THE BURDEN OF DIABETES IN WEST VIRGINIA

Bob Wise
Governor

Paul L. Nusbaum, Secretary
Department of Health and Human Resources

Henry G. Taylor, M.D., M.P.H.
Commissioner, Bureau for Public Health

Alan P. Holmes, M.B.A.
Director, Office of Epidemiology and Health Promotion

Acknowledgments

Project Staff

Peggy Adams, R.N.C., M.S.N., C.D.E., West Virginia Bureau for Public Health,
Diabetes Control Program

James C. Doria, Epidemiologist, West Virginia Bureau for Public Health, Health Statistics Center

Editors

Eugenia Thoenen, Manager, West Virginia Bureau for Public Health, Statistical Services Unit
Marie Gravely, R.D., C.D.E., West Virginia Bureau for Public Health, Diabetes Control Program
Jessica Wright, R.N., M.P.H., CHES, West Virginia Bureau for Public Health,
Chronic Disease Program
Joyce Spiroff, Associate Director, Division of Health Promotion,
West Virginia Bureau for Public Health

Formatting Specialist

Kathy Flenner, Secretary, West Virginia Bureau for Public Health, Division of Health Promotion

Cover Design

Teresa Mace, Media Coordinator, West Virginia Bureau for Public Health,
Division of Health Promotion

Special Acknowledgments

The West Virginia Bureau for Public Health, Health Statistics Center Staff
Daniel M. Christy, M.P.A., Director, Health Statistics Center
Fred King, BRFSS Coordinator
Thomas N. Leonard, M.S., Programmer/Analyst
Tom Light, Data Analyst
Joseph D. Kennedy, Programmer/Analyst
Mary Bee Antholz, M.S., Health Care Financial Analyst, WV Health Care Authority

For additional information, contact the
West Virginia Diabetes Control Program at (304) 558-0644

Funded By CDC Grant # U32/CCU315229-04

EXECUTIVE SUMMARY

Diabetes is a serious chronic disease that affects many people in West Virginia. People who have diabetes need current knowledge to empower them to effectively manage their diabetes. Self-care management is essential for daily diabetes control and for the prevention and/or delay of complications. Recent research shows that prevention of Type 2 diabetes is possible.

The 2000 Behavioral Risk Factor Surveillance System revealed an estimated diabetes prevalence of 7.6% among West Virginia adults. This equals approximately 106,852 West Virginian adults having been diagnosed with diabetes. An estimated 53,000 have diabetes but have not been diagnosed. This ranks West Virginia second in prevalence among the 52 states and territories.

West Virginia's population has the oldest median age in the nation. Forty-four percent (44%) of the persons with diabetes are 65 years or older. Women in this age group are more likely to have diabetes than men. The diabetes population reported having greater numbers of modifiable risk factors than the population without diabetes. In 1999, West Virginia ranked first nationally in the percentage of population that was obese. Obesity and diabetes are risk factors for cardiovascular disease. Cardiovascular disease is the leading cause of premature mortality among persons with diabetes.

Babies born to mothers with pre-existing diabetes were almost twice as likely to have one or more abnormal conditions. In 1990-1999, data show that mothers with diabetes were more likely to have pre-term deliveries.

Intensive diabetes therapy is known to reduce the risk of end stage renal disease (ESRD), and yet ESRD is increasing dramatically each year. West Virginia's African-American population shows a disproportionate percentage of ESRD as compared to the overall state's population.

Nearly 20% of hospital charges in West Virginia in 1998 were diabetes-related. The hospital cost for persons with diabetes was $392,000,000 in that year. More than 70.0% of diabetes-related hospital charges were billed to Medicare. The average cost per hospital stay for persons with diabetes was $9,665 vs. $7,794 for persons without diabetes.

Diabetes is the sixth leading cause of death in West Virginia; the state ranks second among the 49 states and the District of Columbia in diabetes-related deaths.

Diabetes affects the physical, social, psychological, and economic well-being of individuals. Unfortunately, the diabetes population is more likely to be less educated, and more likely to be poor.

Access to medical care is also an issue in rural West Virginia; public transportation is limited in these areas. Many devastating results of diabetes are caused by the lack of implementation of current diabetes knowledge in the diabetes management of our population.

Diabetes is a costly disease for West Virginia's population. Public health personnel need to work in a concerted team effort to facilitate prevention of devastating results.

Table of Contents

Introduction

CHAPTER ONE: INTRODUCTION TO THE PROBLEM OF DIABETES

Diabetes mellitus is a metabolic disorder primarily characterized by elevated blood glucose levels and by microvascular and cardiovascular complications that substantially increase the morbidity and mortality associated with the disease and reduce the quality of life (1). In 1999, diabetes was listed as the seventh leading cause of death in the United States and the sixth leading cause of death in West Virginia. Diabetes impacts the physical, psychological, social, and economic well-being of affected persons, their families, and subsequently the whole population. Diabetes knowledge, treatment, and prevention strategies are advancing rapidly (2). One goal of diabetes therapy is to keep blood glucose at near-normal levels at all times. It is essential that current research be translated from providers to the persons with diabetes. Because people with diabetes must assume responsibility for their daily health care, education in self-care management is integral.

A recently published fact sheet from the U.S. Centers for Disease Control and Prevention (CDC) reveals the following significant complications of diabetes. Heart disease is the leading cause of diabetes-related deaths; the risk of heart disease is two to four times higher in persons with diabetes. The risk of stroke is two to four times greater, and an estimated 60-65% of persons with diabetes have hypertension. It is the number one cause of adult blindness and the leading cause of end-stage renal disease, accounting for about 40% of new cases. Approximately 60-70% of persons with diabetes have neuropathies; more than half of the lower limb amputations occur in persons with diabetes. In addition, periodontal disease occurs more frequently; it dramatically increases the rate of perinatal morbidity and mortality, and it can cause two acute and life-threatening conditions, diabetic ketoacidosis and hyperosmolar nonketotic coma. Annual health care costs for the treatment of diabetes are tremendous, estimated at more than $98 billion nationally in 1997 (3). The recent emphasis on chronic diseases such as diabetes stems from the recognition that these conditions are "among the most prevalent, costly, and preventable of all health problems." Most Americans (seven of every 10 who die every year) will have a chronic disease as the leading cause of death (4).

In 1999, the prevalence of diabetes among adults in West Virginia was 7.3%, compared to the national median prevalence of 5.6%. West Virginia's rate was the fourth highest among the 52 BRFSS participants in that year. Both men and women in West Virginia reported higher rates of diabetes.

Diabetes prevalence increases with age. In 1999, 15.5% of West Virginia's adults ages 65 and older reported having diabetes. Higher rates were also reported by persons with less than a high school education and those with an annual household income of less than $15,000 (Table 1 on page 23).

Diabetes

Diabetes mellitus consists of a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both (5). Chronic hyperglycemia is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels (6). Diabetes may be caused by autoimmune destruction of the Beta-cells of the pancreas causing insulin deficiency or by cellular resistance to insulin action (7). These deficiencies impair carbohydrate, protein, and fat metabolism resulting in hyperglycemia. Symptoms of marked hyperglycemia include extreme thirst, excessive urination, hunger, weight loss, and blurred vision (8).

Acute hyperglycemia can lead to ketoacidosis or nonketotic hyperosmolar syndrome, and both are life-threatening (9). Chronic hyperglycemia in children can result in growth impairment. Susceptibility to infections is more likely with chronic hyperglycemia. Some other complications resulting from diabetes include: retinopathy, nephropathy, peripheral neuropathy, and autonomic neuropathy.

The most frequently diagnosed types of diabetes are Type 1 and Type 2. Type 1 diabetes is caused by Beta-cell destruction and this usually leads to an absolute deficiency of insulin. The causes are now believed to be immune mediated, environmental, genetic, or have no known cause. Type 2 diabetes is the most prevalent form of diabetes and may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance (10).

A less prevalent type of diabetes is gestational diabetes mellitus (GDM). It is defined as any degree of glucose intolerance with an onset or the first recognition occurring during pregnancy (11).

Some of the other less common causes of diabetes include genetic defects of the B-cell, genetic defects in insulin action, drugs that impair insulin secretion, and certain viruses have been associated with B-cell destruction and endocrinopathies (12).

Type 1 Diabetes

In Type 1 diabetes, the Beta-cells of the pancreas produce little or no insulin and therefore exogenous insulin injections are required daily. Type 1 usually occurs under the age of 30 and these persons are usually thin. The length of time for Beta-cell destruction varies from a very rapid onset

with severe hyperglycemia, which most frequently occurs in children and adolescents, to having some Beta-cell function for years; this slower process usually occurs in adults. Children and adolescents are diagnosed frequently with ketoacidosis at the onset of the disease. Ketoacidosis is an acute emergency situation with symptoms of extreme thirst, excessive urination, hunger, and rapid weight loss. Treatment consists of multiple daily insulin injections or insulin pump therapy, meal planning, and exercise planning. Type 1 represents approximately 5-10% of the population with diabetes. The prevalence is higher in whites than nonwhites. Type 1 is more likely to occur in autumn and winter in the northern hemisphere. Diagnosis prevalence peaks at 12 years of age.

Type 2 Diabetes

Type 2 diabetes is caused by insulin action resistance and/or an inadequate compensatory insulin secretory response (13). The body is not always deficient in producing insulin; in fact, the pancreas may be making more than the usual amount of insulin. Type 2 diabetes usually occurs after the age of 30 in persons with a family history of Type 2 diabetes. About 80% of the persons diagnosed with Type 2 are obese and this obesity is frequently in the abdominal region. Type 2 diabetes is often asymptomatic in the early stages and can remain undiagnosed for many years (14). Symptoms of Type 2 diabetes often include a feeling of fatigue, blurred vision/visual changes, tingling, pain or numbness in the hands or feet, and recurrent skin, gum, or bladder infections. Other conditions frequently occurring with diabetes are hypertension and hyperlipidemia. Treatment for Type 2 diabetes varies. It may require lifestyle changes, including an exercise plan and dietary modifications; or an exercise plan, dietary changes, and oral diabetes medication; or an exercise plan, dietary changes, and insulin, or perhaps both oral diabetes medication and insulin will be necessary. Type 2 diabetes represents approximately 90-95% of the population with diabetes.

Gestational Diabetes (GDM)

Gestational diabetes is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (15). This diagnosis applies to all persons whether they require insulin, are treated with dietary modifications, or if the condition persists after pregnancy. It is recommended that women be tested for diabetes six weeks after pregnancy ends to determine if the glucose levels have returned to normal.

GDM complicates about 7% of all pregnancies in the United States (16). GDM represents nearly 90% of all pregnancies complicated by diabetes (17). Risk assessment for GDM should be initiated at the first prenatal visit. Women at high risk are those with marked obesity, personal history of GDM, glycosuria, or a strong family history of diabetes. Persons at high risk should be tested early for GDM. Following pregnancy, glucose levels may return to normal, remain impaired, or progress to frank diabetes. It is estimated that 35-60% will develop diabetes within 15 years. It

is no longer recommended that women of low risk be screened for GDM (18). Medical nutritional therapy, insulin when necessary, and antepartum fetal surveillance can reduce the GDM-associated perinatal morbidity and mortality (19).

Risk Factors for Type 2 Diabetes

A family history of diabetes, obesity, physical inactivity, a previous diagnosis of IFG (impaired fasting glucose), hypertension, low HDL cholesterol and elevated triglyceride levels, history of GDM, giving birth to a baby weighing more than nine pounds, or having polycystic ovary syndrome are all risk factors for diabetes. In addition, certain minority groups have a higher risk for the disease: African-Americans are 1.7 times as likely, Hispanics are almost twice as likely, while Native Americans and Alaska Natives are 2.8 times as likely as the Non-Hispanic white population to develop diabetes (20). Other demographic factors associated with a higher risk for diabetes include female gender, lower education levels, and socioeconomic status.

The criteria for diagnosing diabetes mellitus were revised by a committee of experts on June 23, 1997 (21). It is believed that lowering the diagnostic criteria will yield earlier diagnosis, promote earlier treatment, and subsequently decrease the burden of Type 2 diabetes. There are currently three ways to diagnose diabetes: (1) a fasting plasma glucose (FPG) levels test (this test was lowered to 126mg/dl) with fasting defined as no caloric intake for at least eight hours; (2) the casual plasma glucose concentration (which remains at 200 mg/dl and can be tested at any time of day and is diagnostic if the classic symptoms of diabetes are present); and (3) the two-hour post-glucose load, using a 75-gram load of glucose with a resultant value of 200 mg/dl or higher.

While HbA1c is not recommended for diagnosing diabetes, it is highly recommended as a monitoring and treatment tool. The American Diabetes Association recommends a value of less than 7%. Significant long-term diabetes studies have been completed in the past decade and have led or are leading toward improving diabetes management and care. Three studies are summarized below.

The Diabetes Control and Complications Trial

The Diabetes Control and Complications Trial (DCCT) is significant as the longest and largest Type 1 study conducted to date on the effects of blood glucose concentrations on diabetic complications (22). The DCCT was a long-term, multicenter trial conducted by the National Institutes of Health (NIH) to test a direct relationship between delayed onset and progression of diabetic complications and lowered blood glucose concentrations. The study involved 1,441 volunteers with Type 1 diabetes. There were two groups of patients, one treated conventionally (goal: clinical well-being) and the other treated intensively (goal: normalization of blood glucose). Patients were followed over an average of seven years.

The results of the DCCT, released by the NIH in June 1993, showed a delay in both the onset and progression of three major diabetic complications among those patients receiving intensive therapy. The benefit of intensive therapy was evident regardless of patient age, sex, or duration of disease. Damage to the subject's eyes was reduced by 76%, to the kidneys by 56%, and to the nerves by 60%. DCCT findings indicate a much stronger impact from intensive therapy than was expected and have major implications for health care providers and their patients. One concern with tight control is hypoglycemic reactions and therefore patient selection requires clinical judgment (23).

United Kingdom Prospective Diabetes Study (UKPDS)

The United Kingdom Prospective Diabetes Study (UKPDS) was a multicenter, randomized, controlled trial in 23 centers in the United Kingdom between 1977 and1991. It is the largest and longest study of Type 2 diabetic patients. The study included 5,102 patients with newly diagnosed Type 2 diabetes. These patients were followed for an average of 10 years. The intent of this study was to determine whether intensive use of diabetes medication would result in reducing cardiovascular and microvascular complications and whether different diabetes medications had specific advantages. Additionally, the patients with hypertension were evaluated to determine if an ACE inhibitor (captopril) or B-blockers (atenolol) offered specific therapeutic advantages (24).

The results demonstrated that retinopathy, nephropathy, and possibly neuropathy were lessened by lowered blood glucose levels in Type 2 diabetes patients with intensive therapy. The study showed that, for every percentage point decrease in HbA1c, there was a 35% reduction in the risk of complications. The study did not show a significant effect between lowered blood glucose levels and cardiovascular complications. The study revealed that lowering blood pressure significantly reduced strokes, diabetes-related deaths, heart failure, microvascular complications, and visual loss (25).

Long-Term Results of the Kumamoto Study on Optimal Diabetes Control in Type 2 Diabetic Patients

This study was designed as an eight-year prospective study of Japanese patients with Type 2 diabetes to determine whether intensive glycemic control could decrease the frequency or severity of diabetic microvascular complications. A total of 110 patients participated in the study. They were divided into two groups of which 55 had no retinopathy and 55 had simple retinopathy. All of the patients were treated with insulin. The two groups were divided randomly with one group receiving multiple insulin injection therapy (MIT), with three or more insulin injections daily, and the other receiving conventional insulin injection therapy (CIT), with one or two insulin injections daily. The three clinical values measured to determine glycemic control were fasting blood glucose, two-hour postprandial blood glucose, and HbA1c (26).

The levels of glycemic control were measured to evaluate the effects on retinopathy, nephropathy, and nerve conduction. Findings revealed that near euglycemia values were essential to prevent the onset and/or progression of diabetes microvascular complications. The glycemic values are recorded as: HbA1c of less than 6.5%, fasting blood glucose concentration of less than 110 mg/dl, and two-hour postprandial blood glucose concentrations of less than 180 mg/dl.

Conclusions from the study are that intensive glycemic control can delay the onset and progression of the early stages of diabetic microvascular complications in Japanese patients with Type 2 diabetes. The results also showed that intensive glycemic control could improve the quality of life and save medical resources (27).

West Virginia Diabetes Control Program

The West Virginia Diabetes Control Program (WVDCP), located within the West Virginia Bureau for Public Health, is funded by the CDC. The responsibility of the program is to define the problems of diabetes in West Virginia and to facilitate development of policy and program strategies to effectively reduce negative impact of diabetes within the state. The Commissioner for Public Health appoints persons to serve as members of the West Virginia Diabetes Advisory Committee to ultimately assist the WVDCP address the impact of diabetes in West Virginia. The committee is composed of health professionals, representatives of volunteer organizations, and consumers who reflect a variety of diabetes concerns throughout the state. Committee members work closely with the WVDCP to develop short-term and long-term plans for improving diabetes management and the realization of its objectives (Appendix Two).

INTRODUCTION TO THE PROBLEM OF DIABETES SUMMARY

- Diabetes is a chronic disease whose prevalence has remained constantly higher in West Virginia than in the United States over the past 10 years.

- Diabetes is the sixth leading cause of death in West Virginia and the seventh in the United States.

- Many diabetes problems are associated with life-style behaviors. Some of these risk factors are modifiable (i.e., obesity, smoking, and sedentary lifestyle).

- Family history, increasing age, and belonging to certain ethnic groups (African-Americans, Hispanic-Americans, and Native Americans) increases the risk of Type 2 diabetes.

- Approximately 90-95% of people with diabetes have Type 2 diabetes. The pancreas may not be producing an adequate supply of insulin or the cells may be resistant to a normal amount or overabundance of insulin. Type 2 diabetes usually occurs after 30 years of age and is frequently associated with obesity and other chronic conditions, such as hypertension and hyperlipidemia.

- Persons with Type 2 diabetes frequently present with vague symptoms, such as tiredness or blurred vision; however, they may be asymptomatic. Other symptoms such as slow-healing skin injuries, tingling or numbness in the hands or feet, recurring skin, gum, or bladder infections, frequent urination, unusual thirst, extreme hunger, unusual weight loss, and irritability are occasionally present.

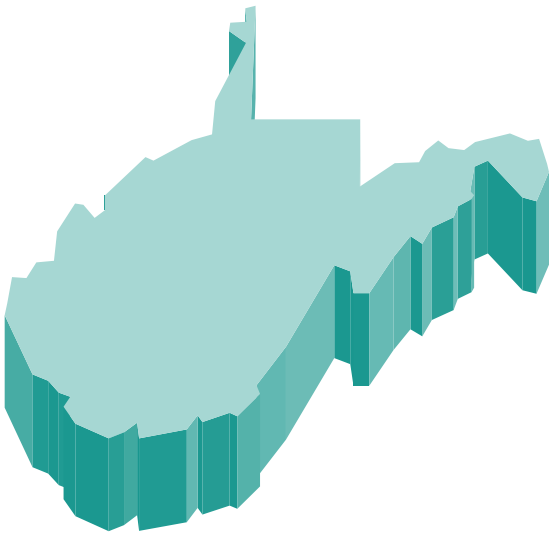
- Type 1 diabetes frequently reaches emergency status before being diagnosed. Some of the classic symptoms of Type 1 diabetes include frequent urination, unusual thirst, extreme hunger, unusual weight loss, and irritability. Type 1 diabetes represents approximately 5-10% of the diabetes population**.**

- Gestational diabetes complicates approximately 7% of all pregnancies. It is estimated that 35-60% of those affected by gestational diabetes will develop diabetes within 15 years after pregnancy. Obesity increases the person's risk of developing diabetes later in life.

- The risk of heart disease is two to four times greater among persons with diabetes. Heart disease is the leading cause of diabetes-related deaths.

- The risk of stroke is two to four times greater in persons with diabetes.

- Hypertension affects approximately 60-65% of people with diabetes.
- Diabetes is the leading cause of new blindness in adults 20 to 74 years old.
- Diabetes is the leading cause of end-stage renal disease.
- Diabetes is responsible for more than half of lower limb amputations.
- Diabetes is a major factor in the development of nervous system problems, including peripheral and autonomic neuropathies.
- Diabetes is a major risk factor for adverse outcomes in pregnancy.
- Persons with diabetes are more likely to have periodontal disease.
- Persons with diabetes are more likely to be susceptible to other illnesses, such as pneumonia or influenza.



CHAPTER TWO: DIABETES PREVALENCE

In 2000, approximately 11.1 million people in the nation reported they had diabetes (28), and approximately 5.9 million who have diabetes are not aware of it according to the CDC (29). Because diabetes is a serious, costly, and increasingly common chronic disease in West Virginia, accurate and ongoing surveillance is necessary to analyze and compile data on this devastating illness and its complications.

Behavioral Risk Factor Surveillance System

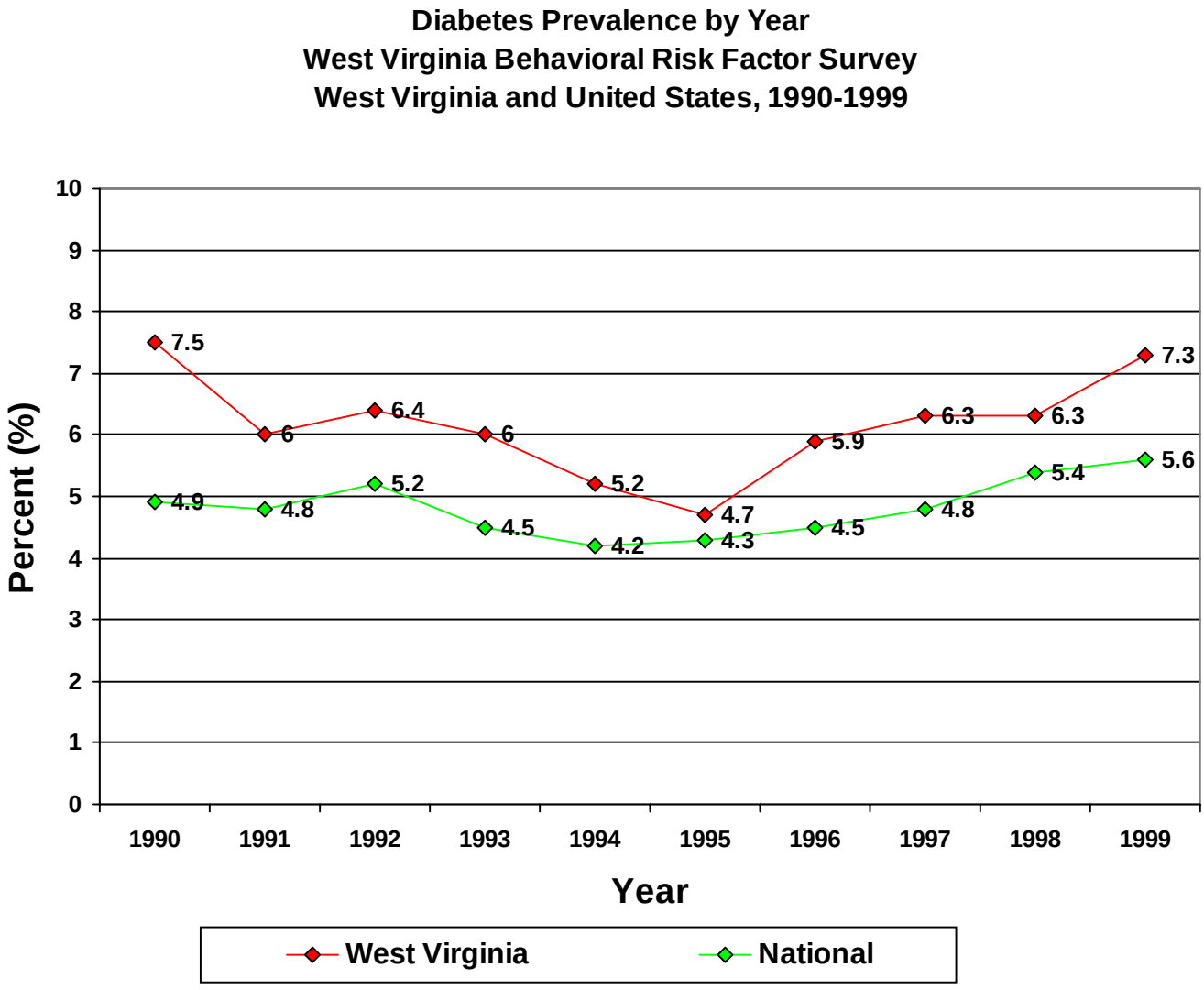
The Behavioral Risk Factor Surveillance System (BRFSS) has been collecting data on diabetes prevalence among West Virginia adults since 1988. Established by the CDC, the BRFSS involves a random sample telephone survey (the Behavioral Risk Factor Survey, or BRFS) designed to measure behaviors related to health problems in the population over 18 years of age.

Over the 10-year period from 1990 through 1999, the overall percentage of West Virginia respondents who reported having been told by a doctor that they had diabetes ranged from 4.7% to 7.5% (Figure 1). Diabetes in West Virginia has consistently mirrored the national trend though at a higher prevalence rate. The prevalence reported among women during the time period of 1990 to 1999 was higher than for men with the exceptions of 1996 and 1997 (Figure 2). Rates are dramatically higher among the age groups of 55 to 64 and 65+ than for the 18 to 54 age group (Figure 3).

Data from 1999 show a 7.3% prevalence rate for diabetes among the population of West Virginians aged 18 and older. West Virginia ranked fourth highest in prevalence among the 52 BRFSS states and territories participating in the 1999 BRFSS. National BRFSS prevalence rates for diabetes ranged from 4.2% in Utah to 9.6% in Puerto Rico (Table A-1, Appendix 3).

BRFSS respondents who reported having diabetes from 1994-1999 were more likely to be older, female, and have less education and lower incomes than those without diabetes (Table 1). Sixty-nine percent (69.1%) of persons with diabetes were over the age of 55 years, compared to 31.0% of the persons without diabetes, and a slightly higher proportion were female (55.3% vs. 52.8%). Although African-Americans made up only 3.2% of the state's population during the years of 1994-1999, 10.7% of the African-American population had diabetes during that time period.

