of persons in the “other” race category is too small for a separate analysis.

Definitions

Age-adjusted death rate: a crude death rate that has been adjusted statistically (standardized to a reference population) to allow comparisons of rates from different time periods, places, or populations.

Incidence: the number (expressed as a rate) of new cases of a disease in a population.

Prevalence: the number (expressed as proportion or percentage) of existing cases of a disease or risk factor in a population at a specific point in time.

Current smoking: defined as having smoked at least 100 cigarettes in one’s lifetime and smoking now (every day or only some days).

High blood pressure: defined as having been told by a health professional that one’s blood pressure was high.

High blood cholesterol level: defined as having been told by a health professional that one’s blood cholesterol level was high (among persons who have ever had a blood cholesterol test).

Overweight/obesity: defined as having a body mass index (BMI) equal to or greater than 25.0 kg/m². Using weight in kilograms and height in meters, BMI equals weight divided by the square of the height. Using weight in pounds and height in inches, BMI equals weight multiplied by 703 and divided by the square of the height.

No regular exercise: defined as not taking any exercise at all in the past month.

Diabetes: defined as having been told by a health professional that one has diabetes.

Abbreviations

CVD = cardiovascular disease

CVA = cerebrovascular accident = stroke (“brain attack”)

WM=white male; AAM=African-American male; WF=white female; AAF=African-American female.

ICD-9: International Classification of Diseases, 9th Revision

ICD-10: International Classification of Diseases, 10th Revision

MDH = Mississippi Department of Health

CDC = Centers for Disease Control and Prevention

NCHS = National Center for Health Statistics

NIH/NHLBI = National Institutes of Health/National Heart, Lung, and Blood Institute

Appendix B: Surveillance of CVD/stroke mortality, morbidity, and risk factors: History, current activities, and future plans

Mortality

Mortality numbers and rates for all types of CVD (including stroke) are based on death certificate data provided by the Office of Health Informatics, Mississippi Department of Health (MDH). CVD/stroke mortality numbers and rates through 2000 are also available from the National Center for Health Statistics (NCHS) via CDCs WONDER system (<http://wonder.cdc.gov>). The following ICD codes are used (Table 10):

Table 10. ICD codes used in CVD mortality surveillance

	ICD9	ICD10
All CVD	390-448	I00-I78
Non-stroke CVD	390-429, 440-448	I00-I59, I70-I78
IHD (CHD)	410-414	I20-I25
CVA (stroke)	430-438	I60-I69

Morbidity

The term *morbidity* is loosely interchangeable with the terms *sickness*, *illness*, and *disease* (including injury and disability). Morbidity statistics (prevalence and incidence), therefore, measure the amount of (non-fatal) illness or disease in the population. *Incidence* measures the how rapidly new cases of a disease are developing, whereas *prevalence* measures the total number of cases, both new and long-standing, in the population. Accurate, reliable morbidity data are more difficult and costly to collect than mortality data. Without some kind of disease registry, incidence data are not available for stroke. Limited prevalence data on stroke can be obtained from the Behavioral Risk Factor Surveillance System, hospital visit data, and (for certain population groups) procedures / reimbursement data. However, no statewide hospital discharge data system exists yet in Mississippi, and at the time of writing there are no plans to obtain such data, although it might be possible to undertake, as a pilot study, limited surveillance

of stroke hospital visit data in the Jackson metro tri-county area (as has been done recently with asthma). Procedures / reimbursement data could also be examined (for example: Medicare, Medicaid, Blue Cross) but to date these sources have not been used and again, at the time of writing, there are no plans to obtain such data.

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS is a statewide random-digit-dialed telephone survey on health and health care behaviors that has been conducted by Mississippi since 1990. It utilizes data from a representative sample of the Mississippi civilian non-institutionalized adult population (18 years of age and older). The overall sample size for 1990-97 varied between 1,578 and 1,599 persons; in 1998, the sample was increased to 2,307 persons and in 2003 was 4,085. The BRFSS is the only instrument for state-level surveillance of chronic diseases, health risk behaviors, and health care practices among adult Mississippians. The main limitation is the self-reporting of all data. Also, gaps in coverage are well recognized – persons living in rural areas, especially the Delta, are under sampled due to lack of phones. Data on CVD/stroke morbidity has been collected through the use of additional modules of questions, beginning in 1998; the schedule through 2007 is given in Table 11 below. From the CVD module questions, an estimate of the prevalence (% of population) of stroke can be determined; also, the frequency of physician counseling and of actions taken lower CVD/stroke risk can be calculated. From the Heart Attack and Stroke Module questions, knowledge of stroke symptoms and signs can be estimated.

Table 11. Schedule for Mississippi BRFSS modules and core questions on CVD, 1998-2007.