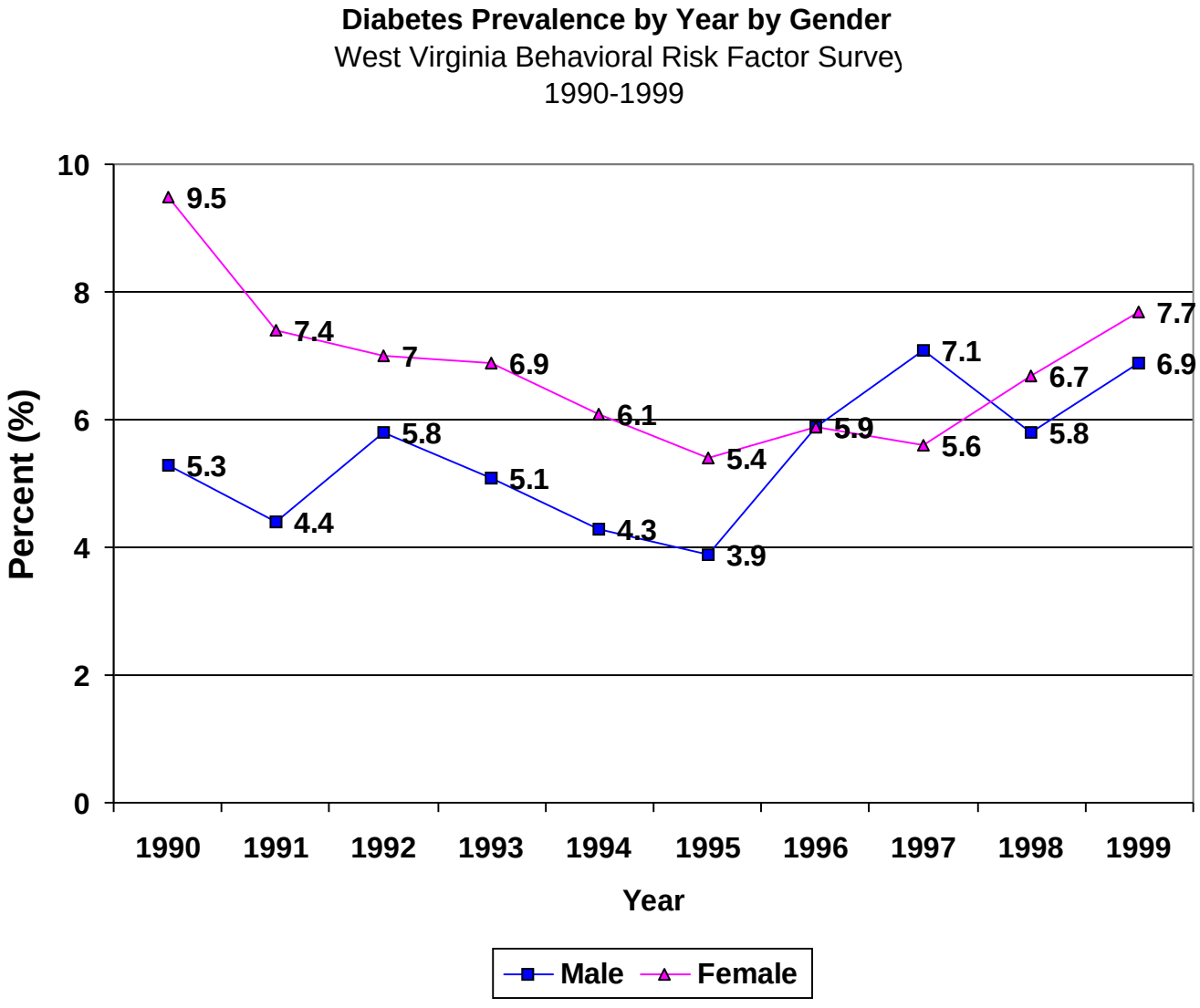
Figure 1



Source: West Virginia Health Statistics Center, 2001

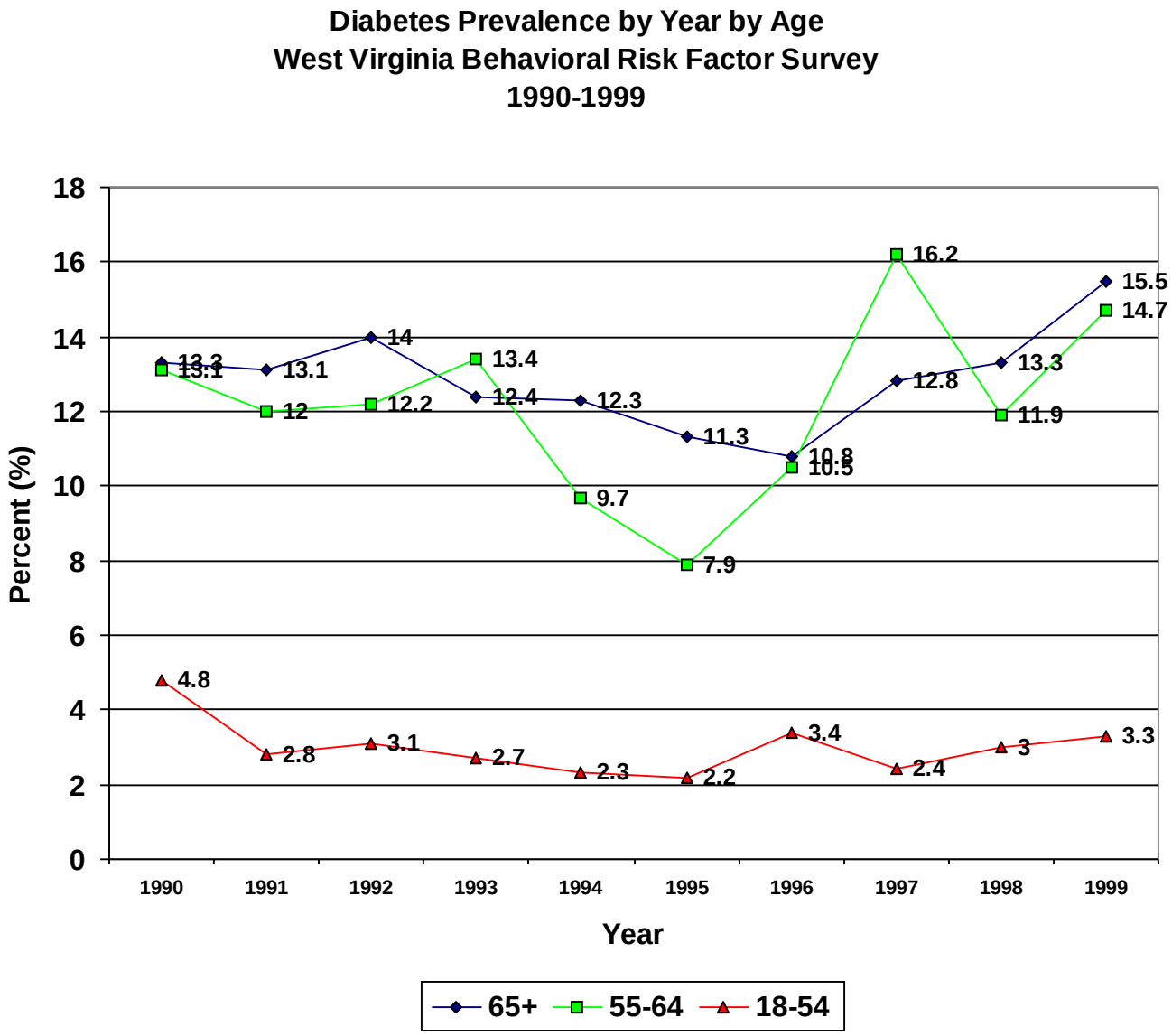
Forty percent (40.1%) of persons with diabetes had less than a high school education, compared to 20.3% of those without diabetes. Approximately one-third (32.2%) of individuals with diabetes had incomes of less than $15,000, compared to only about one-fifth (19.9%) of respondents without diabetes.

Figure 2



Source: West Virginia Health Statistics Center, 2001

Figure 3



Source: West Virginia Health Statistics Center, 2001

Discussion

Review of the demographic characteristics of West Virginia's population with diabetes in West Virginia underlines the urgent need for effective interventions to prevent or delay the complications of diabetes.

Table 1

DEMOGRAPHIC DISTRIBUTION BY DIABETES STATUS

1994 - 1999 West Virginia Behavioral Risk Factor Surveys

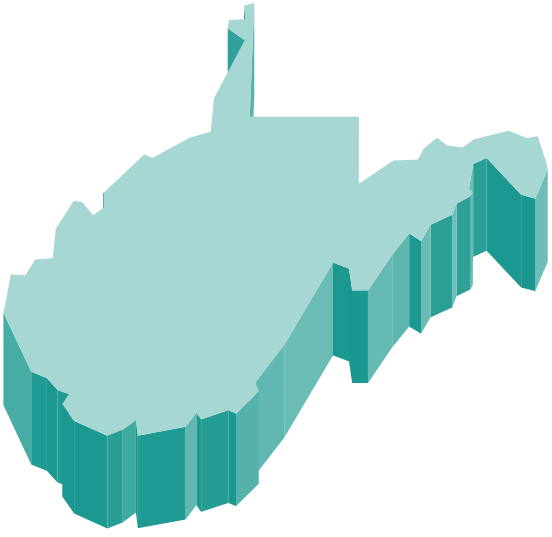
CHARACTERISTIC	WITH DIABETES			WITHOUT DIABETES		
	Men	Women	Total	Men	Women	Total
	%	%	%	%	%	%
	44.7	55.3	100	47.2	52.8	100
AGE						
18-54	34.5	28.0	30.9	71.8	65.9	68.7
55-64	26.6	23.9	25.1	11.7	11.9	11.8
65+	39.0	48.0	44.0	16.3	21.8	19.2
EDUCATION						
< 12 Years	36.8	42.8	40.1	19.8	20.8	20.3
12 Years	30.6	37.7	34.6	42.0	41.4	41.7
13 - 15 Years	19.8	13.4	16.3	20.4	22.6	21.6
16+ Years	12.7	5.5	8.7	17.6	15.0	16.3
Unknown	0	0.6	0.3	0.2	0.1	0.2
INCOME						
< $15,000	25.1	38.0	32.2	16.5	23.0	19.9
$15,000 - $24,999	27.6	26.5	27.0	23.5	22.8	23.1
$25,000 - $49,999	28.9	13.6	20.4	32.5	27.5	29.9
$50,000+	10.2	6.2	8.0	16.0	12.5	14.2
Unknown	8.1	15.8	12.4	11.5	14.2	12.9

According to a recently published Finnish study (30), strategies should focus on healthful behaviors such as improved nutrition, exercise, and weight control. The Finnish study revealed that a weight loss of between five and 10 pounds and exercising for 30 minutes five days a week will prevent Type 2 diabetes in persons with impaired glucose tolerance or prediabetes. It is estimated that only two thirds of persons who have diabetes are aware of it. Lowering the diagnostic criteria has had an impact on identifying people whose diabetes has not yet been detected. Current community screening programs that do not include systematic referral and follow-up have proven to be ineffective in addressing this problem. The American Diabetes Association's (ADA) screening guidelines recommend that screening be done by using the fasting plasma glucose test every three years for persons over the age of 45. The ADA also publishes medical management guidelines annually. A more comprehensive health care system is necessary to provide appropriate supervision and management recommendations to persons with diabetes.

It is estimated that only two thirds of persons who have diabetes are aware of it.

DIABETES PREVALENCE SUMMARY

- According to the U.S. Centers for Disease Control and Prevention, approximately one-third of the people who have diabetes are unaware of it.
- An estimated 7.3% of all West Virginians over 18 years of age have been told by a doctor that they have diabetes.
- West Virginia ranked fourth highest among 52 states and territories participating in the 1999 Behavioral Risk Factor Surveillance System in percentage of the adult population having ever been told they have diabetes.
- An estimated 10.7% of the African-American population in West Virginia had diabetes during the years of 1994 to 1999 although the African-American population represented only 3.2% of the population.
- Diabetes occurs more frequently among people having less education and lower incomes than among those with more education and higher incomes.



CHAPTER THREE: DIABETES AND CARDIOVASCULAR DISEASE

Cardiovascular diseases (CVD) are the most lethal, devastating, and costly complications among the population having diabetes. The greatest cause of mortality among persons with either Type 1 or Type 2 diabetes is cardiovascular disease, with 61% of life lost prematurely due to a combination of CVD and cerebral vascular disease. Mortality ratios for coronary artery disease in persons with diabetes are two and fourfold greater in men and women with diabetes, respectively, than in comparable populations without diabetes. Heart disease in persons with diabetes appears earlier in life, affects women almost as often as men, and is more often fatal, in contrast to people without diabetes (31). Cardiovascular disease remains at the forefront of comorbidities to be prevented, detected, and treated in individuals with diabetes (32).

African-American individuals with diabetes are at risk for macrovascular disease although they have a lower prevalence rate of myocardial infarctions than people of the Caucasian race (33). In addition, they are more likely to have complications such as amputations, kidney failure, and visual impairment. While premenopausal women without diabetes are less likely than males without diabetes for cardiovascular events and complications, this gender-protective advantage does not exist for females with diabetes (34).

Unfortunately, there is an increased risk for cardiovascular disease inherent in diabetes. Obesity, cigarette smoking, hypertension, physical inactivity, and elevated cholesterol are risk factors associated with cardiovascular disease and diabetes. These lifestyle-related risk factors are significant because they can increase the overall morbidity and mortality associated with diabetes and cardiovascular disease.

The nonmodifiable risk factors of diabetes include the duration of diabetes, age, genetics, race, height, autoimmunity, and gender (35). Age and genetics are influential in persons developing both diabetes and cardiovascular disease (36). The duration of diabetes and cardiovascular complications seem to have a linear relationship, that is, the longer a person lives with diabetes the greater the risk for cardiovascular complications. This relationship is more distinct in Type 1 diabetes than Type 2 because the time of onset is more clearly established (37).

Multiple Risk Factors

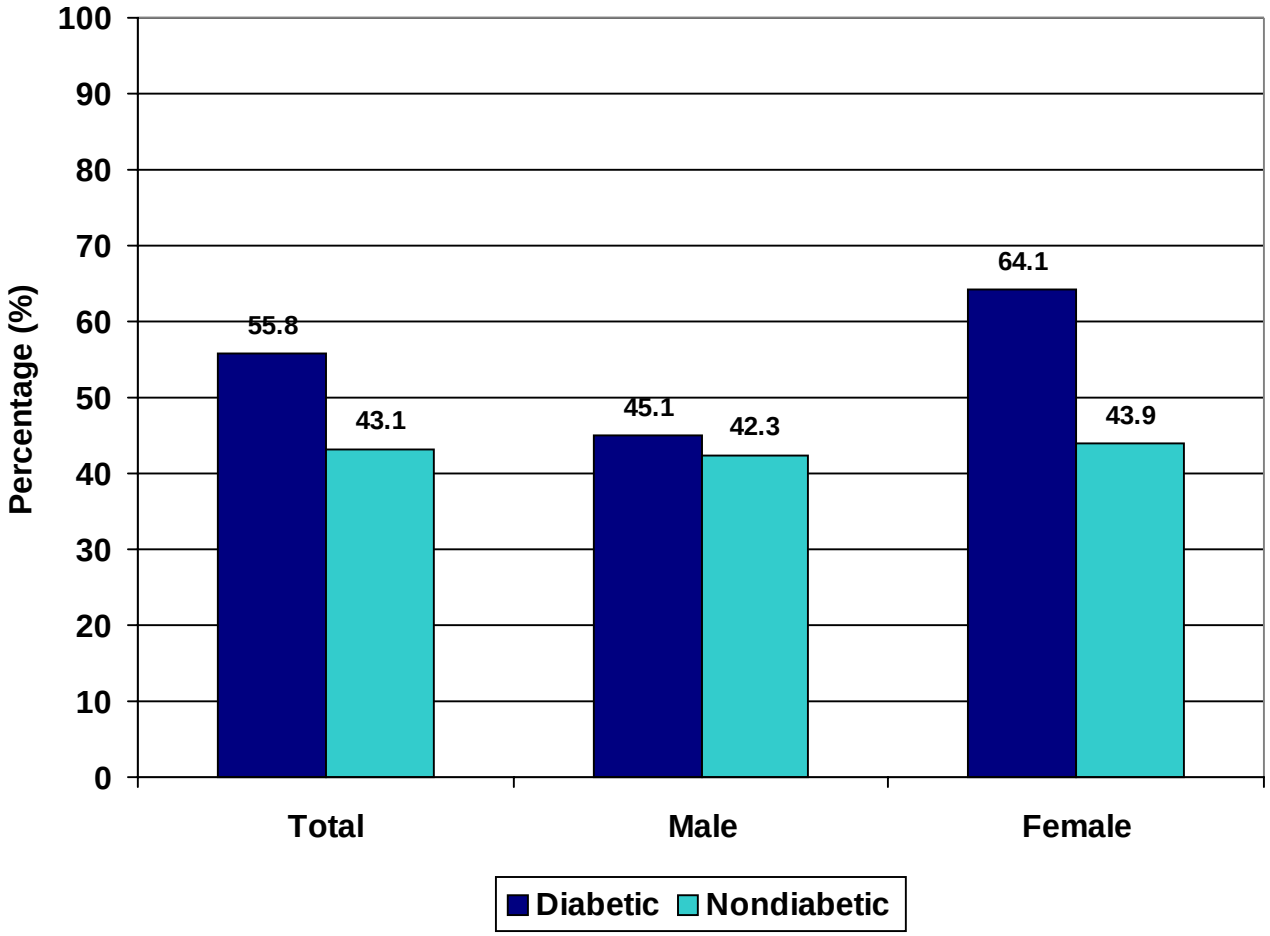
Review of BRFSS data from 1994 through 1999 reveals that persons with diabetes report having multiple risk factors more often than those without diabetes. Dependent on the combination of risk factors used, 33-52% of persons with diabetes report having more than one risk factor versus 23-25% for persons without diabetes.

Modifiable Risk Factors

Physical Inactivity BRFSS defines physical inactivity as no leisure-time activity. BRFSS data reveal that in West Virginia persons with diabetes were less likely to participate in any physical activity than persons not having diabetes. Over half (55.8%) of the persons with diabetes reported that they had little or no activity, while the respondents without diabetes were slightly more active with less than half (43.1%) having no leisure-time activity. The females with diabetes had the highest percentage of reported inactivity (64.1%), compared to only 43.9% of the females without diabetes (Figure 4). Both males and females with diabetes had higher percentages of inactivity. The highest percentage of inactivity was in females ages 55 and above with a percentage of 68.4% (Figure 5).

Figure 4

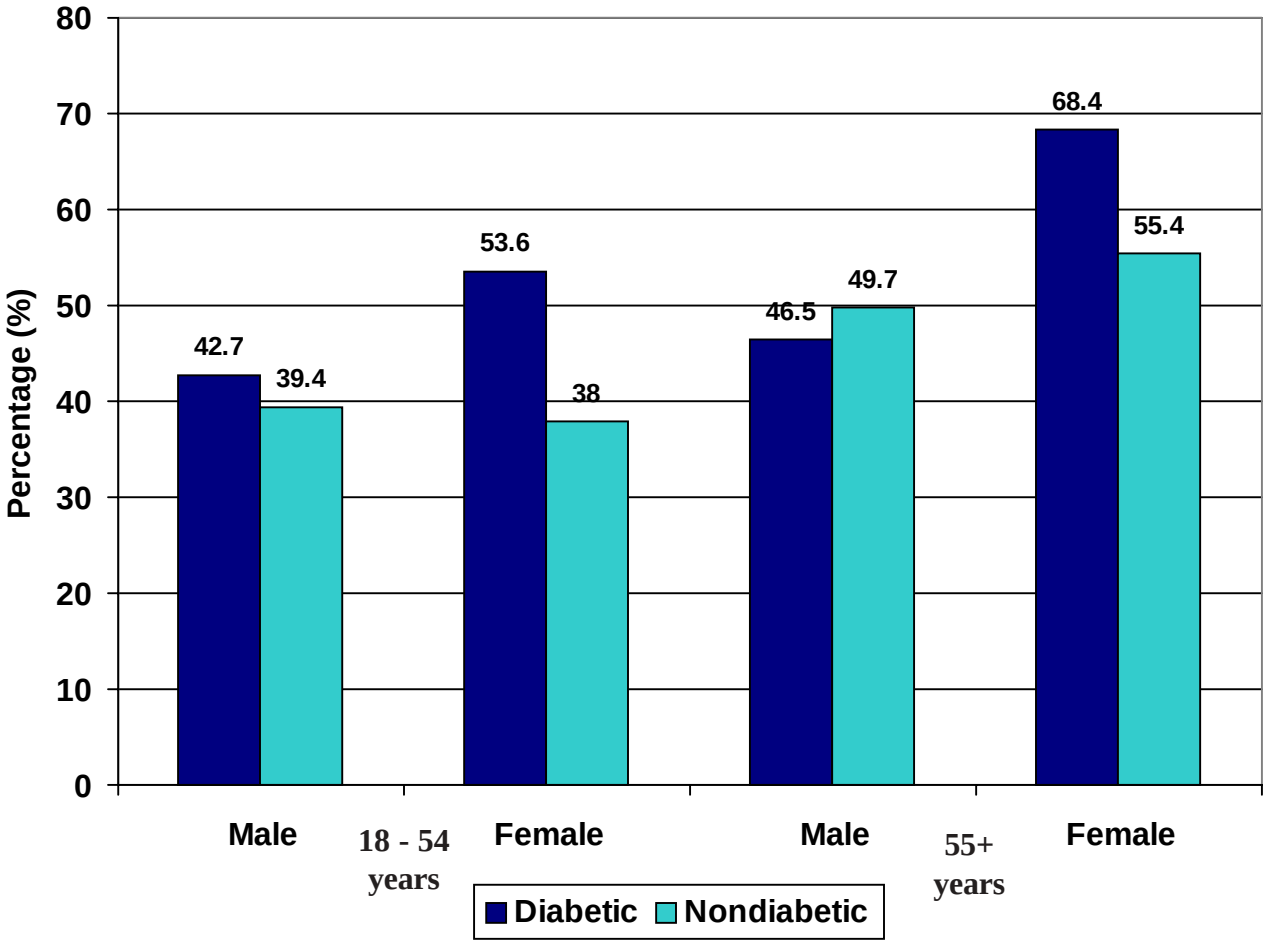
Prevalence of Physical Inactivity
By Diabetic Status By Gender
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*



*Data on Physical Inactivity only collected in even-numbered years.
Source: West Virginia Health Statisiics Center. 2001

Figure 5

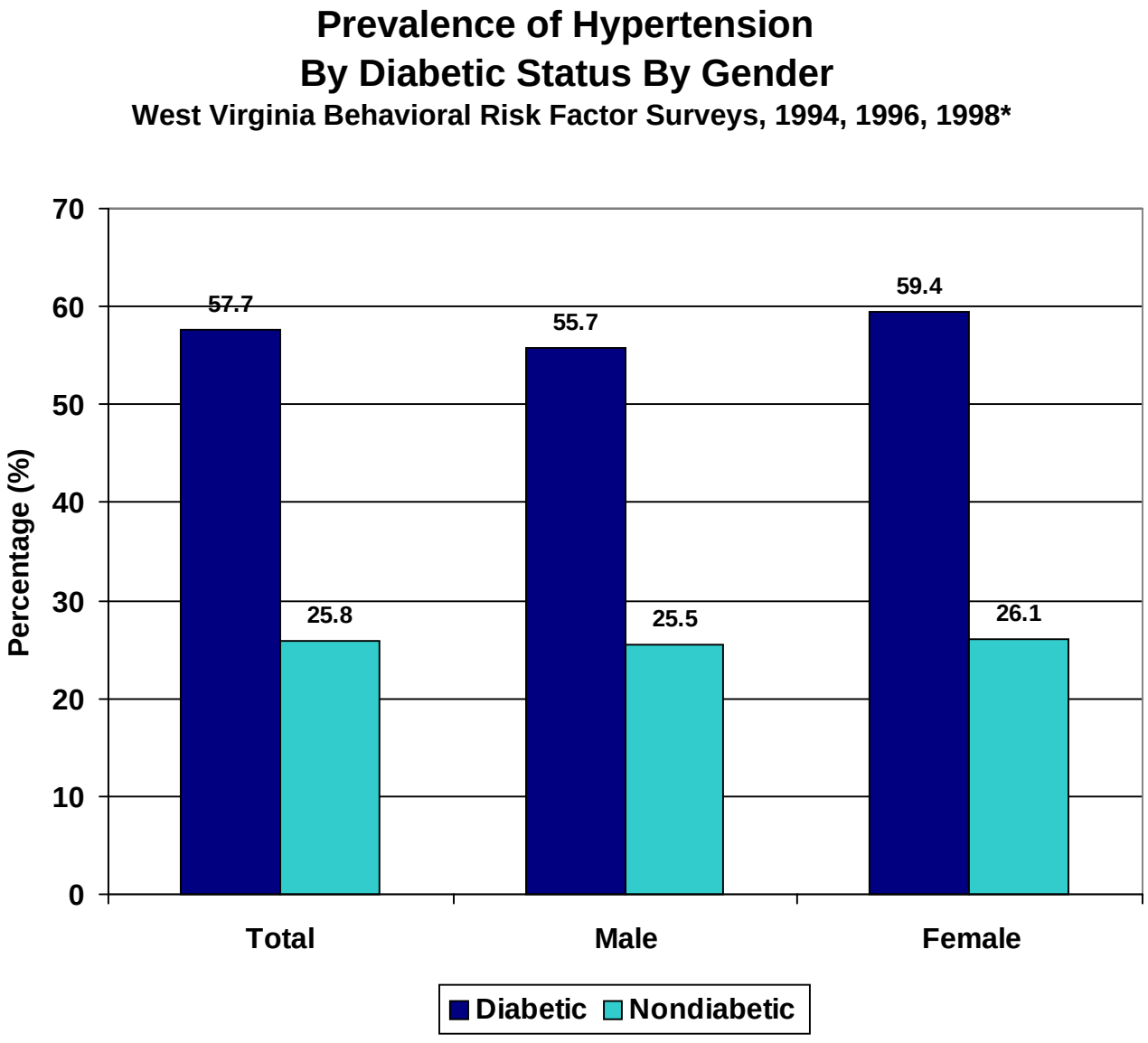
Prevalence of Physical Inactivity
By Diabetic Status By Gender
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*



*Data on Physical Inactivity only collected in even-numbered years.
Source: West Virginia Health Statisiics Center. 2001

Hypertension The overall prevalence of hypertension has been increasing in West Virginia since 1992, according to the BRFSS survey. West Virginia ranks third among the 52 BRFSS 1999 participants (the participants include the 50 states plus the District of Columbia and Puerto Rico) with a prevalence of 31.0%. Comparison of 1995 through 1999 hypertension data for persons with and without diabetes reveals the following information. The greatest difference noted was that 57.7% of the respondents having diabetes had been told that they also had hypertension, while only 25.8% of the respondents not having diabetes reported being told they had hypertension. There was little gender difference noted in the prevalence of hypertension in persons having diabetes (Figure 6).

Figure 6

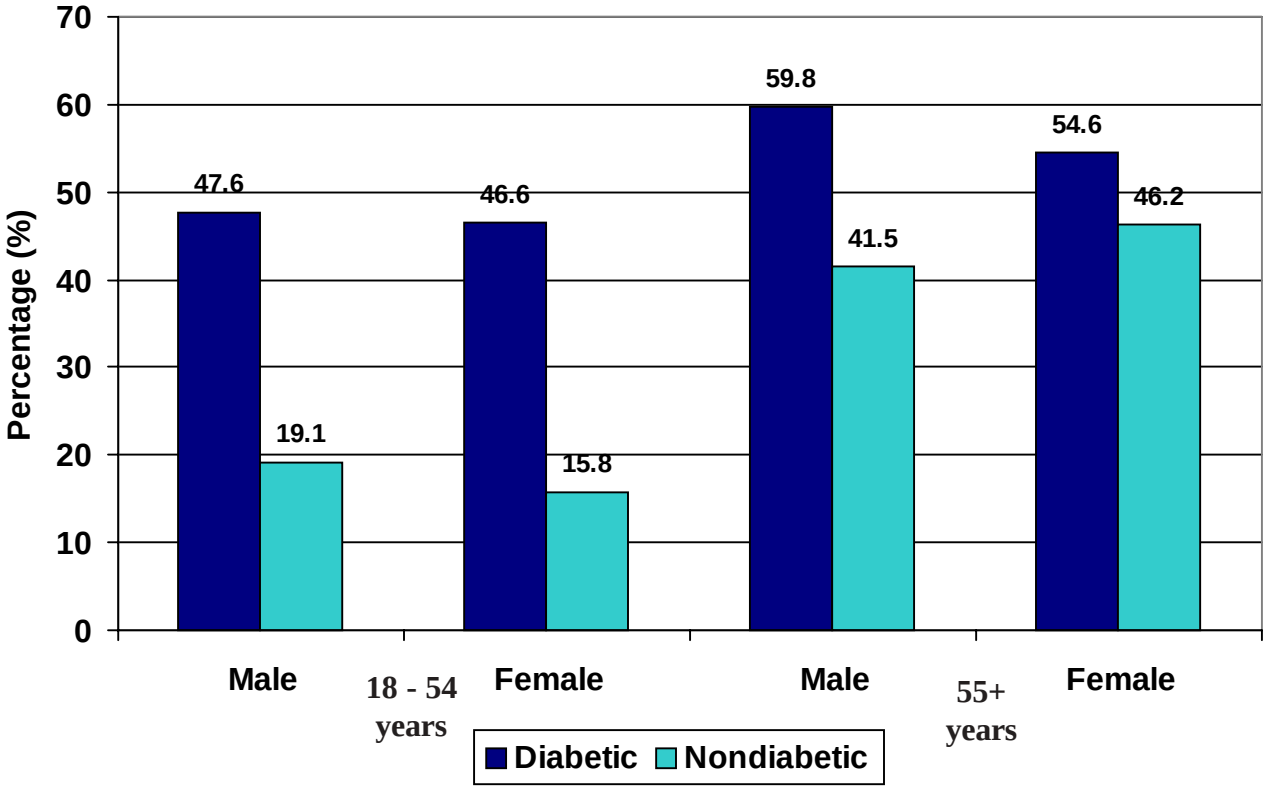


*Data on Physical Inactivity only collected in even-numbered years.
Source: West Virginia Health Statisiics Center. 2001

Both males and females with diabetes are more likely to have hypertension in the 18-54 age group than persons without diabetes. In the over-55 years of age group, females with diabetes are the most likely to have hypertension (Figure 7). These data are similar to the national average of 60% of persons with diabetes reporting hypertension.

Figure 7

Prevalence of Hypertension
By Diabetic Status By Gender
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*



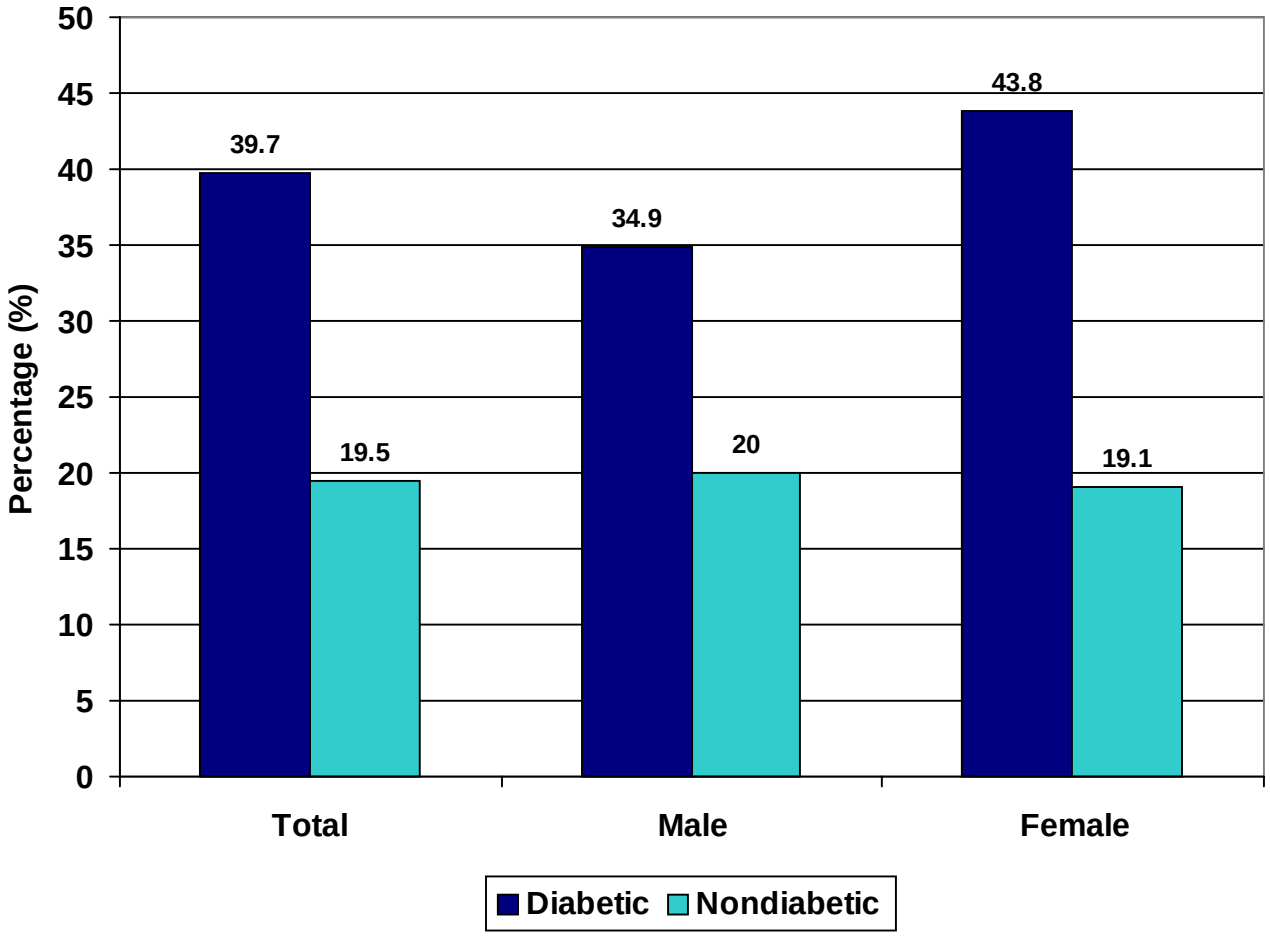
*Data on Physical Inactivity only collected in even-numbered years.
Source: West Virginia Health Statisiics Center. 2001

Obesity West Virginia ranked highest in obesity among all of the 52 BRFSS 1999 participants. The BRFSS data on obesity revealed that West Virginia's population had a prevalence of 24.6%. Obesity is defined as a Body Mass Index (BMI) of 30.0+ or higher. This standard results in a lower figure of obesity and a higher figure for being overweight than results using the past standard, i.e., the Metropolitan Life Insurance height/weight tables. Obesity is the most important preventable cause of diabetes (38). The overall prevalence of obesity among persons with diabetes from 1994-1999 was higher (39.7%) than that reported among persons without diabetes (19.5%). The current data reveal that females with diabetes are more than twice as likely to be obese as females without diabetes. Males with diabetes were almost one and a half times as likely to be obese as males without diabetes (Figure 8). Obesity is twice as great among persons aged 18-54 years with diabetes as among those without diabetes. The percentage of obesity in females with diabetes ages 55 years and older is nearly three times as high as those without diabetes (Figure 9).

Figure 8

Prevalence of Obesity
By Diabetic Status

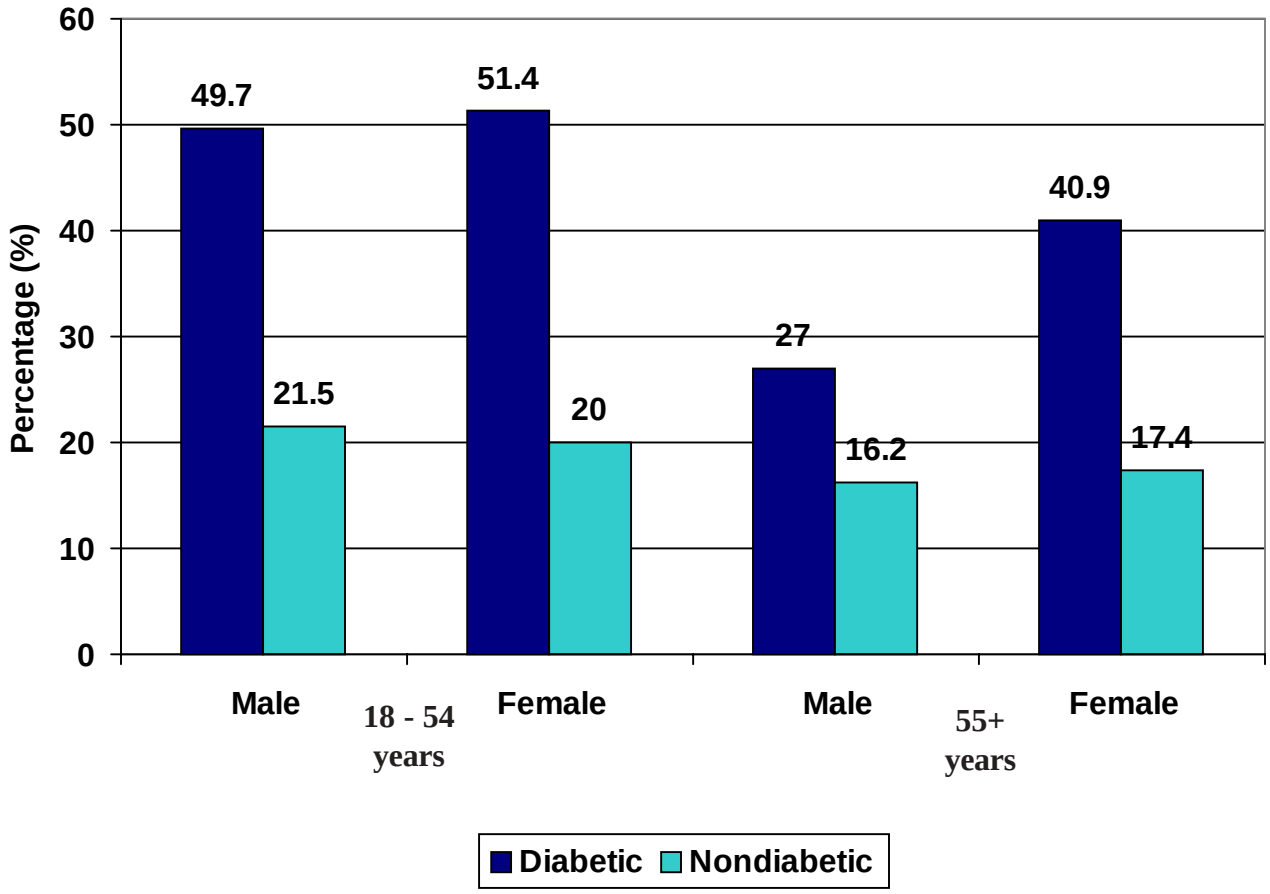
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*



Source: West Virginia Health Statistics Center, 2001

Figure 9

Prevalence of Obesity
By Diabetic Status By Age and Gender
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*

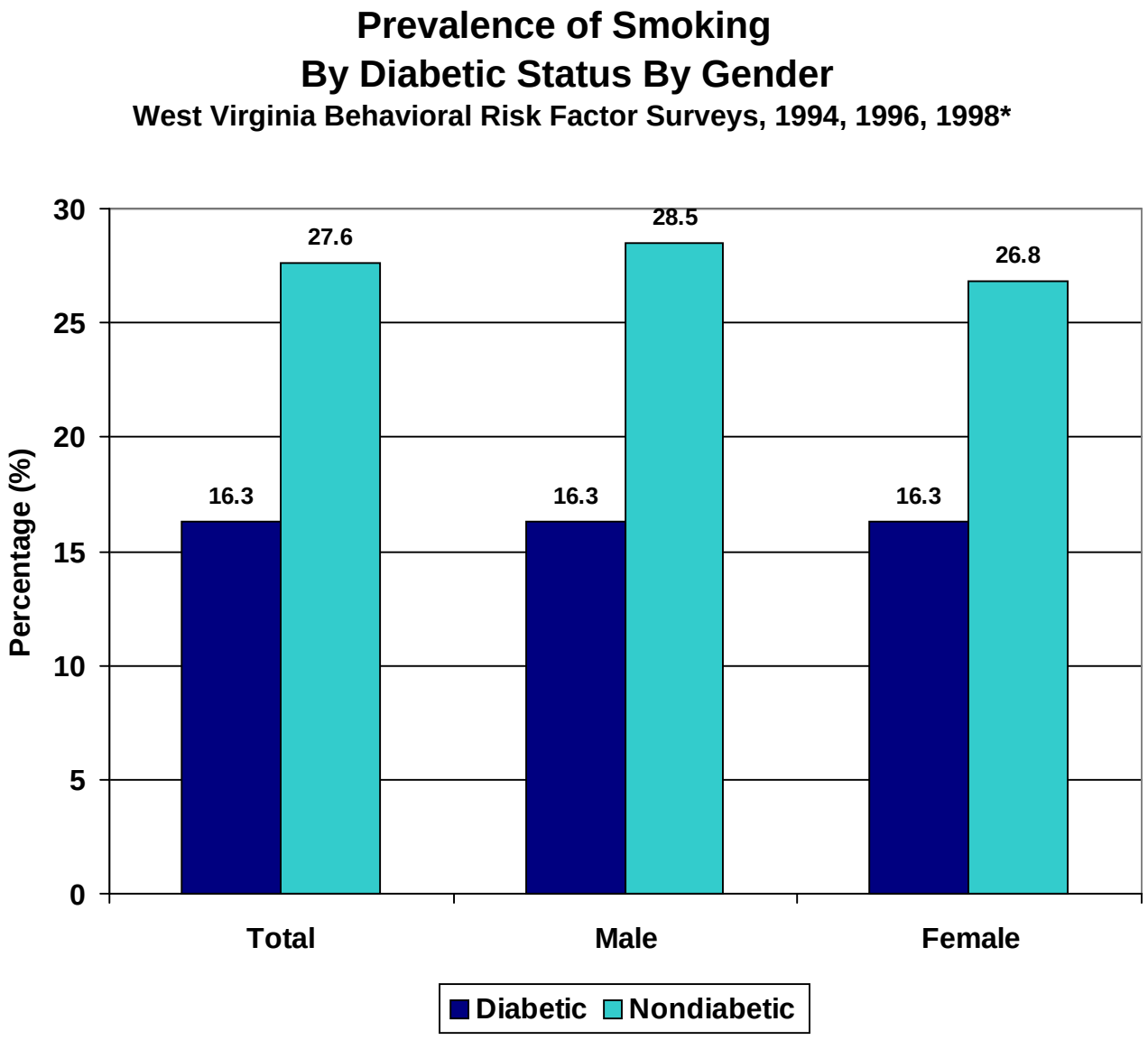


Source: West Virginia Health Statistics Center, 2001

Current Cigarette Smoking Current cigarette smoking, defined as having smoked at least 100 cigarettes during one's lifetime and a smoker at the time of the interview, has remained relatively constant among West Virginia adults from 1990-1999. The variance ranged from a low of 24.5% in 1992 to 27.9% in 1998. Smoking was the only one of the five cardiovascular risk factors studied that the population with diabetes reported at a lower overall rate than did the population without diabetes. Both men and women with diabetes reported current cigarette smoking at 16.3% from data

aggregated for 1994-1999 (Figure 10). Among younger respondents ages 18-54, males with diabetes reported smoking at 21.8%, while males without diabetes reported smoking at 32.1%. The comparison between women with and without diabetes was not as significant. The prevalence rate of smoking decreased dramatically among persons 55 years old and older, both in the group with diabetes and the group without diabetes (Figure 11).

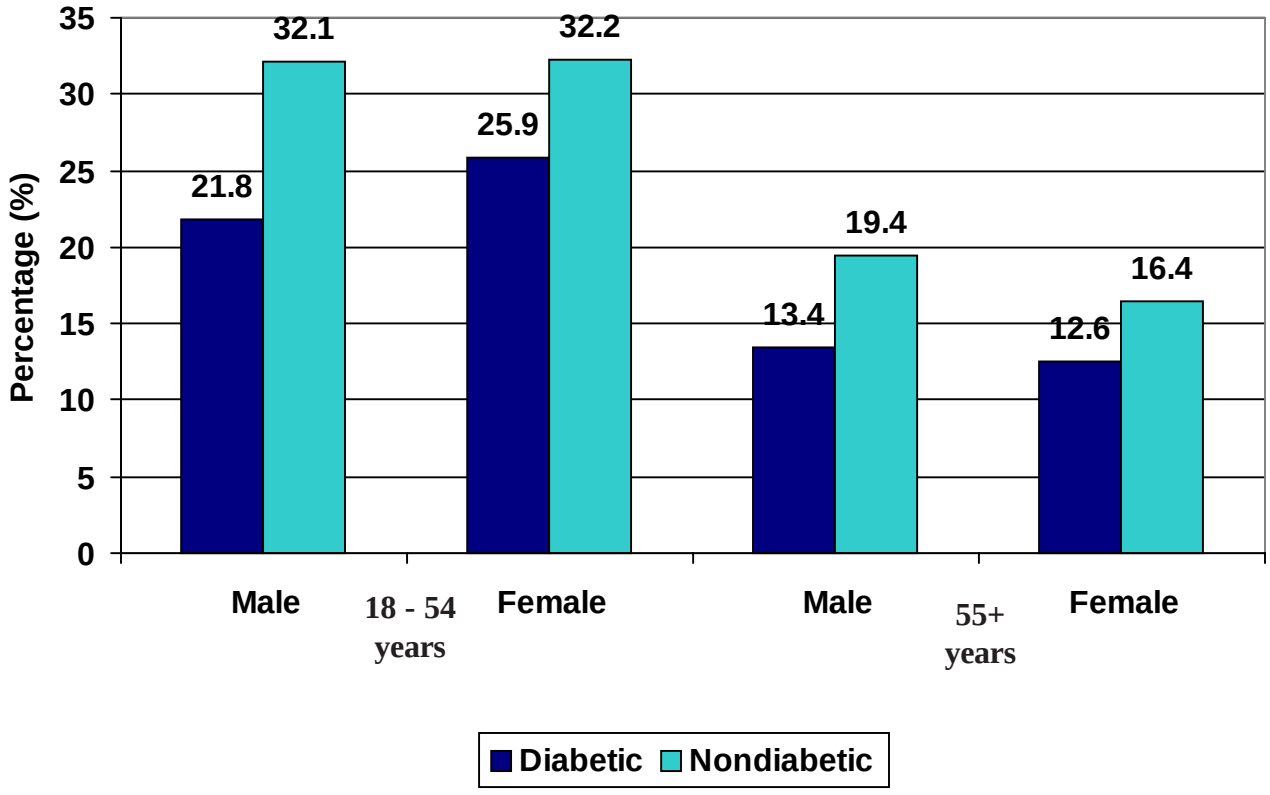
Figure 10



Source: West Virginia Health Statistics Center, 2001

Figure 11

Prevalence of Smoking
By Diabetic Status By Age and Gender
West Virginia Behavioral Risk Factor Surveys, 1994, 1996, 1998*



Source: West Virginia Health Statistics Center, 2001

Discussion

There is a clear association between diabetes and CVD. The BRFSS data raise concern regarding West Virginians' lack of change in lifestyle behaviors. There is a relationship between behaviors such as physical inactivity, obesity, and glycemic control. Evidence from such studies as the San Antonio Heart Study (39) and the United Kingdom Prospective Diabetes Study support (40) improved glycemic control in the prevention of macrovascular disease.

The three major types of macrovascular disease are coronary artery, cerebral vascular, and peripheral vascular disease (41). First, persons with diabetes develop coronary artery disease (CAD) earlier than persons without diabetes, and the coronary vessel involvement is more extensive and diffuse. Secondly, persons with diabetes are more prone to developing cerebral vascular disease at an earlier age. There appears to be a relationship between glycemic control at hospital admission for a "stroke"and mortality. Studies have shown that mortality ratios are from three to five times greater for persons with diabetes than for the populations without diabetes. There also seems to be a higher risk for transient ischemic attacks and thrombotic cerebral vascular accidents. Finally, peripheral vascular disease (PVD) is common in persons with diabetes, which is clinically characterized by intermittent claudication, lower leg and foot ulcers, and the need for amputations (42).

Most persons with diabetes who experience acute coronary insufficiency have the classic signs of angina, diaphoresis, and anxiety. But, some persons with autonomic neuropathy may have symptoms of nausea, shortness of breath, sweating, and vomiting, and may not associate these symptoms with serious heart problems. While activity is an important part of diabetes therapy, the possibility of a "silent heart attack" needs to be considered by both the physician and the person with diabetes when an exercise program is prescribed.

Smoking was the only cardiovascular risk factor studied by BRFSS that the population with diabetes reported at a lower overall rate than the population without diabetes. The results from the other four risk factors surveyed by BRFSS revealed higher levels of hypertension, physical inactivity, cholesterol, and obesity in persons with diabetes.

Physical Inactivity Lack of regular exercise is a serious problem for all West Virginians, not just the state's population with diabetes. Many persons within the state do not incorporate regular exercise into their daily routines. Exercise, along with meal planning, is part of the initial therapies recommended for diabetes self-management. It is important for persons with diabetes to have a comprehensive assessment of their physical status before beginning any exercise program, which should be designed when possible by an exercise physiologist. Exercise can be of great value in prevention and control of diabetes and is at present underutilized as therapy. Even if persons cannot participate in active aerobic exercise, an exercise program to improve or maintain their functional capacity, strength, and flexibility should be addressed.

Hypertension The differences in the risk for hypertension among the state's diabetic and non-diabetic populations are striking. The United Kingdom Prospective Diabetes Study showed the value of normalizing blood pressure levels in persons with diabetes in preventing the development and

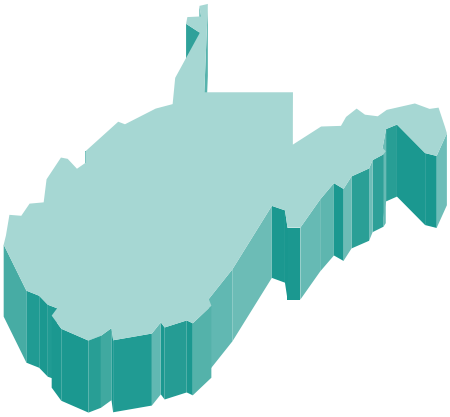
progression of both microvascular and macrovascular complications (43). The usual therapies involve pharmacological treatment and the angiotensin-converting enzyme (ACE) inhibitors or calcium-channel blockers and are often the initial therapy of choice because of the apparent benefit on kidney function. Weight management and exercise are beneficial in obtaining and maintaining normalization of blood pressure.

Obesity The fact that in 1999 West Virginia ranked first in obesity nationally is cause for alarm. Obesity, particularly central adiposity, has been linked to diabetes. Obesity is a problem for most persons with impaired glucose tolerance and Type 2 diabetes. The most common treatment for obesity relies on meal planning and exercise to assist the person with essential lifestyle changes. The Finnish study recently reported that Type 2 diabetes can be prevented by changes in the lifestyles of high-risk persons (44).

Weight management and exercise are beneficial in obtaining and maintaining normalization of blood pressure.

DIABETES AND CARDIOVASCULAR DISEASE SUMMARY

- Cardiovascular disease (CVD) is the most widespread complication of diabetes and the leading cause of premature mortality among diabetics.
- Diabetes is a risk factor for cardiovascular disease.
- Leading behavioral risk factors for CVD include sedentary lifestyle, hypertension, obesity, cholesterol, and smoking.
- More than twice as many persons with diabetes reported at least two additional CVD risk behaviors, 51.6%, compared to only 24.9% of the population without diabetes.
- Physical inactivity is more common among individuals with diabetes (55.8%) than among individuals without diabetes (43.1%).
- Individuals with diabetes were more likely to have hypertension than those without diabetes (57.7% compared to 25.8%), with the difference even more pronounced in the younger age group of 18-54.
- Obesity is a major risk factor for diabetes. In 1999 West Virginia ranked first nationally in percentage of population that is obese. The prevalence of obesity among persons with diabetes was 39.7%.
- Overall, 16.3% of both men and women with diabetes smoked, compared to 28.5% of males without diabetes and 26.8% of women without diabetes.



CHAPTER FOUR: DIABETES AND NATALITY

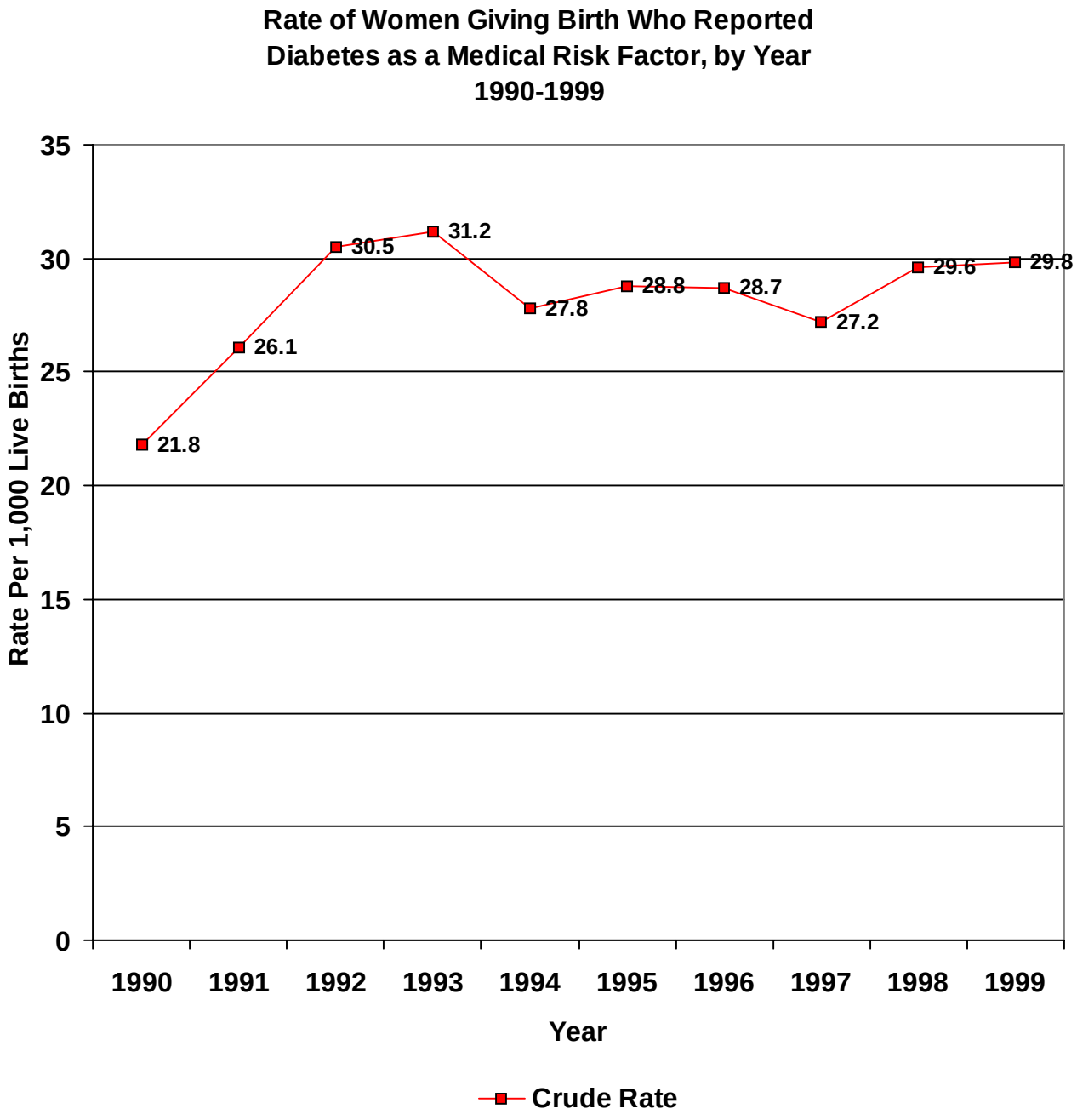
Women with diabetes experience a higher risk of complications during pregnancy, as well as a greater risk of adverse birth outcomes, than do women who do not have diabetes. Since 1989, information concerning maternal diabetes as a medical risk factor has been reported on the birth certificate. No distinction is made, however, between pregestational (having Type 1 diabetes or Type 2 diabetes before pregnancy) or gestational diabetes. Aggregated birth certificate data collected on diabetes among West Virginia women giving birth from 1990 through 1999 are examined in this chapter.