Modules	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CVD	✓	✓	✓	✓	✓	✓	n/a	✓	n/a	✓
Heart Attack & Stroke Symptoms & Signs	n/a	✓	n/a	✓						
Actions To Control High Blood Pressure	n/a	✓	n/a	✓						
Core questions	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Hypertension	n/a	✓								
Cholesterol	n/a	✓								

n/a=not asked

Risk factors for cardiovascular disease

The main modifiable risk factors for stroke are high blood pressure, smoking, overweight/obesity, high blood cholesterol level, diabetes, and lack of regular physical activity. BRFSS prevalence data on these are available for Mississippi since 1990. Risk factor prevalence data are also available for public high school students in the state from the Youth Risk Behavior Survey and Youth Tobacco Survey.

Youth Risk Behavior Survey (YRBS)

The YRBS is a self-administered questionnaire survey of public high school students (grades 9-12) in Mississippi. It was conducted in 1990 and thereafter, beginning in 1993, in alternate years, with a sample size of more than 1,800 high school students in 2001 and 2003. (Beginning with the 2001 YRBS, middle schools (grades 6-8) have also been sampled. These data have not been distributed widely because their validity and reliability are not yet clearly established.) The schedule is given in Table 12. MDH has always managed to maintain an overall survey response rate greater than 60%, allowing weighted estimates to be developed. This is important because the survey results can then be regarded as representative of all public high school students in the state.

The Mississippi YRBS is the only instrument for measuring and monitoring health risk behaviors among adolescents in the state, and provides data on CVD-related risk behaviors such as smoking, overweight, and physical activity. Similar limitations apply to YRBS data as to BRFSS data. No data are collected on children in elementary schools (grades 1-5) and private/parochial schools, or on home school students.

Table 12. Schedule for the Mississippi YRBS.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Public MS				✓		✓		✓		✓
Public HS		✓		✓		✓		✓		✓

MS=middle school HS=high school

The Youth Tobacco Survey (YTS)

More detailed data on knowledge, attitudes, and behaviors related to tobacco use are available from the YTS, which is, like the YRBS, a self-administered questionnaire survey of public and private high and middle school students in Mississippi. It has been conducted according to the following schedule, beginning in 1998 (Table 13):

Table 13. Schedule for the Mississippi YTS.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Public MS	✓	✓	✓		✓	✓		✓		✓
Private MS			✓		✓	✓		✓		✓
Public HS	✓	✓	✓		✓	✓		✓		✓
Private HS	✓	✓	✓		✓	✓		✓		✓

MS=middle school HS=high school

Appendix C: Stroke mortality rates and numbers of deaths by county, Mississippi, 2000-2004

County	Age-adjd. death rate 2000-2004	Rate in top 10?	Difference from state rate	Stat. signif. different from state rate	Age-adjd. death rate 1995-1999	% Change in death rate 00-04 vs. 95-99	All No. of CVA deaths	% of all deaths
All MS	66.8	n/a	n/a	n/a	70.6	-5.4	9,180	6.5
Adams	80.3		13.5	YES	88	-8.8	160	7.9
Alcorn	104.2	YES (3)	37.4	YES	7.6	36.0	209	9.9
Amite	56		-10.8	NO	50.4	11.1	45	6.2
Attala	89.6	YES (9)	22.8	YES	75.5	18.7	119	9.0
Benton	53.7		-13.1	NO	93.5	-42.6	25	5.5
Bolivar	61.7		-5.1	NO	87.3	-29.3	109	5.2
Calhoun	102	YES (4)	35.2	YES	101.8	0.2	106	11.7
Carroll	56.9		-9.9	NO	53.7	6.0	35	6.9
Chickasaw	59.5		-7.3	NO	61.2	-2.8	63	6.4
Choctaw	36.4		-30.4	NO	56.1	-35.1	22	5.1
Claiborne	70.8		4	NO	85.5	-17.2	36	6.8
Clarke	66.7		-0.1	NO	58.4	14.2	71	7.5
Clay	7.5		8.7	NO	67.1	12.5	89	8.0
Coahoma	71.6		4.8	NO	85.1	-15.9	103	6.0
Copiah	63		-3.8	NO	50.4	25.0	91	6.4
Covington	79.6		12.8	YES	74.8	6.4	80	7.3
Desoto	52.8		-14	NO	58.4	-9.6	207	5.0
Forrest	69.6		2.8	NO	73.2	-4.9	232	6.5
Franklin	50.8		-16	NO	50.4	0.8	25	5.2
George	89.2		22.4	YES	64.7	37.9	75	7.1
Greene	57.5		-9.3	NO	56.9	1.1	30	5.1
Grenada	132.2	YES (1)	65.4	YES	150.7	-12.3	172	11.0
Hancock	64.2		-2.6	NO	46.6	37.8	143	6.3
Harrison	51		-15.8	NO	52	-1.9	413	4.6
Hinds	59.3		-7.5	NO	70.4	-15.8	667	6.4
Holmes	83.6		16.8	YES	113.8	-26.5	88	6.7
Humphreys	66.1		-0.7	NO	76.8	-13.9	35	5.5
Issaquena	43.7		-23.1	NO	99.8	-56.2	4	6.2
Itawamba	85.2		18.4	YES	83.4	2.2	105	7.4
Jackson	72.6		5.8	YES	70.5	3.0	373	6.4
Jasper	60.5		-6.3	NO	62.8	-3.7	61	6.7
Jeff Davis	59.7		-7.1	NO	62.5	-4.5	25	5.4
Jefferson	69.4		2.6	NO	62	11.9	53	7.2
Jones	59.5		-7.3	NO	56.9	4.6	205	5.7
Kemper	56.5		-10.3	NO	60.5	-6.6	37	6.8
Lafayette	52.8		-14	NO	78.4	-32.7	85	5.7
Lamar	75.7		8.9	YES	65.8	15.0	113	7.5
Lauderdale	63.7		-3.1	NO	57	11.8	282	5.9
Lawrence	90.7	YES (8)	23.9	YES	73.9	22.7	60	8.4
Leake	59.2		7.6	NO	63.5	-6.8	70	5.7