Diabetes is reported as a medical risk factor during pregnancy with more frequency in West Virginia than in the nation. The overall rate of maternal diabetes reported among West Virginia residents has increased from 21.8 per every 1,000 live births in 1990 to 29.8 mothers per 1,000 live births in 1999 (Figure 12). In 1998, the overall U.S. rate of maternal diabetes per 1,000 live births was 26.7. Nationally, white mothers reported a slightly higher overall rate of diabetes than did black mothers (25.9 compared to 25.1) (45). The reverse was noted in West Virginia; for every 1,000 live births from 1990 through 1999, 30.7 black mothers reported diabetes, compared to 28.0 white mothers.

County Prevalence Marked variation by county was noted with regard to the diabetes status of women giving birth from 1990-1999 (Figure 13). Wyoming County reported the highest rate of mothers with diabetes at 60.9 per every 1,000 live births, followed by Raleigh County (43.9) and Roane County (43.8). Gilmer and Greenbrier counties reported the lowest rates of mothers with diabetes at 12.2and12.7,respectively.

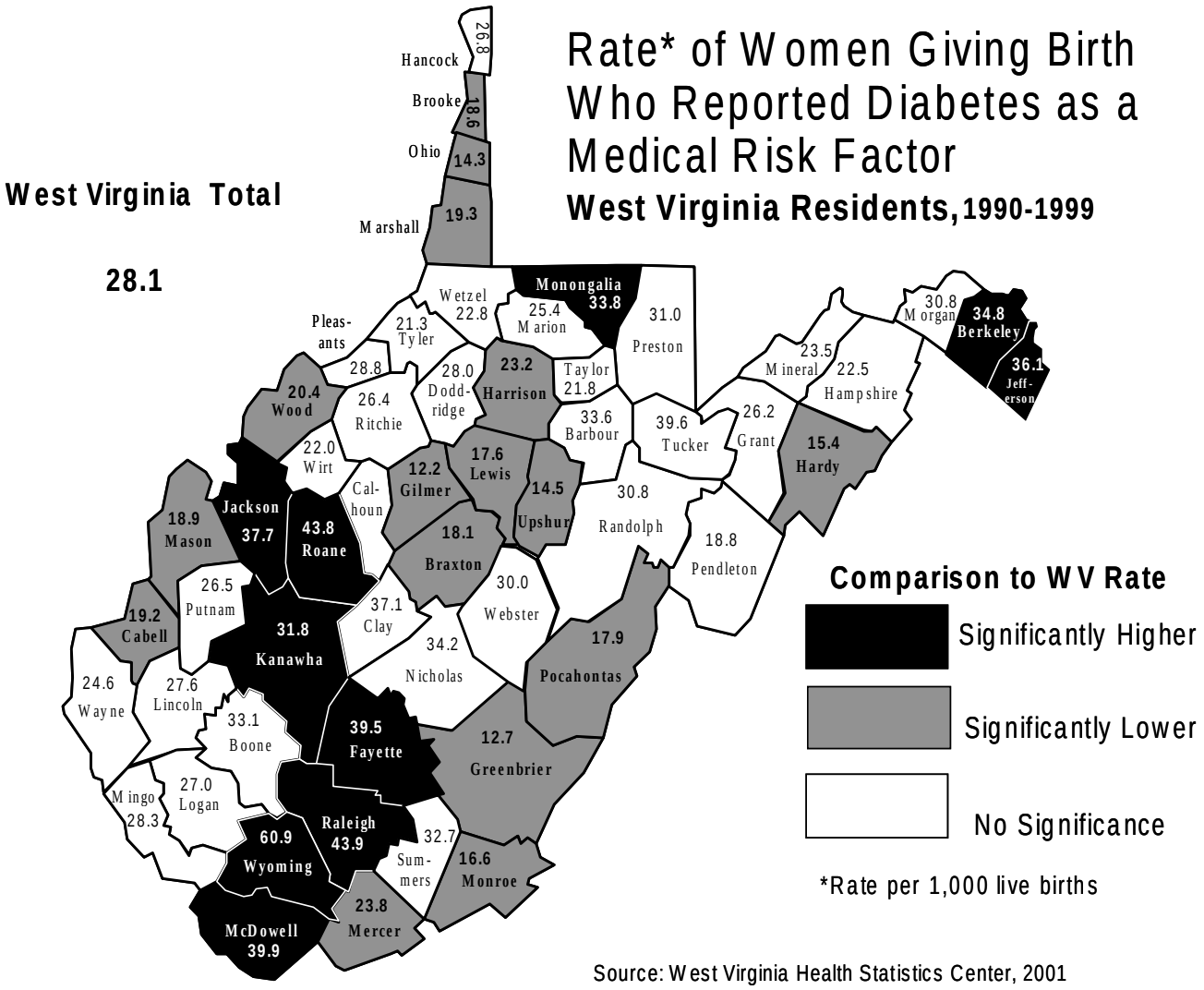
Hospital Prevalence The hospitals reporting the highest rates of mothers with diabetes per 1,000 live births from 1990 to 1999 were West Virginia University Hospital (56.5), Welch Emergency (52.7), Jefferson Memorial Hospital (51.5), Raleigh General Hospital (48.5), Weirton Medical Center (40.5), City Hospital (38.4), and Charleston Area Medical Center - Women & Children's (36.7). The lowest rates were found at Greenbrier Valley Hospital (1.8), Putnam Birthplace (3.8), Stonewall Jackson Memorial Hospital (7.1), and New River Birthing Center (9.0).

Figure 12



Source: West Virginia Health Statistics Center, 2001

Figure 13



Source: West Virginia Health Statistics Center, 2001

Attendant Medical doctors reported diabetes as a maternal medical risk factor among their patients with only slightly more frequency than osteopathic doctors or midwives from 1990 to 1999. Nearly 3% (2.9%) of medical doctors reported maternal diabetes when filling out the birth certificate, compared to 2.6% of osteopathic doctors and 1.9% of nurse midwives (46).

Maternal Age The risk of diabetes increases with maternal age both nationally and statewide. Within every age group, however, West Virginia mothers reported higher rates of diabetes as a medical risk factor than did mothers across the United States as a whole (Figure 14). In West Virginia, the 1990-1999 aggregated rates ranged from 11.5 per 1,000 live births among teenage mothers to a high of 75.2 among mothers aged 40-49. Comparable 1995 U.S. rates ranged from 8.1 among teenage mothers to 62.8 among those aged 40-49.

Prenatal Care Women with diabetes were more likely to initiate prenatal care in their first trimester than were women without diabetes. Only 16.7% delayed their initial visit for prenatal care until after the first trimester compared to 19.0% of women without diabetes from 1990-1999 (Figure 15).

Preterm Delivery Mothers reporting diabetes were more likely to have a preterm delivery, before 37 weeks of gestation, than were mothers who did not report diabetes (Figure 15). From 1990 -1999, 16.4% of mothers with diabetes had preterm deliveries, compared to 11.0% of mothers without diabetes.

Birthweight Diabetes has been associated with macrosomia, or greater-than-average birthweight (4,000 grams or more, or greater than 8 pounds, 14 ounces). A higher percentage (17.2%) of babies weighing 4,000 grams or more were born to mothers with diabetes than to mothers without diabetes (10.0%) in West Virginia from 1990-1999.

Low Apgar Scores The Apgar score is a numerical expression of the condition of a newborn that assesses the heart rate, respiration, muscle tone, reflex irritability, and color of the infant. The percentage of infants with low five-minute Apgar scores was slightly higher among those born to mothers with diabetes (2.0% vs. 1.3%) (Figure 15).

Perinatal Morbidity and Mortality Sudden and unexplained stillbirths remain a concern, especially in women who do not receive optimal care. Stillbirths are most likely to occur after 36 weeks gestation in persons with vascular disease, poor glycemic control, hydramnios, fetal macrosomia, or preeclampsia (47). There has been a marked reduction in intrauterine deaths and a marked decrease in neonatal mortality related to hyaline membrane disease and traumatic delivery (48). Congenital

malformations have emerged as the most important cause of perinatal loss in pregnancies complicated by Type 1 diabetes (49). Studies have shown that major malformations in offspring of mothers with Type 1 diabetes range from 5-10% worldwide (50). Prior to seven weeks gestation, problems impacting pregnancy outcomes include central nervous system malformation, especially anencephaly and spina bifida, and cardiac anomalies such as ventricular septal defects and transposition of the great vessels; the defect most characteristic of diabetic embryopathy is sacral agenesis (51). The profile of a woman most likely to produce an anomalous infant would include a patient with poor periconceptional control, longstanding diabetes, and vascular disease (52). Macrosomia is a common problem in mothers with gestational diabetes. Deliveries of infants weighing more than 4,500 grams occurs 10 times more often in women with diabetes (53). The problems of excessive infant growth include shoulder dystocia, traumatic birth injury, and asphyxia; additionally, the newborn has a greater risk for obesity in later life.

Abnormal Conditions of a Newborn Conditions defined as "abnormal" conditions of a newborn by West Virginia Vital Registration include: anemia, birth injury, fetal alcohol syndrome, hyaline membrane disease/respiratory distress syndrome (RSD), meconium aspiration syndrome, assisted ventilation <30 minutes, assisted ventilation >30 minutes, and seizures.

Babies born to mothers with diabetes were almost twice as likely to have at least one abnormal condition noted on the birth certificate than were babies born to mothers who did not have diabetes (12.4% vs. 6.7%) (Figure 15).

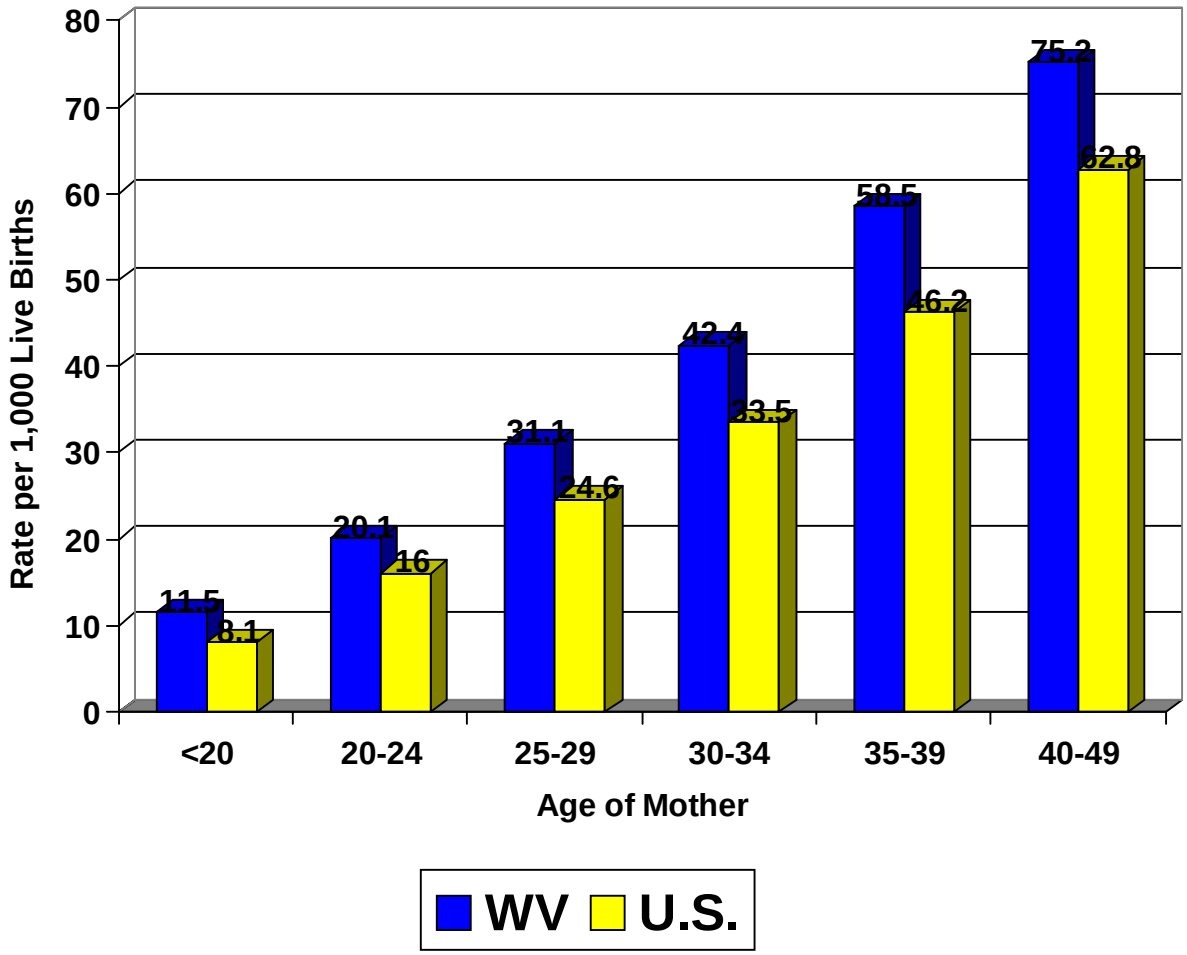
Congenital Anomalies Congenital anomalies, or birth defects, were also more likely to be found in babies born to women reporting diabetes. In fact, when assessing maternal medical risk factors for congenital anomalies, diabetes ranks second. From 1990-1999, 2.7% of the births to mothers with diabetes had one or more congenital anomalies, compared to 1.8% of the births to mothers without diabetes (Figure 15).

Complications of Labor and/or Delivery Women with diabetes are more likely to suffer one or more complications of labor and/or delivery than are women who do not have diabetes. Birth certificate data from 1990-1999 show that 43.3% of women with diabetes had one or more complications of labor and/or delivery, compared to 33.0% of women for whom diabetes was not a medical risk factor (Figure 15).

Infant Mortality The infant mortality rate from 1990-1999 among babies born to West Virginia mothers with diabetes was 8.5 deaths per 1,000 live births. The rate of infant mortality among babies born to mothers without diabetes during the same period was 8.2 deaths per 1,000 live births.

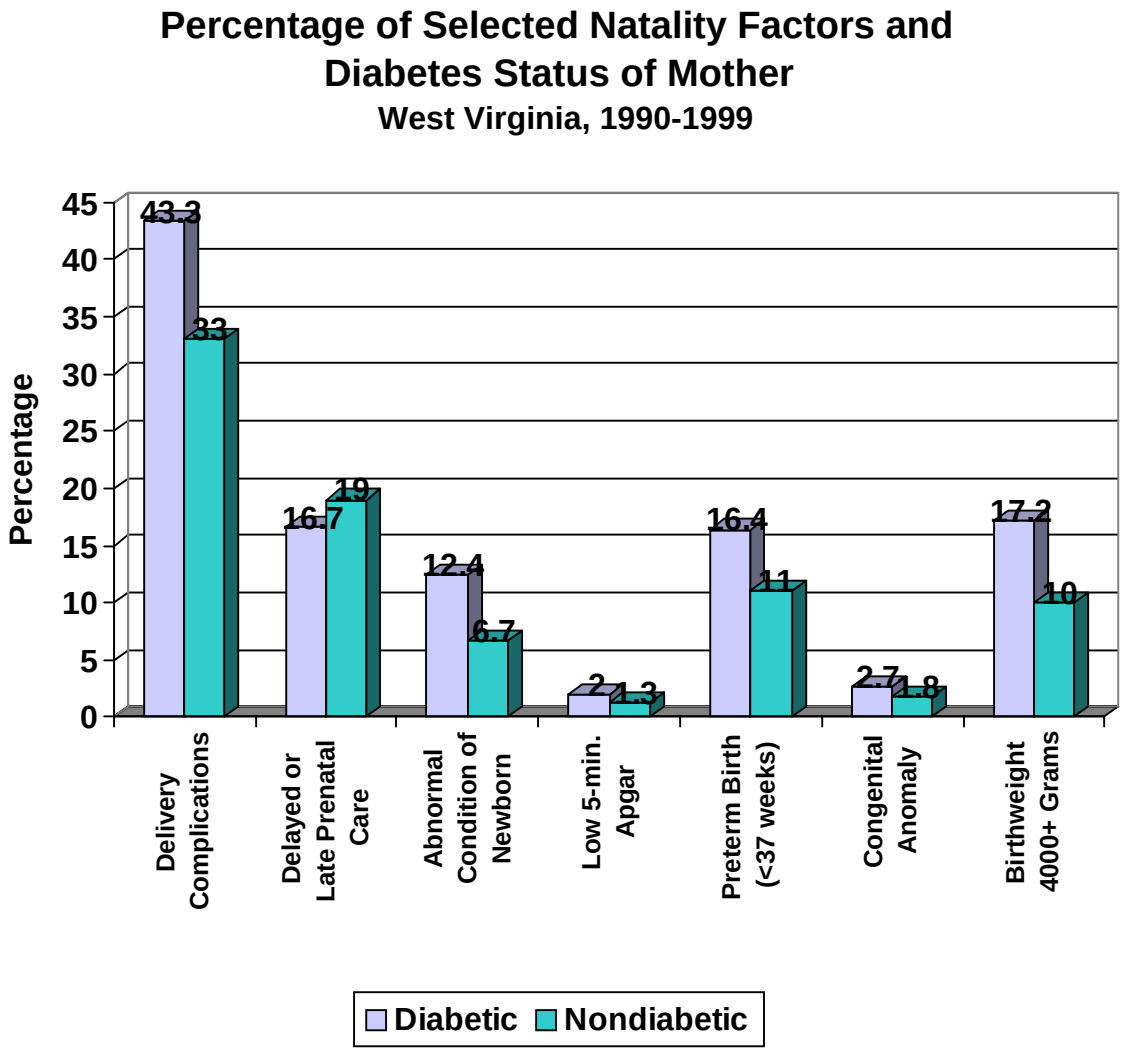
Figure 14

Rate of Women Giving Birth Who Reported Diabetes as a Medical Risk Factor, by Age of Mother
West Virgfinia, 1990-1999 and United States



Source: West Virginia Health Statisiics Center. 2001
National Center for Health Statistics

Figure 15



Source: West Virginia Health Statisiics Center. 2001

Discussion

The association between maternal diabetes and the risk of adverse outcomes of pregnancy is well established. To prevent excess spontaneous abortions and congenital malformations in infants of mothers with diabetes, diabetes care and education must begin before conception. It is recommended that this be done with a multidiciplinary team, skilled in high risk pregnancy management, with the patient as the most active team member (54). The factor most crucial to the outcome of pregnancy among women with diabetes is how well the mother's glucose level is controlled before and during pregnancy.

Because normal pregnancy is a state of insulin resistance, partly due to human placental lactogen (HPL) in which maternal nutrients are shunted to the developing fetus, the normal range of blood glucose is lower by approximately 20% (55). According to Mazze, et al., the glycemic range should be kept within 60-95 mg/dl before meals and <120 mg/dl two hours after meals. Monitoring should be done six to seven times a day, before meals, one to two hours after meals, at bedtime, and as recommended at 3:00 AM. The reason for testing so frequently is to make appropriate insulin adjustments needed for tight control. Self blood glucose monitoring should be recommended to all women with pre-existing or gestational diabetes. The HbA1c should be within the normal range (56). If the person has Type 2 diabetes and is currently treated with an oral agent, the oral agent must be discontinued and insulin needs to be initiated.

Effect on the Fetus Hyperglycemia relates to two types of adverse perinatal outcomes. In the first trimester, hyperglycemia has been associated at a three times greater risk for spontaneous abortions. There is a direct link between hyperglycemia and the first nine weeks of fetal development (during organogenesis) (57), for women with pregestational diabetes. These infants are at risk for developing central nervous system malformations, especially anencephaly and open spina bifida (a 10-fold increase), cardiac anomalies such as ventricular septal defects and transposition of the great vessels, and sacral agenesis (occurring 200 to 400 times more often in infants born to mothers with diabetes) (58). Women with gestational diabetes are not at increased risk for having children with congenital abnormalities because hyperglycemia develops after the period of organogenesis (59). Infants born to mothers with GDM are at risk of macrosomia (large for gestational age), neonatal hypoglycemia, hyperbilirubinemia, polycythemia, shoulder dystocia, and traumatic birth injury (60). Studies have shown that the risk of a large infant is as much as nine times greater among women with glucose levels in excess of 105 mg/dl (61). Large infants are at greater risk for obesity later in life.

Effect on the Mother For persons with pregestational diabetes there is a need for counseling regarding changes in insulin amounts and timing, nutrition, self blood glucose monitoring, and exercise. Ideally, this counseling should occur prior to conception and include a complete history and physical with special attention on evaluation of complications. The history also needs to

ascertain if there is alcohol and/or substance abuse. Special consideration needs to be given to hypoglycemia unawareness, retinopathy, nephropathy, hypertension, neuropathy, and cardiovascular disease. Care during pregnancy is intense. It includes frequent visits with the physician and the team for effective follow-up of glucose management and fetal monitoring. Studies have shown that preconception care is economically prudent.

Both eye- and kidney-related diseases tend to be aggravated during pregnancy (62). Severity of retinopathy is related to the duration of diabetes, level of glycemia, person's age at diagnosis, presence of proteinuria, and higher diastolic blood pressures. While background retinopathy is not considered a contraindication to pregnancy, there is a risk of progression. Women with untreated proliferative retinopathy have the greatest risk of progression, and pregnancy is contraindicated until they receive laser photo coagulation to stabilize their eye disease. Diabetic nephropathy is the complication most likely to affect pregnancy outcomes. Baseline assessment of renal function by serum creatinine and some measure of urinary protein excretion should be completed before conception and on a regular basis during pregnancy because of the potential effect on fetal growth and development. Early presence of proteinuria in excess of 190 mg / 24 hours is associated with a tripling of the risk of hypertensive disorders in the second half of pregnancy. Blood pressure often worsens as pregnancy progresses. Women with nephropathy and hypertension are at a greater risk for preeclampsia and fetal growth retardation than those without nephropathy. Autonomic neuropathy, especially glycemic gastroparesis, urinary retention, hypoglycemia glycemia unawareness, or orthostatic hypotension should be identified and treated before pregnancy (63). Cardiovascular disease is associated with a high mortality rate during pregnancy.

Gestational Diabetes Gestational diabetes is defined as any degree of glucose intolerance with onset or first recognition during pregnancy (64). Some persons with GDM manage their diabetes with meal planning, exercise, and self blood glucose monitoring while others manage their diabetes with meal planning, exercise, insulin, and self blood glucose monitoring. Vigorous attention to proper management is essential for women with gestational diabetes.

Women with high risk of GDM, such as obesity, history of previous GDM, glycosuria, or a family history of diabetes should be tested as soon as possible. Women of average risk should be tested at 24 to 28 weeks of gestation. Recently, it has been recommended that women of low-risk status do not require testing. The criteria for not testing include: being under age 25, normal weight, members of an ethnic group with a low prevalence of GDM, no known diabetes in first-degree relatives, and no history of abnormal glucose tolerance or of a poor obstetric outcome (65).

Pregnant women with gestational diabetes face an increased risk of developing Type 2 diabetes after gestation. It is important to test and counsel persons six weeks after delivery to reclassify their

glycemic status, and, if normal, again every three years (66). All women with previous GDM should be educated about lifestyle changes, including caloric intake and the need for physical activity to decrease the possibilities of insulin resistance. In addition, offspring of women with GDM should be followed for obesity or/and glucose intolerance (67).

Prenatal Care for Diabetic Women Because of the increased risks encountered by pregnant women with diabetes, an experienced health care team is required to provide comprehensive support. Such a team should include the obstetrician or specialist in maternal-fetal medicine, an internist or diabetologist, a pediatrician or neonatologist, a diabetes educator, a dietitian, and a social worker.

Pregnant women with gestational diabetes face an increased risk of developing Type 2 diabetes after gestation.

DIABETES AND NATALITY SUMMARY

- Women with diabetes have a higher risk of complications during pregnancy and delivery than do women without diabetes. Babies born to mothers with diabetes are at greater risk for birth defects.

- Diabetes was reported as a medical risk factor during pregnancy more frequently in West Virginia than in the nation during the period of 1990 to 1999. West Virginia mothers reported higher rates of diabetes than did mothers across the U.S. within all age groups.

- Race makes a difference in maternal diabetes. Nationally, white mothers reported diabetes more frequently, while in West Virginia a greater proportion of black mothers reported diabetes.

- The risk of diabetes increases with maternal age.

In West Virginia from 1990-99:

- County differences in West Virginia women who had diabetes as a medical risk factor were striking. Wyoming County reported the highest rate (60.9) and Gilmer County the lowest rate (12.2) per 1,000 live births.

- Women with diabetes reported as a medical risk factor were slightly more likely to start prenatal care in the first trimester of their pregnancy; however, 16.7% did not get care until their second or third trimester.

- Mothers with diabetes were more likely to have preterm delivery.

- Gestational diabetes is associated with macrosomia. Seventeen percent (17.2%) of infants born to mothers with diabetes met this category, a significant difference from the 10.0% born to mothers without diabetes.

- Babies whose mothers had diabetes had a higher rate of low five-minute Apgar scores than did babies whose mothers did not have diabetes.

- Babies born to mothers with diabetes were almost twice as likely to have one or more abnormal conditions.

- Complications of labor and/or delivery are more common in women with pregestational or gestational diabetes.

CHAPTER FIVE: END-STAGE RENAL DISEASE

Diabetic nephropathy is a serious complication of diabetes mellitus and is the leading cause of end-stage renal failure (ESRD) (68). Diabetes is accountable for approximately 40% of all new cases of kidney failure requiring dialysis or transplantation (69). It is the most costly complication of diabetes. As early as 1993, the DCCT clearly indicated that good blood glucose control prevents or delays renal complications. Later, the UKPDS revealed scientific evidence that critical attention in managing both blood glucose and blood pressure will show significant results in preventing or delaying renal complications. Retinopathy, elevated LDL cholesterol, and duration of diabetes greater than five years are all risk factor predictors of nephropathy. End-stage renal disease (ESRD) develops in three to 15 years after overt diabetic nephropathy develops. ESRD is marked by severe proteinuria and azotemia, which are caused by high levels of urea and creatinine in the blood (70). At this point, renal replacement therapy (dialysis) is begun and kidney transplantation is considered (71). Neither of these solutions is ideal because of the high mortality rates and enormous costs associated with the treatment. However, the development of dialysis, or renal replacement therapy, has afforded ESRD patients additional, and often productive, years of life. While kidney transplantation is the optimal treatment for many ESRD patients, the waiting time for organs, disqualifying comorbidity factors, and the aging of the ESRD population make it likely that dialysis will remain the primary treatment for the disease.

The primary cause of ESRD is diabetes, due to increasing prevalence of Type 2 diabetes. Persons with diabetes are living longer, and more people are being accepted in ESRD treatment programs (72). About 20-30% of people with Type 1 or Type 2 diabetes develop nephropathy. A much smaller fraction of persons with Type 2 progress to ESRD, but because of the high prevalence of Type 2 diabetes, they constitute over half of the people currently starting dialysis. Native Americans, Hispanics, and African-Americans have a much higher risk for developing ESRD than non-Hispanic whites with Type 2 diabetes (73). Normally, renal failure or ESRD develops in three to 15 years after the development of overt diabetic nephropathy (74).

Hypertension is associated with the onset and progression of diabetic kidney disease. The cause of hypertension in Type 1 is usually related to underlying kidney disease, while hypertension in Type 2 is usually present at the time of diagnosis in about one-third of the patients (75). In addition to hypertension, the common coexistence of glucose intolerance, elevated LDL cholesterol and triglycerides (and a reduction in a HDL cholesterol), obesity, and susceptibility to cardiovascular

disease suggests that they may relate to common underlying mechanisms, such as insulin resistence. This is often referred to as syndrome X or insulin-resistance syndrome (76).

The number of persons with diabetes initiating ESRD treatment rose from 16,261 in 1990 to 31,647 in 1996, representing an increase of 94.4% over the six-year period. Of the 31,647 persons initiating treatment for ESRD due to diabetes in 1996, 62% were white, 29% African-American, 4% Asian/Pacific Islanders, 2% Native American, and 2% other (77).

According to a 1999 CDC report, the national incidence of ESRD-DM rose dramatically from 1984 to 1996 (the latest year for which figures are available) (78). West Virginia has followed this national upward trend: the state incidence of ESRD related to diabetes rose from 4.98 cases per 100,000 population in 1989 to 72.1 cases per 100,000 in 1999 (Table 2), an increase of over 1,300%. Figure 16 shows the incidence of ESRD-DM in the United States for 1996.

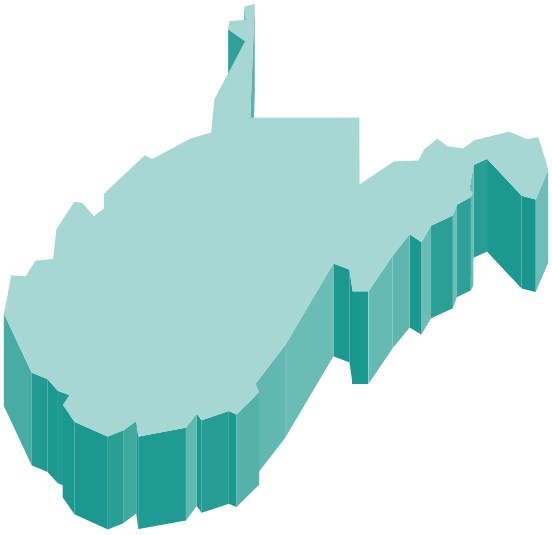


Table 2

INCIDENCE AND PREVALENCE OF ESRD DIALYSIS PATIENTS BY SELECTED DEMOGRAPHIC FACTORS WEST VIRGINIA, 1999

	INCIDENCE*		PREVALENCE*	
	Number	Crude Rate Per 100,000	Number	Crude Rate Per 100,000
Total	583	32.3	1303	72.1
Sex				
Male	278	31.9	648	74.5
Female	305	32.6	654	69.8
Age				
0-39	42	4.5	118	12.6
40-69	289	42.9	704	104.4
70+	248	125.1	465	234.5
Race				
White	521	29.9	1,111	63.9
Black	48	85.5	175	311.9
Other	14	124.8	17	151.5

* Incidence refers to the number of new cases of ESRD reported in a given year.
Prevalence refers to the total number of ESRD patients in the population in a given year.

---------- Chapter Five ----------

The Mid-Atlantic Renal Coalition (MARC) is a nonprofit corporation that serves as the federal contractor for the Network 5 region. West Virginia, Maryland, Virginia, and Washington, D.C., are included in Network 5, which operates under the direction of the MARC. Unless otherwise indicated, all statistics in this chapter were provided by MARC.

Prevalence of Dialysis in West Virginia In 1999, 1,303 West Virginia residents received kidney dialysis in Network 5 (Table 2). The state's crude 1999 prevalence rate of all persons undergoing dialysis was lower than that for the network as a whole (72.1 per 100,000 population vs. 125.5). This represents an increase from crude prevalence rates of 42.9 per 100,000 population in the state and 82.8 in the Network in 1993.

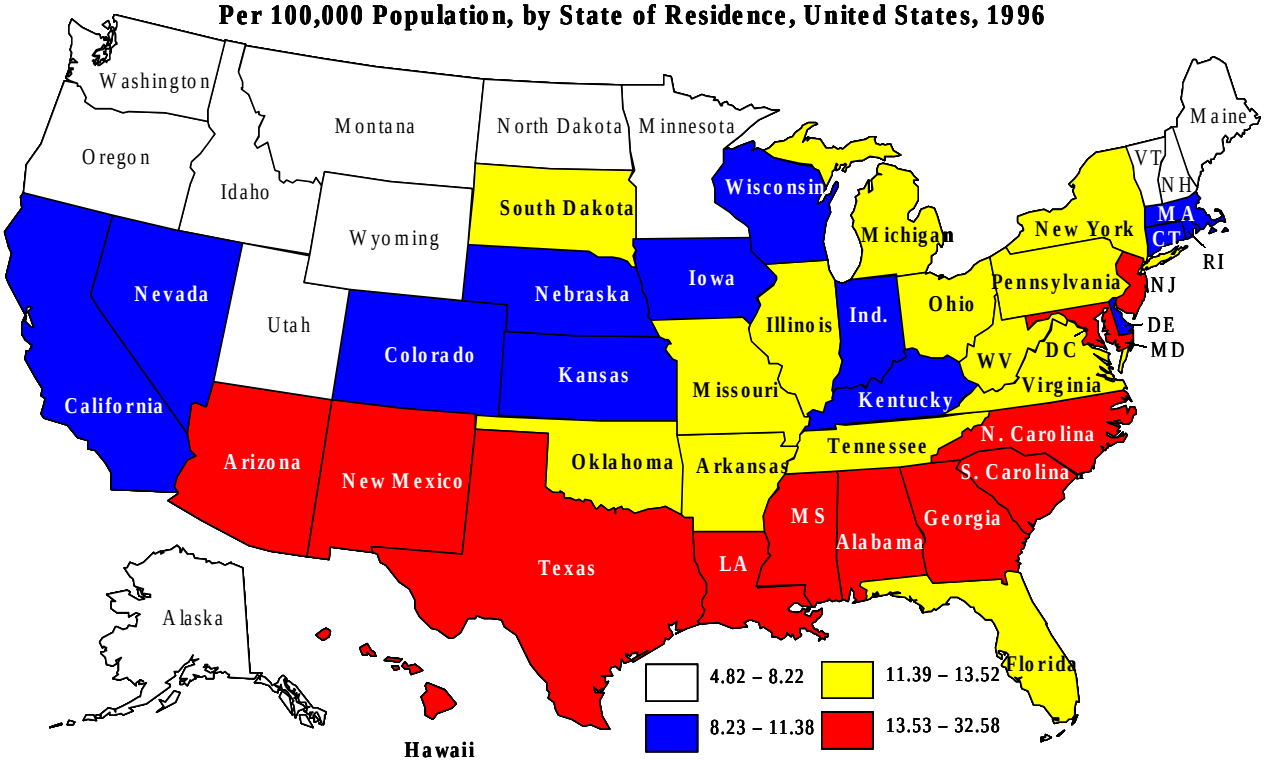
Only 9% of the 1,303 West Virginia residents undergoing dialysis in Network 5 in 1999 were under the age of 40, while 36.0% are 70 and older (Table 2). Men and women accounted for 49.7% and 52.2%, respectively, of the resident dialysis population. African-Americans were disproportionately represented, comprising 13.4% of the state ESRD patients compared to 3.1% of the overall state population in 1999.

Of the 1,303, 570 (44%) had a primary diagnosis of diabetes. Data from other Network 5 members show slightly lower percentages having a primary diagnosis of diabetes, 31% in Washington, D.C., 36% in Maryland, and 37% in Virginia.

Figure 16

Diabetes Surveillance, 1999

Incidence of Treatment forEnd-stage Renal Disease Related to Diabetes
Per 100,000 Population, by State of Residence, United States, 1996



Source: United States Renal Data System. Data computed by the Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, Centers For Disease Control and Prevention.

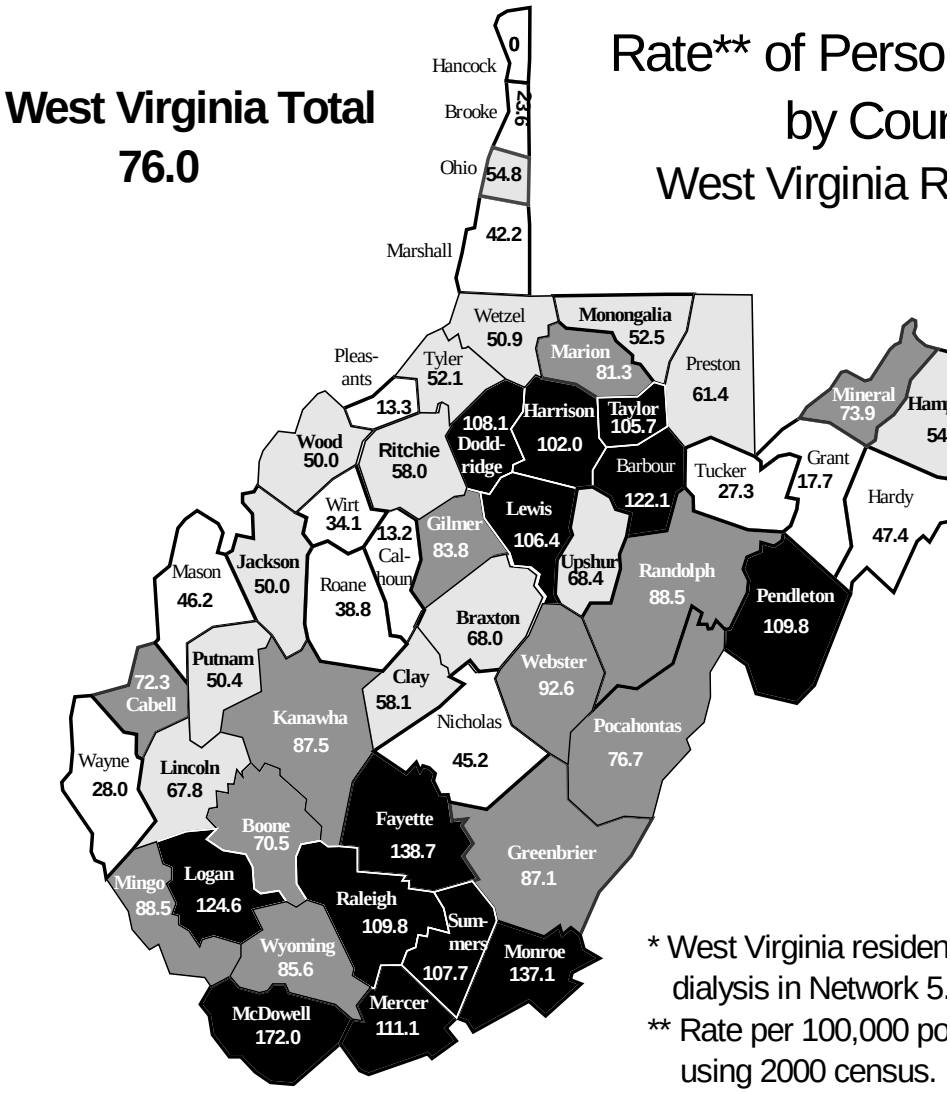
A marked variation was noted among counties in the crude prevalence rates of residents on dialysis, with the southern counties showing the highest concentrations (Figure 17). McDowell County had the highest rate, with 172.0 per 100,000 population, followed by Fayette (138.7) and Monroe (137.1). Only Hancock County had no dialysis patients in 2000.

Incidence of Dialysis in West Virginia Newly diagnosed cases (incidence) of ESRD in West Virginia numbered 583 with 48% having a primary diagnosis of diabetes for a crude incidence rate of 32.3 per 100,000 population (Table 2). The corresponding proportions for Network 5 members with diabetes as the primary diagnosis are as follows: 39%, Washington, D.C., 41% Maryland, and 42% Virginia.

Dialysis Patient Treatment Distribution In 1999, there were 16,114 dialysis patients treated at 261 facilities in Network 5. Eighty-nine percent (89%) were treated with in-center dialysis and 11% used home dialysis. There were an additional 252 persons who received treatment in seven non-Medicare units in the Network. That same year, there were 21 dialysis providers and two transplant centers in the state of West Virginia (Figure A-1). Among all persons receiving dialysis in West Virginia in 1999, 85.7% were treated in a dialysis center and 14.3% in the home setting.

Vocational Rehabilitation of Dialysis Patients Networks are mandated to promote vocational rehabilitation for ESRD patients. In 1999, the rehabilitation efforts were educational in nature. A newsletter is one example of how the network provides information about work incentives and vocational resources to patients. The vocational rehabilitation status is documented by survey for person ages 18-55 years at the end of each year. Persons are defined as vocationally active, if employed, students, volunteers, or homemakers. Vocationally inactive includes all unemployed persons. Persons considered vocationally unsuitable include retired, nursing home, or incarcerated persons, and those unable to work due to health problems.

Figure 17



According to MARC's 1999 data, the vocational rehabilitation status of 407 West Virginia dialysis patients between the ages of 18 and 55 was as follows: 26% were vocationally active, 14% were vocationally inactive, and 59% were retired, in nursing homes, in jail, or unable to work.

---------- Chapter Five ----------

Discussion

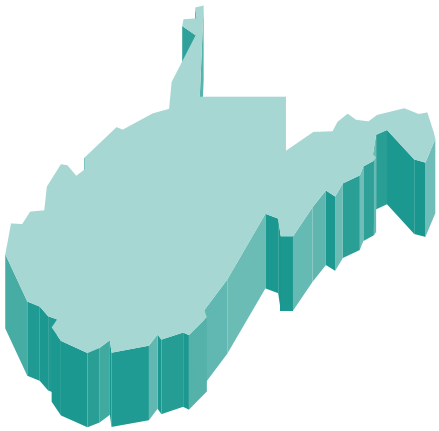
The rate of persons initiating ESRD treatment is increasing nationally at an average of 13.5% annually. The greater incidence of ESRD-DM is in part due to the higher prevalence of Type 2 diabetes. People with diabetes are living longer and persons with diabetic ESRD are now being accepted into ESRD treatment instead of being excluded. West Virginia's 1999 BRFSS data revealed that West Virginia ranks first nationally in obesity, third in physical inactivity, and has the oldest population in the nation. These data are alarming when considering the risk factors associated with Type 2 diabetes and the trends of ESRD stated within this chapter.

About 20-30% of persons with Type 1 or Type 2 diabetes develop nephropathy. A much smaller percentage of those with Type 2 diabetes progress to ESRD and yet, about half of the persons initiating ESRD therapy have Type 2 diabetes, because type 2 diabetes represents approximately 90-95% of the diabetes population (78). Native Americans, Hispanics and African-Americans have a much higher risk for developing ESRD than non-Hispanic whites with Type 2 diabetes. In West Virginia there is a disproportionate African-American population with ESRD.

Prevention and Management of ESRD-DM Intensive diabetes therapy can significantly reduce the risk of ESRD in all persons with diabetes. It is recommended that all persons with Type 2 diabetes be tested for microalbumin at the time of diagnosis because the duration of the disease is unknown for Type 2 diabetes. Annual screening for microalbuminuria will identify patients with nephropathy (80). A major aspect of initial treatment should consist of lifestyle modification, including; weight loss, reduction of salt and alcohol intake, and development of an exercise program (81). Other important considerations are improving glycemic control, and aggressive antihypertensive treatment (the recommended goal is <130 mm Hg systolic and <85 mm Hg diastolic). The use of ACE inhibitors will slow the rate of progression of nephropathy. At this time, a protein restricted meal plan is recommended for persons diagnosed with overt nephropathy, and these meal plans should be designed by a dietitian familiar with dietary management of diabetes (82).

END-STAGE RENAL DISEASE SUMMARY

- Diabetes is the major cause of end-stage renal disease (ESRD), also known as kidney failure.
- It is estimated that ESRD is increasing nationwide at a rate of 13.5% per year.
- Nearly one half (44%) of kidney dialysis patients in West Virginia in 1993 had a primary diagnosis of diabetes. This rate was higher than the other Network 5 members.
- Thirty-six percent (36%) of dialysis patients in West Virginia in 1999 were 70 years old or older, and only 9% were under the age of 40.
- African-Americans represented 13.4% of the state's ESRD patients compared to 3.1% of the overall state population in 1999.
- In 1999, 1,303 West Virginia residents received kidney dialysis in Network 5 (West Virginia, Virginia, Maryland, and Washington, D.C.). In 1999, there were 21 dialysis providers and two transplant centers in the state.
- The prevalence of ESRD diagnosis within West Virginia and also the United States seems to be clustered in the southern regions.



CHAPTER SIX: DIABETES HOSPITALIZATIONS

Hospitalization data provide additional insight into the burden imposed upon a population with diabetes and are the only measure available of the morbidity associated with the disease. Data from the West Virginia Health Care Authority's (WVHCA) database were used to estimate diabetes-related hospitalizations among West Virginia residents for 1998. The WVHCA collects inpatient data from all nonfederal licensed hospitals in the state and Medicare data on West Virginia residents hospitalized in out-of-state hospitals, including information on patient age, sex, and length of stay. (This study presents data only on West Virginia residents.) Up to nine diagnoses (one primary and eight secondary diagnoses) and three surgical procedures are recorded, and coded according to the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM).

In 1998, there were a total of 242,723 inpatient hospital discharges of West Virginia residents in West Virginia. Of these, 40,571 (16.7%) records listed diabetes as any listed diagnosis, (i.e., any one of the first nine hospital diagnoses) while 3,685 (1.5%) listed diabetes as the primary discharge diagnosis.

Diabetes-Related Hospital Discharge Rates

Table 3 presents West Virginia hospital discharge rates per 10,000 population for 1998 by age, gender, with comparable 1998 U.S. rates. The rates for primary diagnoses of diabetes increased dramatically with age, with West Virginia women generally showing overall higher rates of hospitalization for diabetes. Total rates for the state and the nation were similar for hospitalizations.

Table 3

Number and Rate (per 10,000 Population) of Inpatient Hospital Discharge Records Having Diabetes as the Primary Diagnosis, West Virginia and United States, 1998

	DIABETES			
	WV		US	
	Number	Rate	Number*	Rate
Male	1,591	18.2	251,000	19.3
Female	2,094	22.3	261,000	19.3
<45	1,010	9.3	153,000	8.6
45-64	1,116	25.1	161,000	30.0
65+	1,559	56.8	200,000	59.1
Total	3,685	20.3	513,000	19.3

* Numbers do not equal total due to rounding.
Source: West Virginia Health Care Authority.

The 1998 county rates for any diabetes-related hospital discharges ranged from a low of 50.9 hospitalizations per 10,000 population in Hampshire County to a high of 382.7 per 10,000 population in Logan County, as illustrated in Figure 18.

In 1998, 35.6% of all diabetes-related hospital discharges in the state had cardiovascular disease as the primary discharge diagnosis, compared to 36.0% of all diabetes-related discharges in the U.S. as a whole in 1996. Table 4 provides a percentage breakdown of diabetes-related discharges by primary diagnosis.

Figure 18

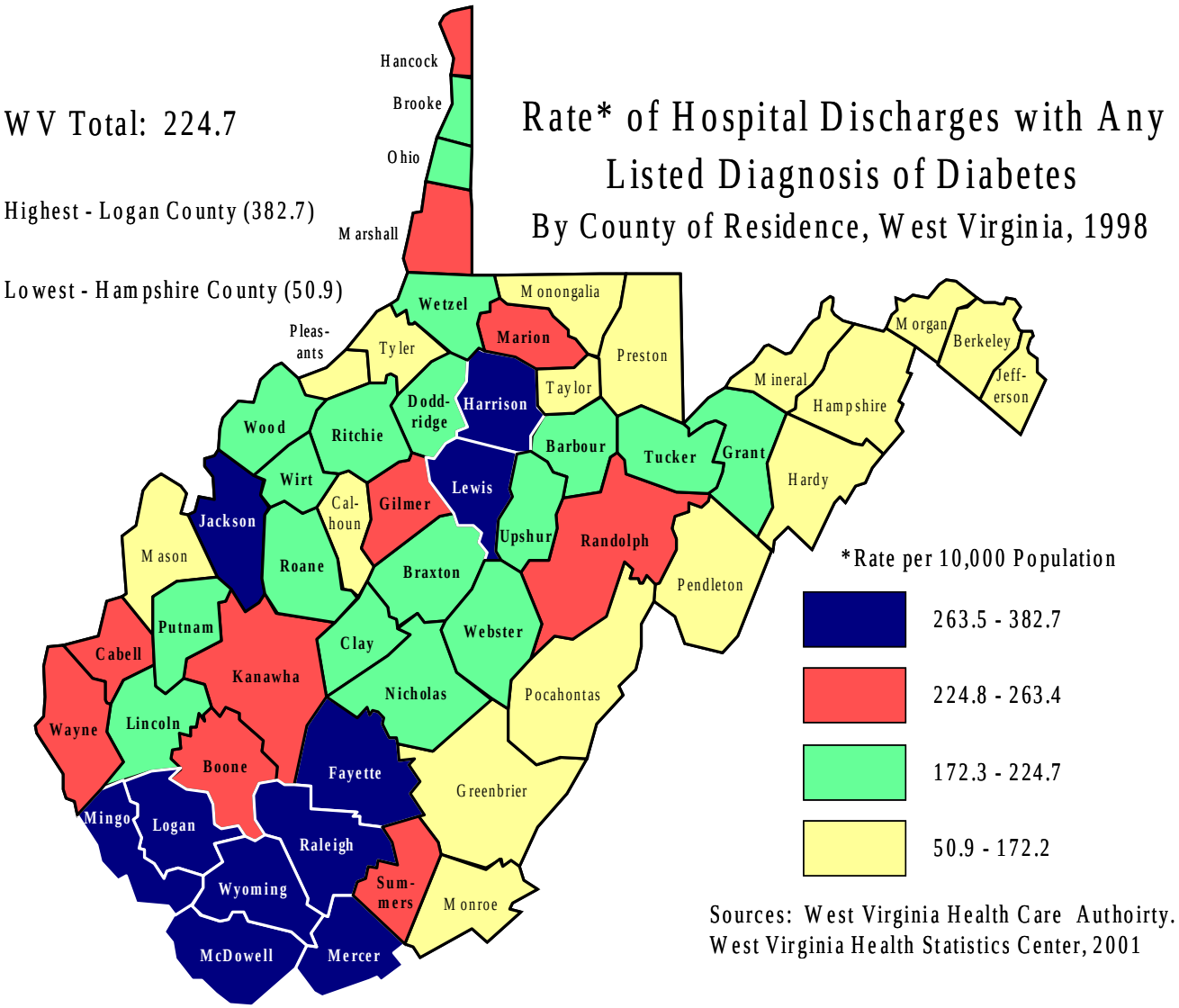


Table 4

DISTRIBUTION OF PRIMARY DIAGNOSES AMONG HOSPITAL DISCHARGESWITH DIABETES AS ANY LISTED DIAGNOSIS
West Virginia, 1998* and United States, 1996**

Primary Diagnosis	WV 1998 (%)	U.S. 1996 (%)
Diseases of the Circulatory System (390-459)	35.6	36.0
Diabetes (250)	8.6	13.1
Diseases of the Digestive System (520-579)	8.3	7.8
Diseases of the Respiratory System (460-519)	12.2	10.0
Diseases of the Genitourinary System (580-629)	4.5	4.7
Injury and Poisoning (800-999)	6.0	6.5
Malignant Neoplasms (140-239)	3.2	3.7
Diseases of the Musculoskeletal System and Connective Tissue (710-739)	3.2	3.9
Other Endocrine, Nutritional, and Metabolic Diseases and Immunity Disorders (240-270, not 250)	0.3	2.9
Diseases of the Skin and Subcutaneous Tissue (680-709)	2.2	2.4
Infections and Parasitic Diseases (001-139)	2.7	2.8
Mental Disorders (290-319)	2.2	2.5
Diseases of the Nervous System and Sense Organs (320-389)	0.9	1.1
Complications of Pregnancy, Childbirth, and the Puerperium (630-676)	0.4	0.3
Other	9.7	2.2

*Source: WV Health Care Authority

**Source: CDC, Diabetes Surveillance 1999

Average Length of Stay for Diabetes-Related Discharges

The average length of stay (ALOS) for West Virginia residents having diabetes as a primary diagnosis was 7.0 days in 1998, compared to a national average of 6.3 days for the nation in 1996. The ALOS for West Virginians with diabetes as any listed diagnosis was 6.6 days, compared to 6.5 days for the nation in 1996. In West Virginia, diabetes with ketoacidosis resulted in the longest average stay of 10.6 days. Diabetes with other specified manifestations and diabetes with peripheral circulatory disorders had average stays of 10.3 and 10.0 days, respectively.

Diabetes-Related Discharge by Specific Diagnosis

The most commonly occurring diabetes-related diagnosis associated with a hospitalization was diabetes without complication (75.6%), while 8.0% of the hospitalizations were diagnosed as diabetes with neurological manifestations. Table 5 presents the number of hospital discharges in 1998, as well as the charges, by specific diabetes diagnosis. The average charge per hospital stay for patients with diabetes-related diagnoses was $9,665, compared to an overall average charge per stay for all diagnoses of $7,794. Diabetes with coma was the most expensive diabetes complication in terms of average charge per hospital stay at $17,446, followed by diabetes with hyperosmolar coma at $14,265 and peripheral circulatory disorders at $13,073.