County	Age-adjd. death rate 2000-2004	Rate in top 10?	Difference from state rate	Stat. signif. different from state rate	Age-adjd. death rate 1995-1999	% Change in death rate 00-04 vs. 95-99	All No. of CVA deaths	% of all deaths
Lee	81		14.2	YES	78.1	3.7	289	7.9
Leflore	92.8	YES (6)	26	YES	75.3	23.2	167	8.2
Lincoln	67.1	YES (4)	0.3	NO	83.4	-19.5	120	6.3
Lowndes	55.2		-11.6	NO	70.8	-22.0	158	6.0
Madison	94.9	YES (5)	28.1	YES	63.7	49.0	303	6.6
Marion	106.6	YES (2)	39.8	YES	116.8	-8.7	150	9.1
Marshall	76.5		9.7	YES	86.5	-11.6	116	6.7
Monroe	54.1		-12.7	NO	74.8	-27.7	119	6.0
Montgomery	55.5		-11.3	NO	95.7	-42.0	45	6.6
Neshoba	74		7.2	NO	86.1	-14.1	118	7.5
Newton	73.2		6.4	NO	56.5	29.6	95	8.0
Noxubee	50.9		-15.9	NO	66.4	-23.3	32	5.5
Oktibbeha	58.7		-8.1	NO	69.2	-15.2	88	6.3
Panola	81		14.2	YES	99.5	-18.6	135	7.9
Pearl River	56.4		-10.4	NO	54	4.4	135	5.6
Perry	48.6		-18.2	NO	99.3	-51.1	24	3.8
Pike	54.4		-12.4	NO	70.7	-23.1	117	5.3
Pontotoc	54.7		-12.1	NO	59	-7.3	77	6.2
Prentiss	53.6		-13.2	NO	58.9	-9.0	78	6.5
Quitman	55.3		-11.5	NO	66.7	-17.1	27	4.7
Rankin	39.9		-26.9	NO	45.2	-11.7	179	4.4
Scott	46.3		-20.5	NO	59.2	-21.8	68	5.0
Sharkey	61.1		-5.7	NO	118.1	-48.3	19	6.1
Simpson	83		16.2	YES	78.6	5.6	118	7.7
Smith	53.8		-13	NO	69.8	-22.9	45	5.5
Stone	63.2		-3.6	NO	40.5	56.0	37	5.1
Sunflower	78.2		11.4	YES	86.8	-9.9	107	6.6
Tallahatchie	66.4		-0.4	NO	63.5	4.6	51	6.8
Tate	58.7		-8.1	NO	71	-17.3	70	5.6
Tippah	89.3	YES (10)	22.5	YES	63.2	41.3	108	8.4
Tishomingo	66.1		-0.7	NO	66.4	-0.5	80	6.1
Tunica	60.7		-6.1	NO	91.3	-33.5	24	4.8
Union	81		14.2	YES	91	-11.0	118	8.9
Walthall	63		-3.8	NO	58.9	7.0	54	6.5
Warren	78.4		11.6	YES	91.3	-14.1	185	7.1
Washington	65.7		-1.1	NO	87.5	-24.9	190	5.9
Wayne	71.3		4.5	NO	66.8	6.7	71	7.0
Webster	72.1		5.3	NO	73.1	-1.4	48	6.6
Wilkinson	90.8	YES (7)	24	YES	62	46.5	51	7.5
Winston	63.8		-3	NO	76.5	-16.6	80	7.4
Yalobusha	68		-1.2	NO	74.2	-8.4	55	7.4
Yazoo	76.6		9.8	YES	80.6	-5.0	106	7.2