Table 5

NUMBER OF DISCHARGES, CHARGES, AND AVERAGE COST PER DIABETES-RELATED* HOSPITALIZATION BY SPECIFIC DIABETES DIAGNOSIS

West Virginia Residents, 1998

Diagnosis (ICD-9-CM Code)	Discharges	Charges	Average Cost Per Hospital Stay
Diabetes without mention of complication (250.0)	30,685	$283,645,627	$9,243
Diabetes with ketoacidosis (250.1)	208	$2,704,632	$13,003
Diabetes with hypersomolar coma (250.2)	50	$713,273	$14,265
Diabetes with other coma (250.3)	28	$488,487	$17,446
Diabetes with renal manifestations (250.4)	2,306	$27,658,258	$11,994
Diabetes with ophthalmic manifestations (250.5)	1,624	$16,600,207	$10,222
Diabetes with neurological manifestations (250.6)	3,276	$34,071,808	$10,400
Diabetes with peripheral circulatory disorders (250.7)	735	$9,608,638	$13,073
Diabetes with other specified manifestations (250.8)	1,190	$12,252,730	$10,296
Diabetes with unspecified complication (250.9)	469	$4,395,019	$9,371
Total	40,571	$392,127,678	$9,665

* Diabetes as one of 1st through 9th diagnoses.

Note: Overall state average cost per stay was $7,794.

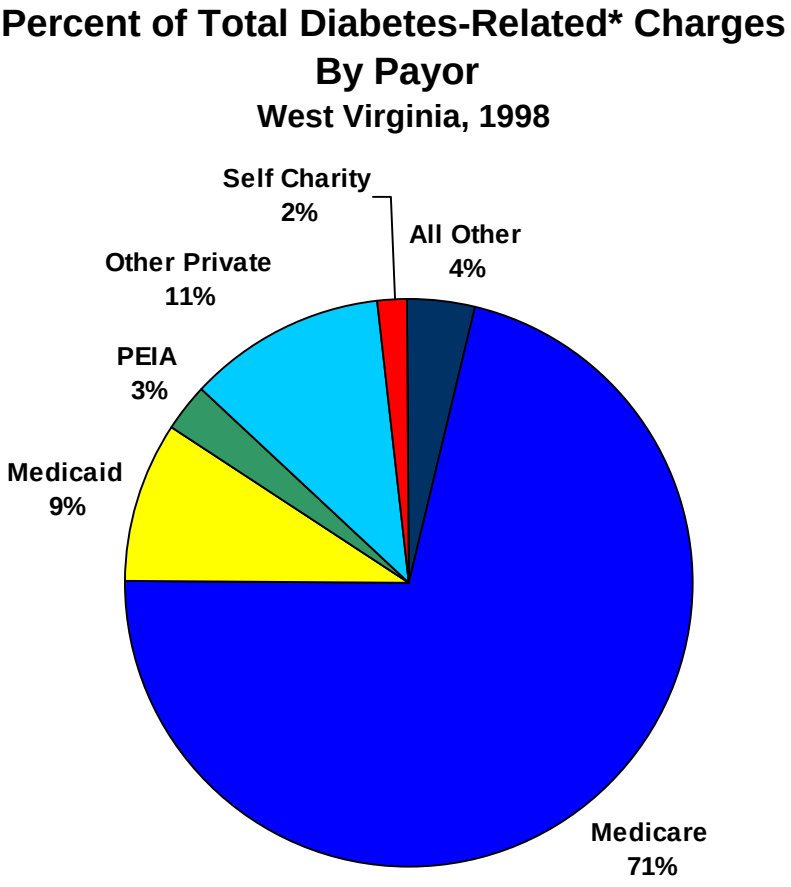
Source: West Virginia Health Care Authority

Diabetes-Related Hospital Charges by Payor

Nearly one out of every five dollars (20.3%) billed for hospital charges in West Virginia in 1998 was diabetes related. Of a total of $1,928,153,929 in billed hospital charges, $392,127,678 was attributed to a diabetes-related condition (Table 6). Figure 19 illustrates the breakdown of total billed diabetes-related charges by payor.

Over seventy percent (71.2%) of all diabetes-related charges in 1998 were billed to Medicare. Nine percent (9.2%) were billed to Medicaid and 2.6% to the Public Employees Insurance Agency (PEIA). Diabetes-related billing represented 25.2% of the total hospitalization charges billed to Medicare in 1998 (Table 6). Nearly 18% (17.7%) of all hospital charges billed to PEIA were diabetes related.

Figure 19



Source: West Virginia Health Care Authority
*ICD-9-CM codes 250.0-250.9 as 1st through 9th diagnosis
West Virginia HEalth Statistics Center, 2001

Table 6

NUMBER OF HOSPITAL DISCHARGES AND CHARGES FOR DIABETES RELATED* HOSPITALIZATIONS, BY PAYOR

West Virginia Residents, 1998

PAYOR	DISCHARGES			CHARGES ($)		
	Total Diabetes Related	Total	Diabetes Related as % of Total	Total Diabetes Related	Total	Diabetes Related as % of Total
Medicare	28,685	114,822	24.9%	$279,179,436	$1,106,740,046	25.2%
Medicaid	3,847	44,162	8.7%	$36,271,068	$265,276,145	13.7%
PEIA**	975	7,796	12.5%	$10,022,484	$56,505,119	17.7%
Other Private	4,675	52,971	8.8%	$44,561,409	$344,827,932	12.9%
Self/Charity	755	10,319	7.3%	$6,737,335	$61,213,239	11.0%
All Other	1,634	12,653	12.9%	$15,355,947	$93,591,448	16.4%
Total	40,571	242,723	16.7%	$392,127,679	$1,928,153,929	20.3%

* Diabetes listed as one of 1st through 9th diagnoses.
** PEIA = Public Employees Insurance Agency
Source: West Virginia Health Care Authority.
West Virginia Health Statistics Center, 2001

Discussion

Persons with diabetes are at particularly high risk for hospitalization because of the acute and chronic complications associated with diabetes. Diabetes-related hospitalization rates increase with age and are higher among women than among men. The fact that West Virginia has the oldest population in the nation correlates with the fact that Medicare is responsible for the majority of the financial burden of diabetes, which demonstrates the higher prevalence of the disease in the population over the age of 65. As our population ages, hospitalization rates for diabetes-related illnesses can be expected to increase accordingly if measures are not taken to prevent or slow the progression of the disease and its complications.

The lengthy hospital stays necessary for persons with ketoacidosis, other specified manifestations, and circulatory disorders, as well as the elevated average charges per stay for these hospitalizations, clearly illustrate the excessive burden placed upon the health care system by diabetes care. Prevention and control efforts need to focus on prevention of the complications, both acute and chronic, that necessitate hospital care. The provision of comprehensive diabetes self-management education to patients with diabetes has been shown to effectively reduce hospitalization stays for those individuals (83).

Persons with diabetes are at particularly high risk for hospitalization because of the acute and chronic complications associated with diabetes.

DIABETES HOSPITALIZATIONS SUMMARY

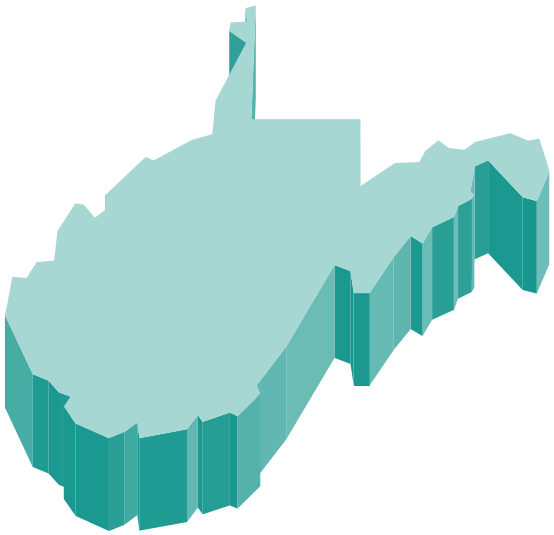
In West Virginia from 1998:

- Diabetes hospitalization discharge rates increased dramatically with age.
- Women had a higher rate of diabetes-related hospitalizations than men.
- Substantial variation in hospitalization rates was noted by county with higher concentrations in the southern portion of the state.
- Over 16% of West Virginia inpatient hospital discharges listed diabetes as one of the first nine diagnoses. Diabetes was listed as the primary diagnosis in 1.5 % of hospital discharges.
- A significant finding was that, in 1998, 35.6% of all diabetes-related hospital discharges in West Virginia had cardiovascular disease as the primary discharge diagnosis; this compared to 36.0% at the national level in 1996.
- Diabetes with circulatory disorders resulted in the longest average stay (15.7 days) for women, while diabetes with renal complications was the longest average stay among men (13.7 days).
- The average length of stay (ALOS) has decreased both nationally and statewide. The ALOS for West Virginians having a primary diagnosis of diabetes was 7.0 days in 1998, which compared to the national average of 6.3 days in 1996. The ALOS for West Virginians with diabetes as any listed diagnosis was 6.6 days, compared to 6.5 days for the national average in 1996.
- Diabetes with ketoacidosis resulted in the longest average stay of 10.6 days.
- Diabetes-related hospital stays continue to cost more than the average hospital stay. The average charge per diabetes-related hospital stay was $9,665, compared to an overall average charge of $7,794.
- The most expensive diabetes diagnosis was diabetes with coma, with an average cost of $17,446. The next most expensive in hospital costs were hyperosmolar coma at $14,265 and peripheral circulatory disorders at $13,073.

- Slightly more than one out of every five dollars (20.3%) billed for hospital inpatient charges in West Virginia in 1998 was diabetes-related.

- Of the $392,127,679 spent on diabetes-related hospitalizations, 71.2% was billed to Medicare. This percentage reflects $279,179,436 being spent by Medicare in 1998. Medicaid received bills for 9.2% of West Virginia diabetes-related hospitalizations. The amount billed to Medicaid was $36,271,068 in 1998. Medicare and Medicaid were the payors for slightly more than 80% (80.4%) of the total diabetes-related charges in West Virginia. The resultant total charges for these two public payors were $315,450,504 in 1998.

- Diabetes-related billing represented 25.2% of Medicare's total hospitalization charges, 13.7% of Medicaid's and 17.7% of PEIA's.



CHAPTER SEVEN: DIABETES MORTALITY

In 1999, diabetes ranked as the sixth leading cause of death in West Virginia and as the seventh leading cause of death in the United States. Mortality statistics seriously understate the burden of diabetes, because people often die from the complications of the disease, which are then coded as the underlying, or primary, cause of death.

In 1995, West Virginia's age-adjusted diabetes mortality rate of 30.7 deaths per 100,000 population was 27.4% higher than the national rate of 24.1 per 100,000. A study of national and state trends in diabetes mortality from 1970 through 1995 (Table 7 and Figure 20) revealed that prior to 1975 West Virginia had lower rates of diabetes mortality than the nation as a whole. Since then, West Virginia has reported higher rates of death due to diabetes than the national average. Figure 21 and Table 7 illustrate the substantial rise in the mortality of both men and women in West Virginia. Comparing race-specific death rates, little difference was noted between the white population in West Virginia and the United States until 1990-1995 (Table 7). In 1995, the WV white mortality rate was 29.6 per 100,000 population, compared with the U.S. white rate of 21.9. Nationally, the rates of diabetes mortality in blacks were consistently higher than whites over the twenty-five year period (Figure 22). This finding is even more dramatic in West Virginia; West Virginia's black mortality rate in 1995 was recorded at 71.6 deaths per 100,000, while the United States death rate was 49.0 deaths per 100,000.

When comparing diabetes mortality by age for the state and nation (Table 7), West Virginia's diabetes mortality rates from 1980-1995 begin to diverge from the U.S. after the age of 44, with the greatest disparity among older persons (aged 65+) in 1995.

Table 7

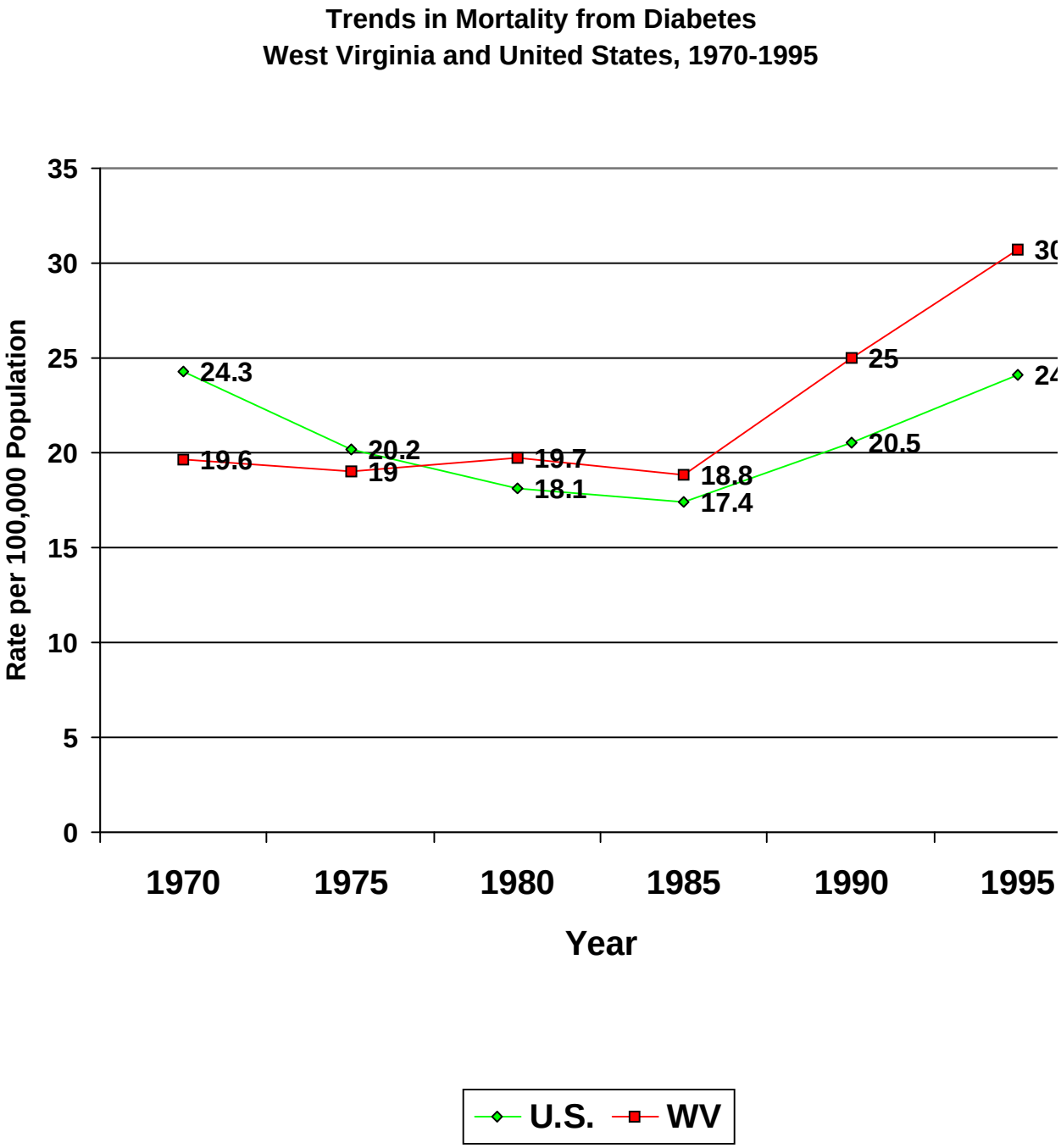
RATES* OF DIABETES MORTALITY, BY GENDER, RACE AND AGE West Virginia and United States, 1970-1995

		1970	1975	1980	1985	1990	1995
Total	WV	19.6	19.0	19.7	18.8	25.0	30.7
	U.S.	24.3	20.2	18.1	17.4	20.5	24.1
Gender							
Male	WV	16.7	16.5	17.6	19.6	24.1	28.8
	U.S.	23.0	19.7	18.1	17.6	21.5	26.4
Female	WV	22.0	20.7	21.3	17.7	25.4	31.5
	U.S.	25.1	20.4	18.0	17.1	19.7	22.4
Race							
White	WV	18.6	18.3	18.8	18.2	24.6	29.6
	U.S.	22.9	18.9	16.9	16.1	18.9	41.0
Black	WV	43.0	34.7	44.0	37.0	41.0	71.6
	U.S.	38.4	34.9	32.8	33.2	40.4	49.0
Age							
0-44	WV	1.1	1.4	0.8	1.2	1.9	1.6
	U.S.	1.4	1.1	1.0	1.1	1.3	1.4
45-64	WV	23.7	20.6	20.4	22.8	33.5	34.5
	U.S.	25.3	21.1	20.3	20.0	25.2	29.4
65+	WV	115.4	108.9	114.1	94.7	109.7	146.4
	U.S.	168.2	132.1	110.6	101.7	114.4	134.3

* Rates are per 100,000 population adjusted by age to the 2000 U.S. standard million

Source: West Virginia Health Statistics Center, 2001

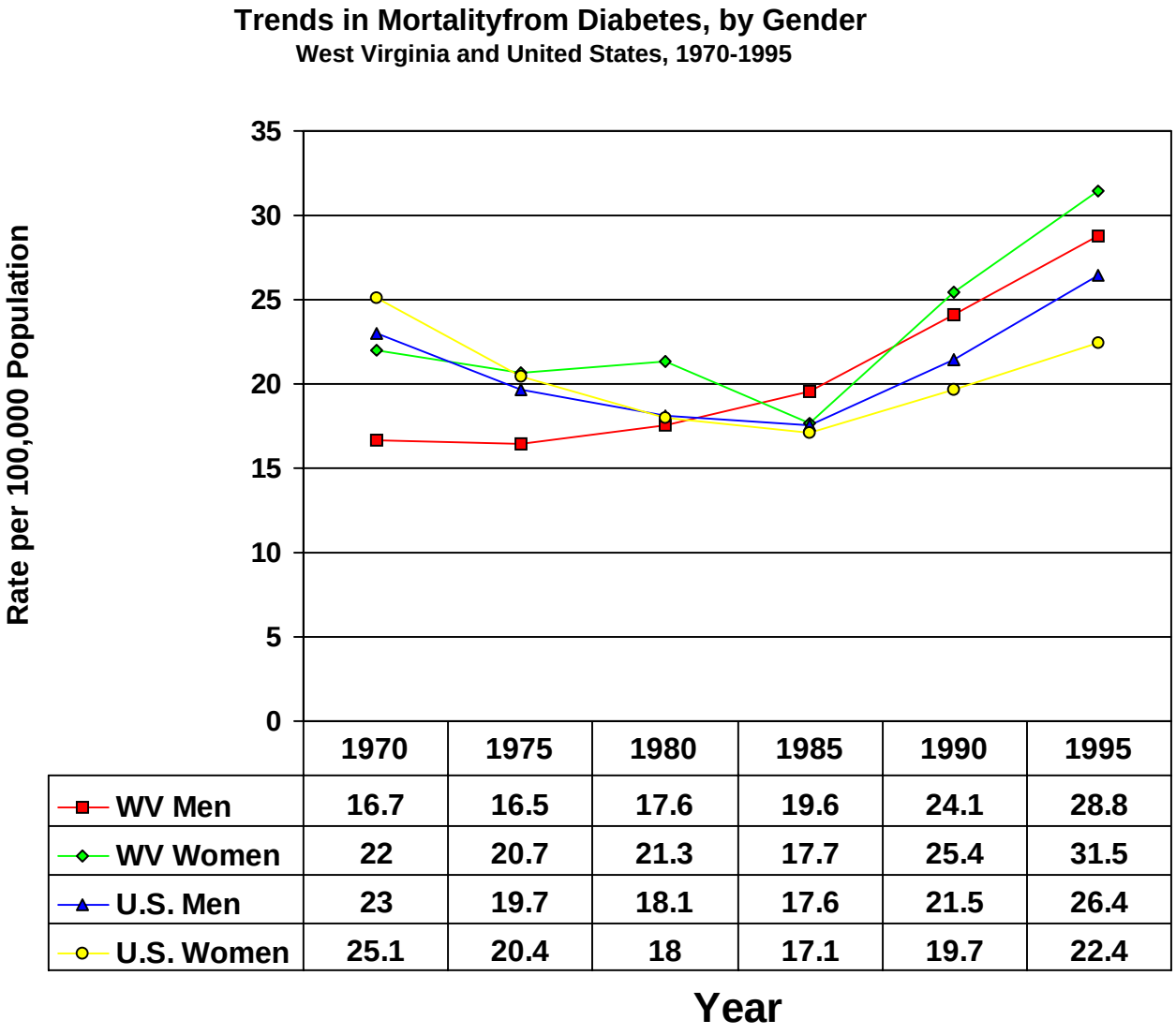
Figure 20



Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

Figure 21

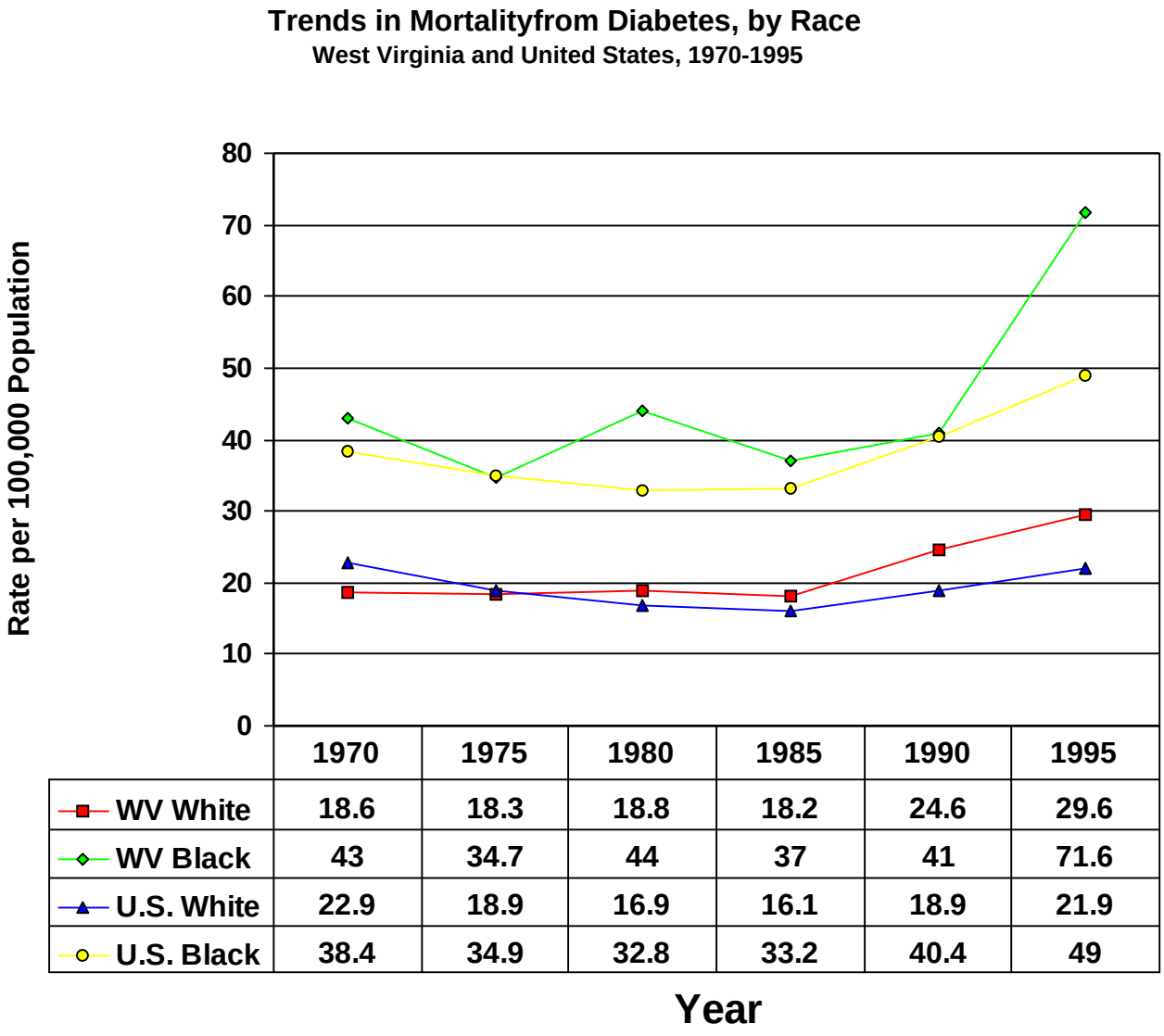


	1970	1975	1980	1985	1990	1995
WV Men	16.7	16.5	17.6	19.6	24.1	28.8
WV Women	22	20.7	21.3	17.7	25.4	31.5
U.S. Men	23	19.7	18.1	17.6	21.5	26.4
U.S. Women	25.1	20.4	18	17.1	19.7	22.4

Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

Figure 22



	1970	1975	1980	1985	1990	1995
WV White	18.6	18.3	18.8	18.2	24.6	29.6
WV Black	43	34.7	44	37	41	71.6
U.S. White	22.9	18.9	16.9	16.1	18.9	21.9
U.S. Black	38.4	34.9	32.8	33.2	40.4	49

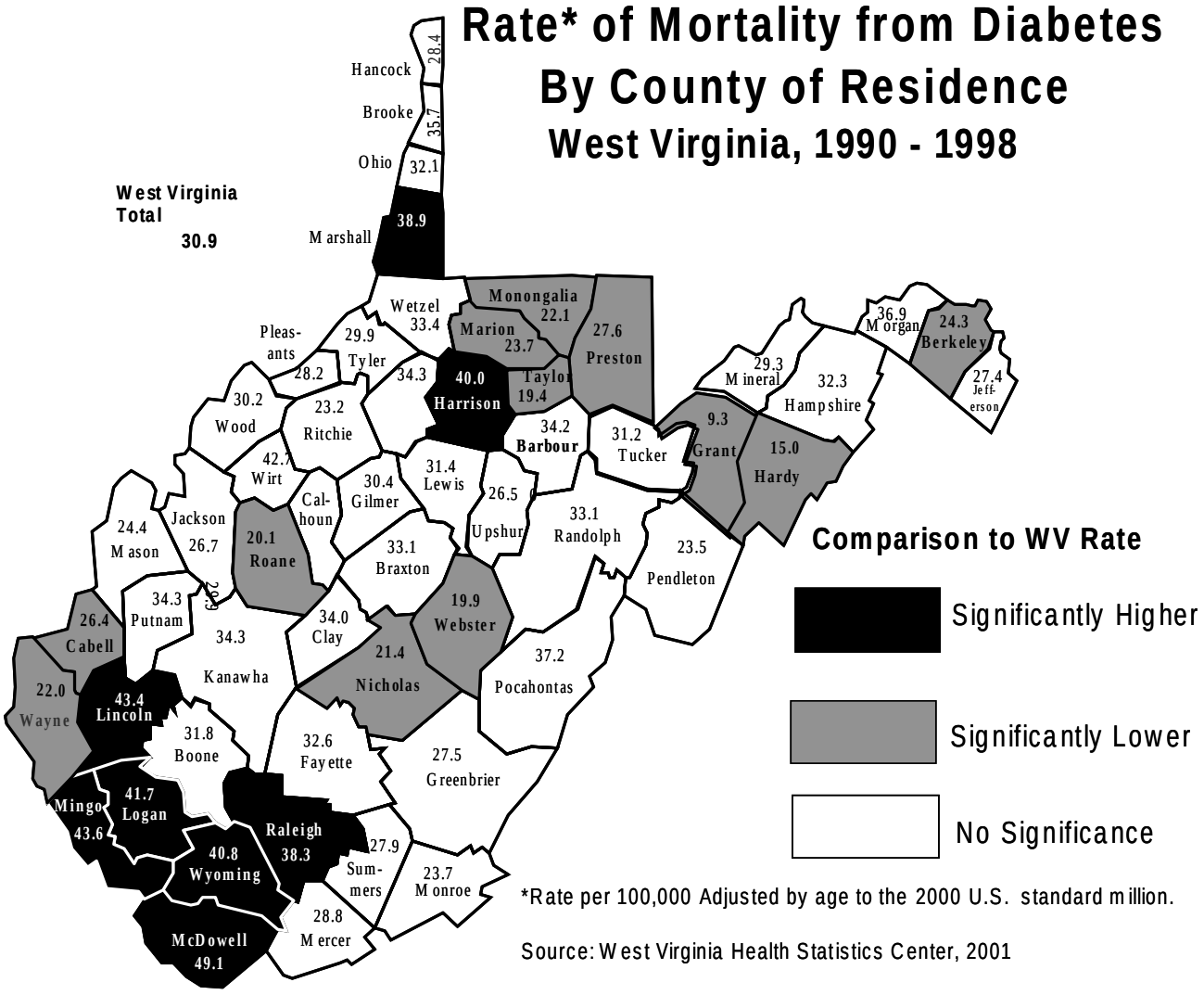
Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

County Mortality Rates

Figure 23 illustrates the range of diabetes mortality rates by county. McDowell County continues to have the highest rate at 49.1 deaths per 100,000 population, while Grant County reported the lowest rate at 9.3. (See Table A-2 in Appendix 3 for individual county rates.)

Figure 23



Multiple Causes of Death Data

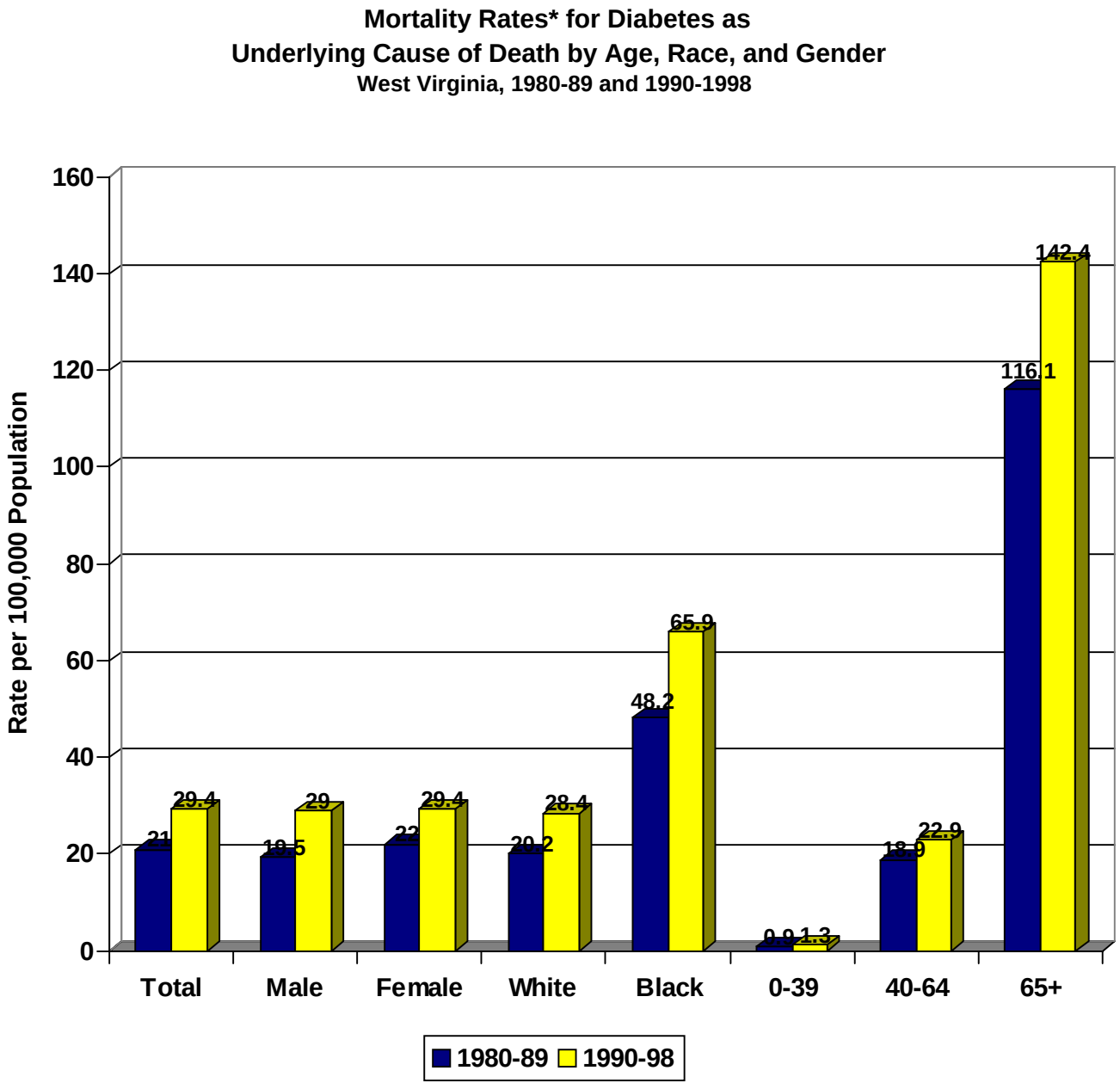
The National Center for Health Statistics (NCHS) compiles and codes data on all deaths in the United States according to the ICD-9-CM.* The information collected by NCHS is released on annual multiple-cause-of-death tapes that include the following: decedent's age, sex, race, and state of residence; the underlying cause of death, and contributing causes of death (up to 19 additional causes). This analysis examines multiple-cause-of-death data for West Virginia for the aggregated years 1990-1998, with comparisons to the state data for 1980-1989.

Diabetes as Underlying Cause For the years 1990-1998, diabetes was the underlying cause of death in 3% of all deaths among West Virginia residents, 2.4% of male deaths and 3.6% of female deaths. The state rate of diabetes mortality for those years was 29.4 per 100,000 population, 40% higher than the 1980-1989 rate of 21.0 (Figure 24). The 1990-98 rates of diabetes as the underlying cause of death by age, gender, and race were consistently higher than those in 1980-89 (Table 8).

Diabetes as Any Listed (Diabetes-Related) Cause West Virginia ranked 2nd among the other 49 states and the District of Columbia in the mortality rate for diabetes-related deaths from 1994-98 (Figure 25). Diabetes was listed as any cause of mortality in 9.7% of all deaths to West Virginia residents from 1990-98, 8.2% of male deaths and 11.3% of female deaths. The state rate of diabetes-related mortality in 1990-98 was 95.3 per 100,000 population, nearly 20% higher than the rate of 79.5 reported in 1980-89 (Figure 26). The 1990-98 rates for diabetes-related deaths by gender, race, and age group were consistently higher than those for comparable groups in 1980-89 (Table 8).

*ICD-10 was adopted by NCHS in 1999.

Figure 24



Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

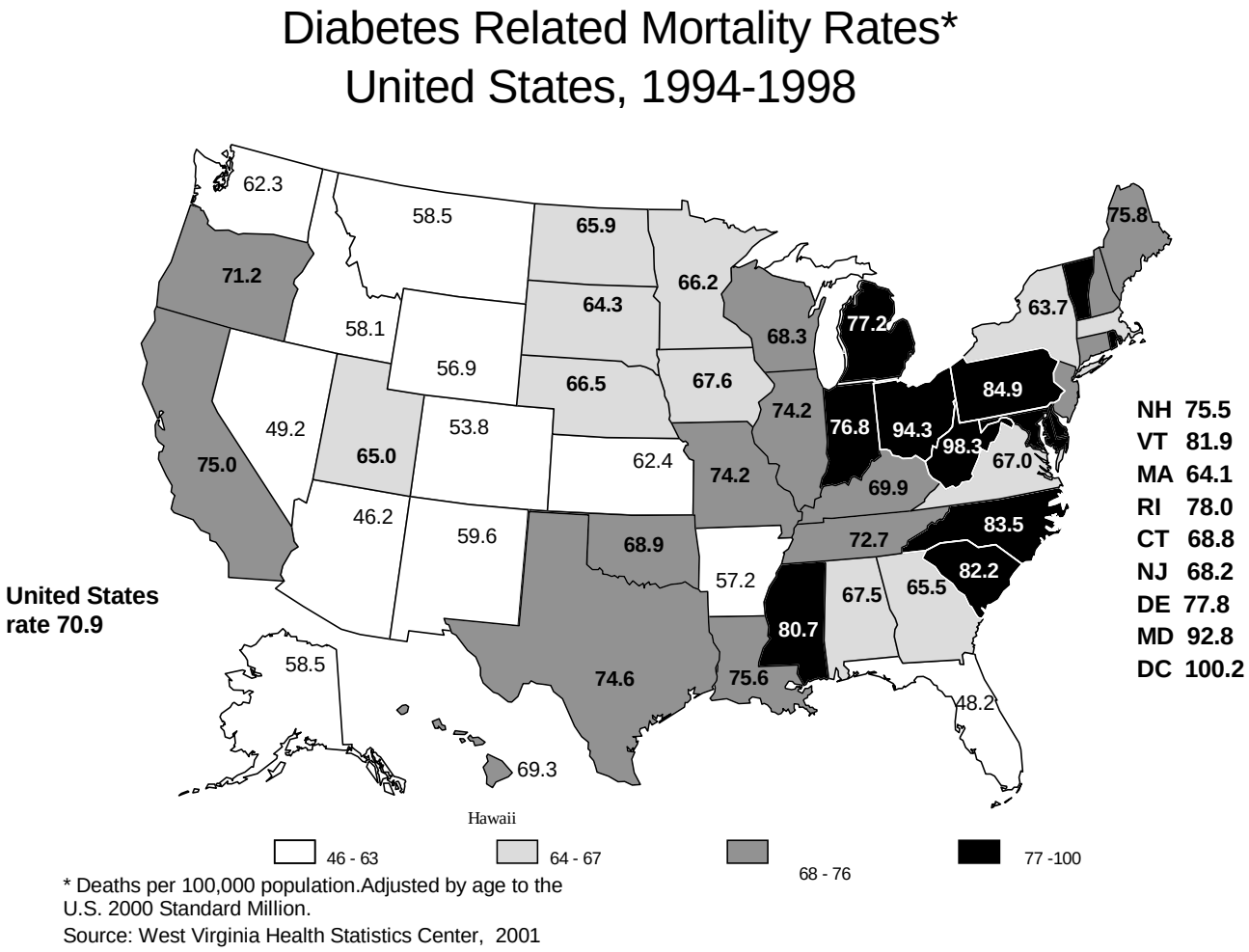
Table 8

RATES* OF DIABETES AS UNDERLYING AND CONTRIBUTING CAUSES OF DEATH BY GENDER, RACE, AND AGE
West Virginia, 1980-1989 and 1990-1998

	Underlying			Contributing		
	1980-89	1990-98	%Change 1980-89 to 1990-1998	1980-89	1990-98	%Change 1980-89 to 1990-1998
Total	21.0	29.4	39.7	79.5	95.3	19.9
Gender						
Male	19.5	29.0	48.5	77.2	101.4	31.3
Female	22.0	29.4	33.6	80.4	91.0	13.1
Race						
White	20.2	28.4	40.8	77.6	93.1	19.9
Black	48.2	65.9	36.8	140.2	181.8	29.7
Other	0.0	0.0	0.0	13.3	18.1	36.0
Age						
0-39	0.9	1.3	47.1	1.7	2.4	42.5
40-64	18.9	22.9	20.6	65.9	64.3	(2.4)
65+	116.1	142.4	22.7	456.9	487.8	6.8

* Rate per 100,000 population adjusted by age to the U.S. standard million.
Source: West Virginia Health Statistics Center, 2001

Figure 25

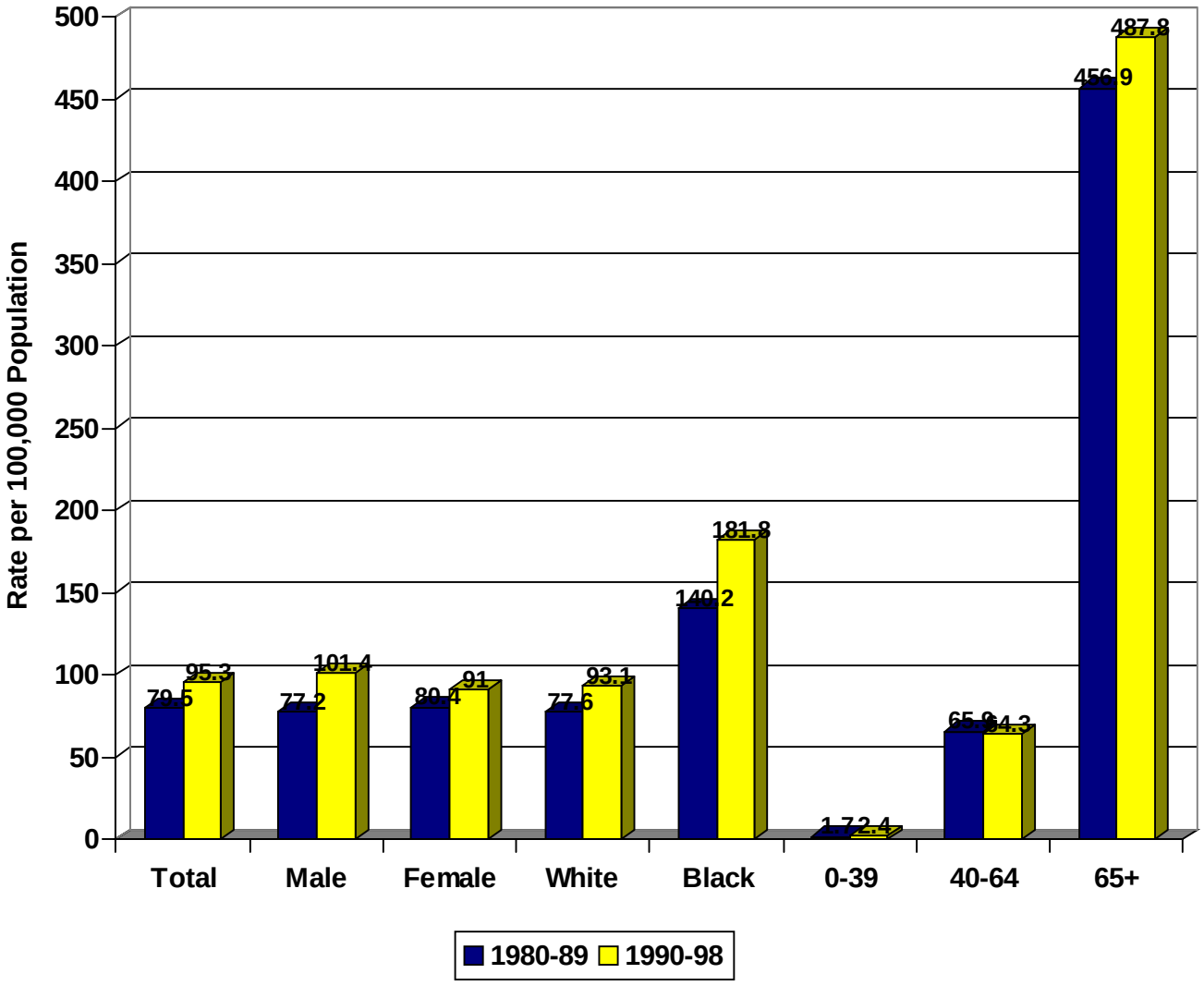


* Deaths per 100,000 population.Adjusted by age to the U.S. 2000 Standard Million.

Source: West Virginia Health Statistics Center, 2001

Figure 26

Mortality Rates* for Diabetes as
Any Listed Cause of Death by Age, Race, and Gender
West Virginia, 1980-89 and 1990-1998



Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

Cardiovascular Disease

Cardiovascular disease remains the leading cause of death among persons having diabetes. From 1990-98, 43% of all diabetes-related deaths in West Virginia had cardiovascular disease as the underlying cause, the same percent as found in the nation as a whole in 1996 (84). Of these, 60% were due to ischemic heart disease (i.e., heart attack) and 13% to stroke.

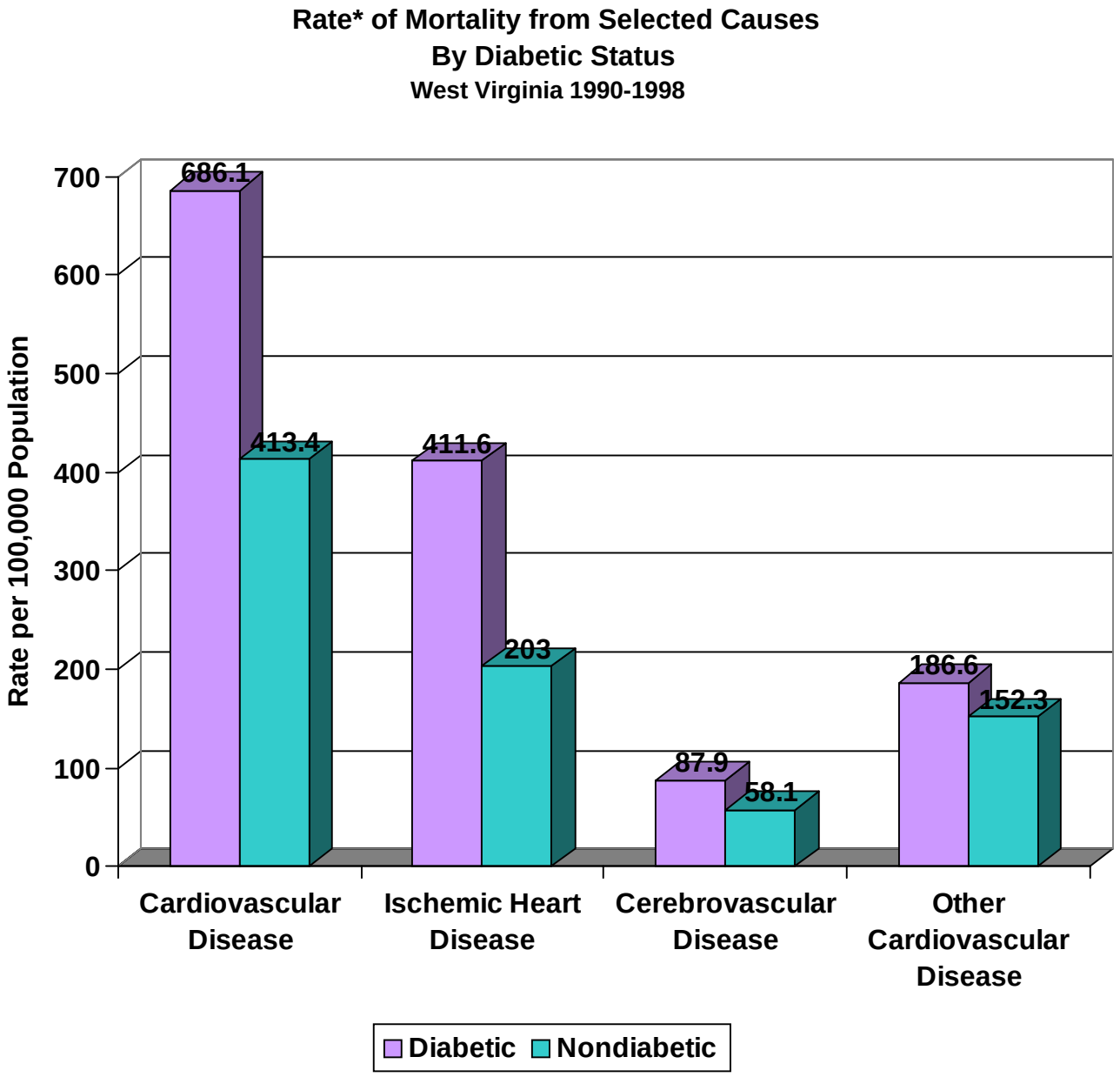
While cardiovascular death rates have been falling among the general population, this is not true for persons with diabetes. While the state's overall mortality rate from cardiovascular disease decreased 7.6% from 1980-89 to 1990-1998, the rate increased 8.7% among persons having diabetes listed as a contributing cause of death on the death certificate.

Looking at West Virginia aggregated data from 1990-98, the rate of cardiovascular mortality was over one and a half (1.7) times that found among the overall population (686.1 deaths per 100,000 in the diabetic population as compared with 413.4 deaths per 100,000 in the general population) (Figure 27). The mortality rate due to ischemic heart disease among people with diabetes was twice (2.0) as great as that for persons without diabetes (411.6 deaths per 100,000 diabetic population vs. 203.0 deaths in the general population).

Discussion

Diabetes is one of the leading causes of death in both West Virginia and the United States. Unfortunately, West Virginia mortality statistics trend higher than national averages, with a substantial rise n the mortality of both men and women. Nationally, men have a higher death rate than women, while women in West Virginia have a higher death rate than men. The death rate in older individuals remains the highest of all age groups. The trend of much higher mortality rates consistently reported for the black population along with increased prevalence illustrates a disparity that has not been adequately addressed to date. A significant gap also exists between the diabetic and nondiabetic populations in death from cardiovascular disease, showing the need for a concerted effort to create a public health awareness of the modifiable cardiovascular risk factors.

Figure 27



Source: West Virginia Health Statistics Center, 2001

Rate per 100,000 population adjusted by age to the 2000 U.S. standard million

DIABETES MORTALITY SUMMARY

- Diabetes is the sixth leading cause of death in West Virginia.
- Diabetes is under-reported on death certificates partially because people die from complications rather than the disease itself.
- In 1995, West Virginia's age-adjusted diabetes mortality rate was 27.4% higher than the national rate.
- West Virginia's black population continues to have a much higher death rate due to diabetes than reported nationally.
- Diabetes was listed as the underlying cause of death for 3% of all deaths in West Virginia from 1990-1998. It was included on any listed cause of death for 9.7% of all deaths.
- West Virginia ranks second among the other 49 states and the District of Columbia in mortality rate for diabetes-related deaths from 1994-1998.
- Cardiovascular disease is the leading cause of death among persons having diabetes. From 1990-1998, 43% of all diabetes-related deaths in West Virginia had CVD as an underlying cause.
- While the state's overall mortality rate from CVD decreased 7.6% between 1980-1989 and 1990-1998, the rate actually increased 8.7% among persons having diabetes listed as a contributing cause of death on the death certificate.

CHAPTER EIGHT: MANAGEMENT AND RESOURCES FOR DIABETES CARE

Diabetes takes a tremendous toll on the people of West Virginia, both in terms of quality of life and the financial burden imposed. It affects persons with diabetes physically, socially, psychologically, and economically. Therefore, effective management is prudent for persons with diabetes. Research has indicated that it is not only possible to delay or prevent diabetes complications but also to prevent Type 2 diabetes. Diabetes self-management requires a team effort and the person with diabetes needs adequate knowledge to effectively lead the process. Education about the management of diabetes, the accessibility of quality health care, and diabetes support groups is essential if the burden of diabetes is to be reduced in our state. The fact that West Virginia has an older, less educated, rural population, with fewer financial resources than the nation as a whole, poses additional challenges in the struggle against the disease's devastating effects.

Access to Medical Care

Access to medical care continues to be a major problem faced by many West Virginians. The federal government determines "medically underserved" areas using the following criteria: the ratio of primary care physicians to the general population; infant mortality rate; the percentage of the population over age 65; and the percentage of population below poverty level. Under these guidelines, 50 of the state's 55 counties were defined as medically underserved in 2001 (Figure 32).
Many of the state's residents with diabetes live in parts of the state that do not have easy access to primary health care .

Because of the critical role of self-management, certified diabetes educators (CDEs), licensed professionals with advanced certification in diabetes care and patient education, serve an essential need in the health and well-being of the state's population with diabetes. They include registered nurses, registered dietitians, pharmacists, physicians, physician assistants, occupational therapists, physical therapists, and podiatrists. In 2001, 79 diabetes educators were located in the state (Figure A-2). The vast majority of the CDEs continue to practice in urban hospital or academic settings.

---------- Chapter Eight ----------

Health Care Coverage

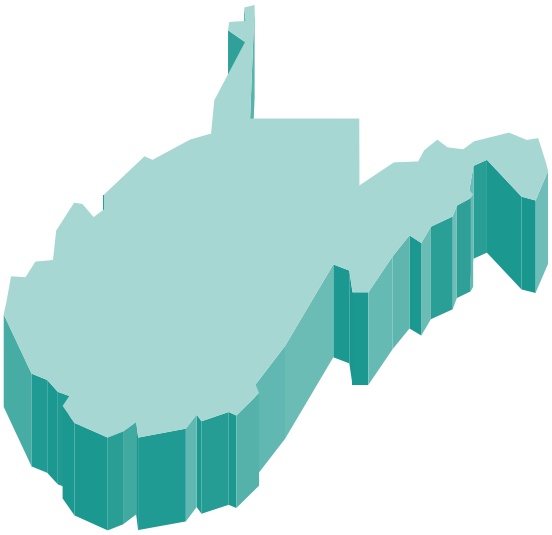
Health care coverage is an important issue for everyone but is especially so for persons with diabetes to insure the care necessary to control glucose levels and prevent complications. The Behavioral Risk Factor Survey included questions on health care coverage beginning in 1991. According to aggregated data from 1999-2000, respondents with diabetes were more likely than those without diabetes to have some type of health care coverage. While 81.3% of non-diabetic respondents reported that they had coverage, either through private or government-sponsored insurance plans, 90.6% of respondents with diabetes reported having such coverage. Respondents with diabetes who were under the age of 40 reported having coverage more frequently than those without diabetes (76.7% vs. 72.0%). Those aged 40-64 also reported having coverage more frequently (87.2% vs. 83.0%). No difference was noted among persons aged 65+ (97.1% vs. 97.3%).

Discussion

Diabetes management requires the involvement of qualified health professionals and the ability of the individual with diabetes to take responsibility for his or her own health through self-care management. The most important goal of the diabetes management, whether through meal planning and exercise, or with pharmacological therapy, is to maintain blood glucose levels that are as close to normal as possible. The hemoglobin A1c has become the gold standard in diabetes management and should be evaluated at least every six months and, for persons on insulin, every three months. Results released in 1994 from the Diabetes Control and Complications Trial indicated that rigorous control of blood glucose levels successfully slowed the progression and onset of complications to the kidneys, nerves, and eyes in persons with Type 1 diabetes. The United Kingdom Prospective Diabetes Study, completed in 1991, showed similar findings in persons with Type 2 diabetes. Two recently released studies, the Finnish Study and the Diabetes Prevention Program, both indicated that moderate changes in diet and exercise can delay and possibly prevent Type 2 diabetes in people with impaired glucose tolerance (85). Most recently, impaired glucose tolerance and impaired fasting glucose have been reclassified, and are now called “pre-diabetes.” The purpose is to promote incentives for physicians to screen persons at risk and to provide awareness for persons who have pre-diabetes, so that they can make essential changes (86).

MANAGEMENT AND RESOURCES SUMMARY

- Access to health care professionals for diabetes self-care management is limited in West Virginia.
- West Virginia has 79 certified diabetes educators (CDEs). The CDEs are primarily located in urban or academic areas.
- Fifty of the state's 55 counties were defined as medically underserved in 2001.



REFERENCES

1. American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S5

2. Ibid. p.S 120

3. National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Fact Sheet. March 27, 2002 pp.1-8. http:www.cdc.gov/diabetes/pubs/estimates.htm

4. National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Fact Sheet. August 11,1999 pp.1-3

5. Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.308

6.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S5

7. Ibid. p.S5

8. Ibid. p.S5-6

9. Ibid. p.S8

10.American Association of Diabetes Educators. A Core Curriculum for Diabetes Education 3rd Edition. American Association of Diabetes Educators. Chicago, IL 1998. p.175–9

11. American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S10

12.Ibid. p.S10

13.Ibid. p.S9

14.Ibid. p.S9

15.Ibid. p.S10

16.Ibid. p.S77

17.Ibid. p.S10

18. Ibid. p.S77

19.Ibid. p.S78

20.Ibid. p.S22

21.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S5-16

22. Ibid. p.S25-7

23. Ibid p.S23

24. Ibid. p.S28-31

25. Ibid. p. S32

26.American Association of Diabetes Educators. A Core Curriculum for Diabetes Education 3rd Edition. American Association of Diabetes Educators. Chicago, IL 1998. p.763

27. Ibid. p. 659

28. National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Fact Sheet. pp.1-8. http:www.cdc.gov/diabetes/pubs/estimates.htm

29. National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Fact Sheet. pp.1-8. http:www.cdc.gov/diabetes/pubs/estimates.htm

30.National Diabetes Data Group. Diabetes in America. 2nd. Edition. National Institutes of Health NIH Publication No. 95-1468. 1995. p. 429

31. American Association of Diabetes Educators. A Core Curriculum for Diabetes Education 3rd Edition. American Association of Diabetes Educators. Chicago, IL 1998. p.661-4

32. Ibid. p. 661

33.Ibid. p. 661

34.Ibid. p. 661

35.Ibid. p. 661

36.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.209

37.American Association of Diabetes Educators. A Core Curriculum for Diabetes Education 3rd Edition. American Association of Diabetes Educators. Chcago, IL 1998. p.663

38. Behavioral Risk Factor Survey 2000 Report on the Lifestyle Behaviors Affecting the Life of West Virginia. Department of Health and Human Resources, Bureau for Public Health, Office of Epidemiology and Health Promotion. February 2002

39.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.209

40. Ibid. p. 209

41.American Association of Diabetes Educators. A Core Curriculum for Diabetes Education 3rd Edition. American Association of Diabetes Educators. Chicago, IL 1998. p.790

42.Ibid. 790

43.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.210

44. Tuomilehto J., et al. Prevention of Type 2 Diabetes Mellitus by Changes in Lifestyle Among Subjects with Impaired Glucose Tolerance. New England Journal of Medicine. 344:1343-1350

45. National Centers for Health Statistics. Publications and Information Products. Volume 48 #3. www.cdc.gov/nchs/products/pubs/pubd/nvsr/48/48-19.htm. www.cdc.gov/nchs/products/pubs/pubd National Vital Statistics, March 2000, Volume 28

46. National Centers for Health Statistics. Publications and Information Products. Volume 48 #3. www.cdc.gov/nchs/products/pubs/pubd/nvsr/48/48-19.htm.

47. 412. Gabbe, Steven G., Jennifer R. Nebyl, and Joe Leigh Simpson. Pocket Companion to Obstetrics: Normal & Problem Pregnancies. St. Louis, MS. 1999 p. 491

48. Ibid. p491

49. Ibid. p491

50. Ibid. p, 491

51. Ibid. p. 491

52. Ibid p.491

53. Ibid. p.491

54.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S66

55. Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.175

56. Ibid p.175

57. Ibid p.174

58. Ibid p.174

59. Ibid p.174

60. Ibid p.174

61. Ibid p.174

62. American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S68
63. Ibid p.S68
64. American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S10
65. Ibid. p.S11
66. Ibid. p. S79
67. Ibid. p. S79
68.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.229
69.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S69
70.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.230
71.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.230
72.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S69
73. Ibid. p. S69
74.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.230
75.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S70
76.Ibid. p.S70
77.CDC's Diabetes Program - Statistics - Diabetes Surveillance, 1999 - Chapter 8 - Table 8.1. http://www.cdc.gov/diabetes/statistics/survl99/chap8/table1.htm
78.CDC's Diabetes Program - Statistics - Diabetes Surveillance, 1999 - Chapter 8 - Table 8.1. http://www.cdc.gov/diabetes/statistics/survl99/chap8/table1.htm
79.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S69
80.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S69,70
81.Mazze, Roger, Strock, Ellie, Simonson, Gregg, Bergenstal, Richard and Etzwiler, Donnell. Staged Diabetes Management A Systematic Approach. International Diabetes Center. 2000. p.229
82. Ibid. 230
83.American Diabetes Association. Diabetes Care. Clinical Practice Recommendations Supplement 1. January 2001. p.S120

APPENDIX ONE: TECHNICAL NOTES

Population Denominators

Denominators for the calculation of ESRD, hospitalization, and mortality rates among the West Virginia population were taken from the 2000 census figures obtained from the U.S. Bureau of the Census, unless otherwise noted. Denominators for maternal diabetes rates were based on the numbers of live births during the time periods noted. Denominators for hospitalization and mortality rates among the state's diabetic population were estimated from the 1995 West Virginia population. All population figures are available from the Health Statistics Center, West Virginia Bureau for Public Health.

Determination of Statistical Inference

Determination of statistical inference for data in this report was based on non-overlapping 95% confidence intervals. In order to compute appropriate standard errors for calculating these confidence intervals, the raw sample size for the West Virginia Behavioral Risk Factor Survey was adjusted to account for equal probability for selection and remove bias caused by non-response . The term "significantly higher or lower" indicates that the difference in estimates was statistically significant. A lack of comment regarding the difference between any two estimates, however, does not mean that the difference was tested and found not to be significant.

Data Limitations

Detailed discussions of the limitations to diabetes-related data are provided in CDC's online version of *Diabetes Surveillance 1999*. CDC's discussions on diabetes prevalence, mortality, and end-stage renal disease are relevant to the interpretation of data in this report. In addition, the following paragraphs address specific limitations.

The Behavioral Risk Factor Surveillance System Analyses of data from the West Virginia BRFSS are subject to at least two limitations. First, telephoned-based surveys undersample populations that do not participate or cannot be reached by telephone. According to the 1998 U.S. Census Bureau/ Genesys Sampling Systems, about 94% of the occupied housing units in West Virginia have telephones. Secondly, information obtained by self-report can be inaccurate; indeed, only two-thirds of the persons with diabetes know they have the disease.

Natality Data The 1989 revision of the U.S. Standard Certificate of Live Birth includes demographic and medical information related to pregnancy. Although the presence of diabetes can be recorded and some state-adopted certificates distinguish the types of diabetes during pregnancy, diabetes-related

live births in West Virginia are not distinguished by established diabetes (i.e., diabetes mellitus diagnosed before conception) or gestational diabetes (carbohydrate intolerance of variable severity with onset or first recognition during pregnancy). To reduce the risk for adverse fetal and maternal outcomes, various health professionals recommend that women who are of childbearing age and have diabetes undergo pre-pregnancy counseling and that all pregnant women receive early and continued prenatal care, including screening for gestational diabetes.

End-Stage Renal Disease Data Although data from MARC covers 18 networks of hospitals and other care facilities, only data from the network that includes West Virginia are in this report. Hence, a direct comparison of West Virginia data with that for all 18 networks is not provided.

Hospitalization Data The data used in our study do not include out-of-state hospitalizations among state residents not covered by Medicare. HCA does not collect from the state's veteran hospitals: a number of West Virginia's male population of the ages to be at risk for diabetes are likely to utilize VA services and are thus excluded from our study.

Comparison of County-Level Data Even though some county-level data are actual counts, they may be affected by random variation. Since county-level data include small numbers and the prevalence of diabetes is relatively minimal, caution should be observed when interpreting comparisons of county-level rates.

Age-adjusted rates

Age adjustments are used so that age distribution of a population is held to a constant standard to allow meaningful analysis: Age adjusting allows comparisons between different populations or geographic areas such as states or counties within a particular state by eliminating changes or differences in age composition. Mortality rates in this publication are adjusted by age to the 2000 U.S. standard million.

APPENDIX TWO: WEST VIRGINIA DIABETES ADVISORY COMMITTEE

Roberta Ahearn
American Diabetes Association
1221-A Ohio Avenue
Dunbar, WV 25064
rahearn@diabetes.org

Joan Bryant
1616 McClung Street, Apt. 2
Charleston, WV 25311

Patti Crawford
WV School of Osteopathic Medicine
400 North Lee Street
Lewisburg, WV 24901
pcrawford@wvsom.edu

Martha Dobbins
Braxton County Support Group
2600 Airport Road
Sutton, WV 26601

Barbara S Fierst, R.N., M.A., C.D.E.
337 Mulberry Street
Morgantown, WV 26505
fierst@adelphia.net

Thomas Griffith, O.D.
205 Fourth Avenue
St. Albans, WV 25177
teg0000@aol.com

Stephen R. Grubb, M.D.
3110 MacCorkle Avenue, SE
Charleston, WV 25304
srgrubb@citynet.net

April Hamilton, R.N.
Martinsburg VA Hospital, Room #2
Rt. 9, 109E
Martinsburg, WV 25401
aprilhamilton@martinsburgva.org

Jeff Hamrick, Pharm.D., C.D.E.
Bristol-Meyers Squibb Company
134 Scott Acres
Scott Deport, WV 25560
jeffhamrick@bms.com

Julie Le Jeune
AARP Associate Director
300 Summers Street, Suite 400
Charleston, WV 25301
jlejeune@aarp.org

Jennifer Orren
Rt.2, Box 382
Bluefield, WV 24701
jennifer@mercerboh.org

Leesa Prendergast
WVU - Dept. of Community Medicine
Robert C. Byrd Health Sciences Center
PO Box 9190
Morgantown, WV 26506
eprendergast@hsc.wvu.edu

Mary Jo Satterfield
Martinsburg VA Hospital, Room #2
Rt. 9, 109E
Martinsburg, WV 25401
maryjosatterfield.@med.va.gov

Frank Schwartz, M.D.
PO Box 4310
Parkersburg, WV 26104
endoguy@hotmail.com

Janet Shrewsbury, R.N., B.S.N., C.D.E.
Princeton Community Hospital
PO Box 1369
Princeton, WV 24740
jshrewsbury@pchonline.com

Advisory Committee continued:

Thom Stevens
PO Box 5008
Charleston, WV 25302
stevensgrs@aol.com

Joyce Zambito, R.N., M.S., C.D.E.
Wheeling Health Right, Inc.
99 Main Street
Wheeling, WV 26003
jezcde@aol.com

Fereydoun Zangeneh, M.D.
830 Pennsylvania Avenue
Charleston, WV 25361

Diabetes Control Program Staff

Peggy Adams, R.N.C., M.S.N., C.D.E.
Program Manager, Diabetes Control
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
peggyadams@wvdhhr.org

Jessica Wright, R.N., M.P.H., CHES
Program Director, Chronic Disease
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
jessicawright@wvdhhr.org

Joyce Spiroff
Associate Director, Division of Health Promotion
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
joycespiroff@wvdhhr.org

Jim Doria, Epidemiologist
WVBPH, Division of Health Statistics
350 Capitol St., Room 160
Charleston, WV 25301-3715
jimdoria@wvdhhr.org

Marie Gravely, R.D., C.D.E.
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
mariegravely@wvdhhr.org

Barbara Warwick
Office Assistant
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
barbarawarwick@wvdhhr.org

Charlene Hickman
Administrative Assistant
WVBPH, Division of Health Promotion
350 Capitol St., Room 319
Charleston, WV 25301-3715
charlenehickman@wvdhhr.org

The Diabetes Advisory Committee's goals are:

1. Increase diabetes awareness including public, professional, and consumer.
2. Increase early detection of Type 2 diabetes and of diabetes complications.
3. Improve management of diabetes care in West Virginia, including the accessibility and quality of care.
4. Increase or improve epidemiological data collection.
5. Monitor and evaluate the effectiveness of the state program.

APPENDIX THREE: TABLES AND FIGURES

Table A-1

PREVALENCE OF SELF-REPORTED DIABETES MELLITUS BY STATE
BEHAVIORAL RISK FACTOR SURVEYS, 1999

STATE	PREVALENCE 1999	RANK	STATE	PREVALENCE 1999	RANK
Puerto Rico	9.6	1	Georgia	5.6	27
Mississippi	7.9	2	New Mexico	5.5	28
Alabama	7.4	3	Michigan	5.4	29
West Virginia	7.3	4	Maine	5.4	29
Florida	6.9	5	New Jersey	5.4	29
Maryland	6.8	6	Kansas	5.4	29
Indiana	6.6	7	Wisconsin	5.3	33
Arkansas	6.6	7	Rhode Island	5.3	33
D.C.	6.5	9	Washington	5.2	35
Illinois	6.4	10	Iowa	5.2	35
Kentucky	6.4	10	Hawaii	5.2	35
Pennsylvania	6.4	10	North Dakota	5.0	38
South Carolina	6.4	10	Massachusetts	5.0	38
Oklahoma	5.8	11	South Dakota	4.9	40
Texas	6.2	14	Idaho	4.8	41
North Carolina	6.1	15	Minnesota	4.8	41
Louisiana	6.1	15	Wyoming	4.6	43
Missouri	6.1	15	Oregon	4.6	43
Ohio	6.1	15	New Hampshire	4.3	45
California	6.1	15	Vermont	4.3	45
Virginia	6.1	15	Connecticut	4.3	45
Delaware	6.0	21	Nebraska	4.3	45
Tennessee	6.0	21	Arizona	4.3	45
Montana	5.9	23	Utah	4.2	50
Nevada	5.8	24	Colorado	3.8	51
New York	5.7	26	Alaska	3.5	52
MEDIAN	5.6				

Table A-2

NUMBER AND RATE* OF DIABETES DEATHS BY COUNTY, WEST VIRGINIA, 1990-1998

COUNTY	NUMBER OF DEATHS	ADJUSTED RATE**	SI***	COUNTY	NUMBER OF DEATHS	ADJUSTED RATE**	SI***
Barbour	55	34.2	H	Mineral	76	29.3	L
Berkley	129	24.3	SL	Mingo	98	43.6	SH
Boone	67	31.8	H	Monongalia	128	22.1	SL
Braxton	50	33.1	H	Monroe	34	23.7	L
Brooke	99	35.7	H	Morgan	54	36.9	H
Cabell	268	26.4	SL	Nicholas	53	21.4	SL
Calhoun	25	29.9	L	Ohio	184	32.1	H
Clay	31	34.0	H	Pendleton	21	23.5	L
Doddridge	26	34.3	H	Pleasants	21	28.2	L
Fayette	173	32.6	H	Pocahontas	40	37.2	H
Gilmer	24	30.4	L	Preston	77	27.6	L
Grant	10	9.3	SL	Putnam	120	34.3	H
Greenbrier	104	27.5	L	Raleigh	294	38.3	SH
Hampshire	50	32.3	H	Randolph	94	33.1	H
Hancock	102	28.4	L	Ritchie	28	23.2	L
Hardy	17	15.0	SL	Roane	32	20.1	SL
Harrison	310	40.0	SH	Summers	44	27.9	L
Jackson	67	26.7	L	Taylor	33	19.4	SL
Jefferson	80	27.4	L	Tucker	27	31.2	H
Kanawha	702	34.3	H	Tyler	29	29.9	L
Lewis	58	31.4	H	Upshur	57	26.5	L
Lincoln	77	43.4	SH	Wayne	86	22.0	SL
Logan	140	41.7	SH	Webster	21	19.9	SL
McDowell	142	49.1	SH	Wetzel	64	33.4	H
Marion	158	23.7	SL	Wirt	20	42.7	H
Marshall	138	38.9	SH	Wood	261	30.2	L
Mason	57	24.4	L	Wyoming	80	40.8	SH
Mercer	190	28.8	L	WV Total	5,425	30.9	

Source: West Virginia Health Statistics Center, 2001

** Adjusted by age to the U.S. 2000 standard million

*** SI (Significance Indicator relative to State Rate):

* Rate per 100,000 population

SH=significantly higher; H=higher

SL=significantly lower; L=lower

Figure A-1

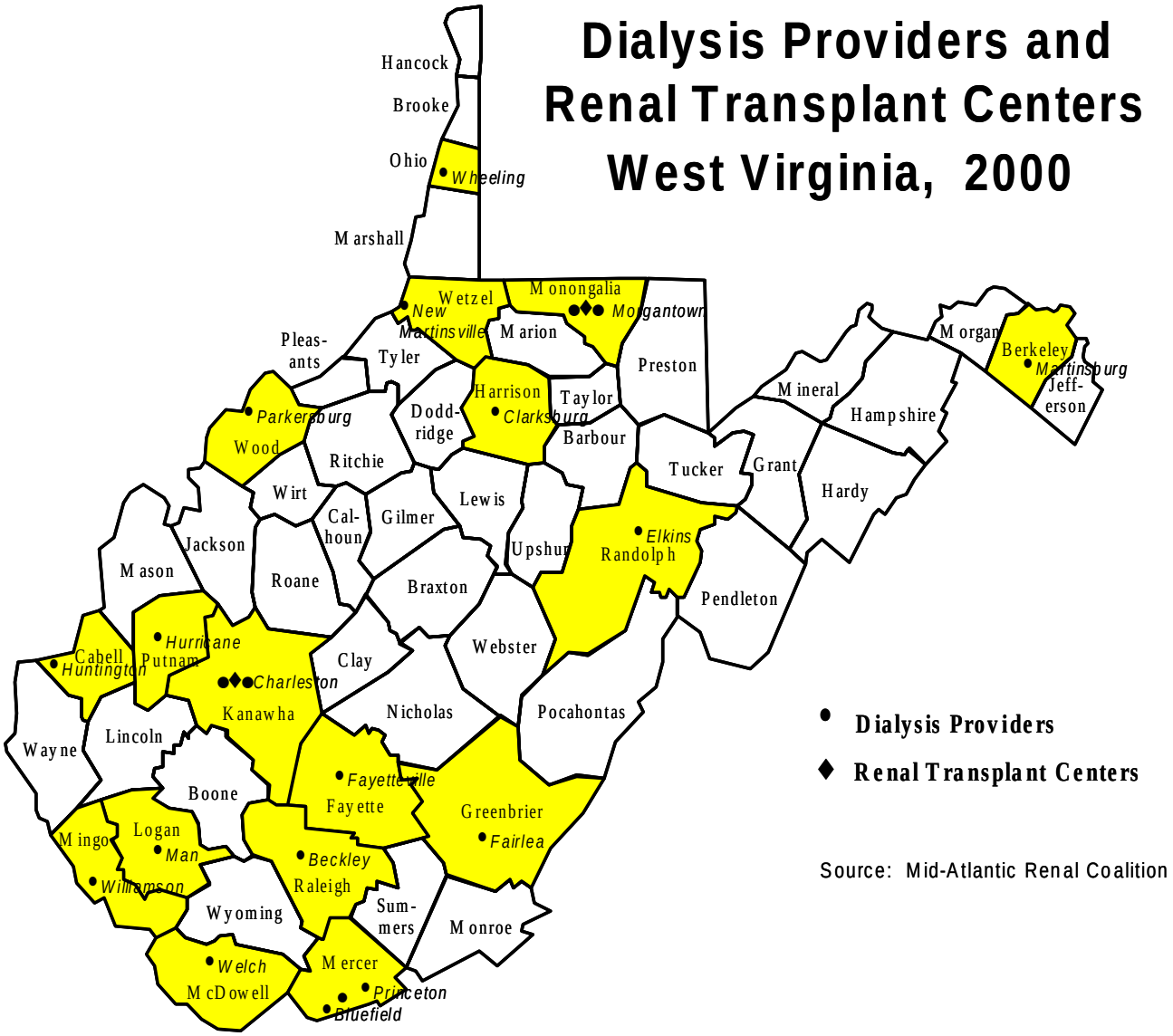
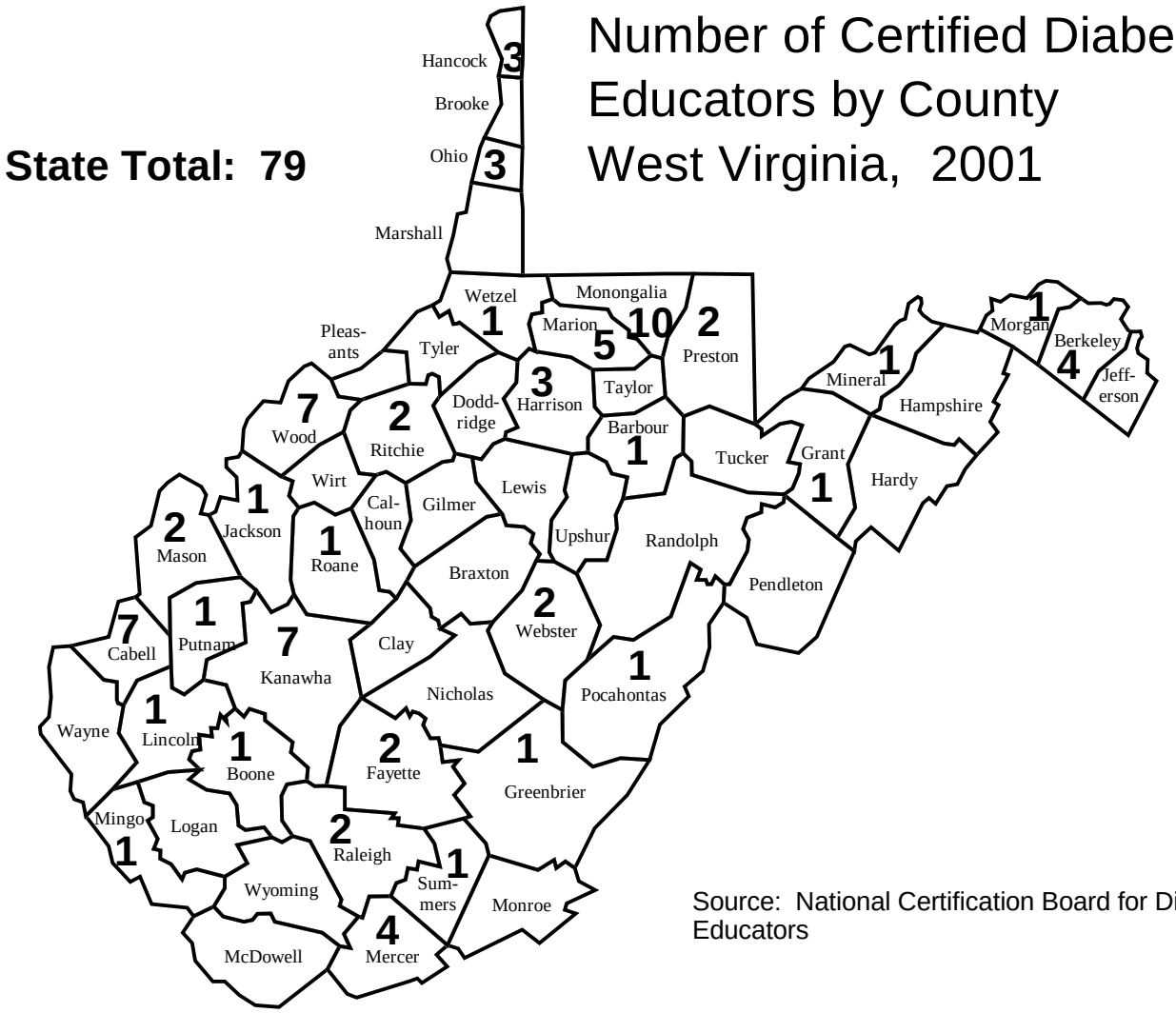

Dialysis Providers and
Renal Transplant Centers
West Virginia, 2000
Hancock
Brooke
Ohio
Wheeling
Marshall
Wetzel
New Martinsville
Monongalia
Morgantown
Marion
Pleas-ants
Tyler
Preston
Morgan
Berkeley
Martinsburg
Jeff-erson
Mineral
Hampshire
Parkersburg
Wood
Dodd-ridge
Harrison
Clarksburg
Taylor
Barbour
Tucker
Grant
Hardy
Ritchie
Wirt
Cal-houn
Gilmer
Lewis
Upshur
Elkins
Randolph
Jackson
Mason
Roane
Braxton
Pendleton
Hurricane
Cabell
Huntington
Putnam
Charleston
Kanawha
Clay
Webster
Nicholas
Pocahontas
Wayne
Lincoln
Boone
Fayetteville
Fayette
Greenbrier
Fairlea
Mingo
Logan
Man
Beckley
Raleigh
Williamson
Wyoming
Sum-mers
Monroe
Welch
McDowell
Mercer
Princeton
Bluefield
Dialysis Providers
Renal Transplant Centers
Source: Mid-Atlantic Renal Coalition

Figure A-2



Source: National Certification Board for Diabetes Educators

APPENDIX FOUR: LIST OF ACRONYMS AND ABBREVIATIONS

ALOS	Average Length of Stay
BRFS	Behavioral Risk Factor Survey
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CDE	Certified Diabetes Educator
CVD	Cardiovascular Disease
DCCT	Diabetes Control and Complications Trial
D.O.	Doctor of Osteopathy
ESRD	End-Stage Renal Disease
ESRD-DM	End-Stage Renal Disease due to Diabetes Mellitus
HCFA	Health Care Financing Administration
ICD-9-CM	International Classification of Diseases, 9th Edition, Clinical Modification
IDDM	Insulin Dependent Diabetes Mellitus
M.D.	Medical Doctor
NCHS	National Center for Health Statistics
NIDDM	Non-Insulin-Dependent Diabetes Mellitus
NIH	National Institutes of Health
NVSS	National Vital Statistics System
PEIA	Public Employees Insurance Agency
UMWA	United Mine Workers of America
USRDS	United States Renal Data Systems
WVHCA	West Virginia Health Care Authority

For additional information, contact the West Virginia Diabetes Control Program at (304) 558-0644

West Virginia Diabetes Control Program

West Virginia Department of Health and Human Resources