

## Diabetes

### *The Disease*

Diabetes is a serious, costly, and increasingly common chronic disease that can cause devastating complications, including heart disease, kidney failure, leg and foot amputations, and blindness, as well as resulting in disability and death.<sup>231 232</sup> It is estimated that 33% of Americans born in 2000 will develop diabetes during their lifetime and that the incidence of the disease will double by 2050.<sup>233</sup>

Disability affects 20-50% of the diabetic population.<sup>234</sup> Annual healthcare costs for a person with type 2 diabetes complications are about three times that of the average American without diagnosed diabetes. The State of Diabetes Complications in America report estimated that poorly managed type 2 diabetes cost the US healthcare system \$22.9 billion in direct costs in 2006 to deal with complications of the disease ([www.stateofdiabetes.com](http://www.stateofdiabetes.com)). Diabetes accounted for 12% of dollars spent by the federal government health care programs (*USA Today* 6/19/07, 9D). The prevalence of diabetes is more common among obese individuals, but it is the diabetes and not their obesity that raises the risk of severe health problems.<sup>235</sup> Weight loss is the key factor in reducing diabetes risk for high-risk, overweight persons.<sup>236</sup> Progress in reducing mortality rates among persons with diabetes has been limited to men.<sup>237</sup> Diabetes continues to greatly increase the risk for mortality, particularly among women.

The classification of diabetes reflects the complexity of the disease. Type 1 diabetes (formerly insulin dependent diabetes or juvenile-onset diabetes), accounts for 5-10% of all diabetes cases. Type 1 diabetes develops when the body's immune system destroys pancreatic beta cells, the only cells in the body that make the hormone insulin that regulates blood glucose. Autoimmune, genetic and environmental factors are believed to cause type 1 diabetes.

Type 2 diabetes (formerly non-insulin dependent diabetes or adult onset diabetes) accounts for 90-95% of diabetes cases. It usually begins as insulin resistance, a disorder in which the cells do not use insulin properly. As the need for insulin rises, the pancreas gradually loses its ability to produce it. Risk factors for type 2 diabetes include older age, obesity, family history of diabetes, a prior history of gestational diabetes, impaired glucose tolerance, physical inactivity, and race/ethnicity. Many people with

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<sup>231</sup> Kengne AP, Patel A. How important is diabetes as a risk factor for cardiovascular and other diseases in older adults. *PLoS Medicine* 2006;3:e424.

<sup>232</sup> Buse JB et al. Primary prevention of cardiovascular diseases in people with diabetes mellitus. A scientific statement from the American Heart Association and the American Diabetes Association. *Diabetes Care* 2007;30:162-172.

<sup>233</sup> Narayan KMV et al. Impact of recent increase in incidence on future diabetes burden, US, 2005-2050. *Diabetes Care* 2006;29:2114-2116.

<sup>234</sup> Eberhardt MS et al. Mobility limitation among persons aged  $\geq 40$  years with and without diagnosed diabetes and lower extremity disease – United States, 1999-2002. *MMWR* 2005;54:1183-1186.

<sup>235</sup> Slynkova K et al. The role of body mass index and diabetes in the development of acute organ failure and subsequent mortality in an observational cohort. *Crit Care* 2006;10:R137.

<sup>236</sup> Hamman RF et al. Effect of weight loss with lifestyle intervention on risk of diabetes. *Diabetes Care* 2006;29:2102-2107.

<sup>237</sup> Gregg EW et al. Mortality trends in men and women with diabetes, 1971-2000. *Ann Intern Med* 2007;147:149-155.

type 2 diabetes develop more than one other serious health problem associated with the disease: 10.3% have two other serious health problems, 6.7% have three, and 7.6% have four. Therefore, it is not surprising that nearly half of adults with diabetes report that their health is fair or poor.<sup>238</sup>

Among youth, the highest incidence of type-1 diabetes is associated with non-Hispanic whites, while the highest incidence of type-2 diabetes is among minority youth.<sup>239</sup> Type 2 diabetes among children and adolescents is linked to two modifiable risk factors: obesity and physical inactivity.<sup>240 241</sup> Among Native Americans, youth with type 2 diabetes have an increased incidence of end-stage renal disease and death when they are young and middle aged adults.<sup>242</sup>

Gestational diabetes is a type of diabetes that only pregnant women get. If not treated, it can cause problems for both the mothers and babies. It develops in 2% to 5% of all pregnancies but usually disappears when a pregnancy is over. Gestational diabetes is a form of glucose intolerance and requires treatment to normalize maternal blood glucose levels to avoid complications in the infant. Gestational diabetes occurs more frequently in non-Hispanic blacks, Hispanics, Native Americans, and people with a family history of diabetes. Obesity is also associated with higher risk. Women who have had gestational diabetes are at increased risk for later developing type 2 diabetes. In some studies, nearly 40% of women with a history of gestational diabetes developed diabetes in the future. These women also are at risk of developing pancreatic cancer later in their lives.<sup>243</sup> Yet, among women who had gestational diabetes, this condition does not appear to motivate the women to take better care of their selves following the pregnancy.<sup>244</sup>

Other specific types of diabetes resulting from specific genetic syndromes, surgery, drugs, malnutrition, infections, and other illnesses may account for 1% to 5% of all diagnosed cases of diabetes.

In addition, there is prediabetes, defined as at least two fasting plasma glucose levels of 100-125 mg/dL (100-109 mg/dL is termed type 1 prediabetes, and 110-125 mg/dL is termed type 2 prediabetes).<sup>245</sup> Like type 2 diabetes, it is linked to two modifiable risk factors: obesity and physical inactivity. Currently, 19.8 million Americans 40 to 74 years of age are considered prediabetic and that

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<sup>238</sup> Pan L et al. Self-rated fair or poor health among adults with diabetes – United States, 1996-2005. *MMWR* 2006;55:1224-1228.

<sup>239</sup> The Writing Group for the SEARCH for Diabetes in Youth Study Group. Incidence of diabetes in youth in the United States. *J Am Med Ass* 2007;297:2716-2724.

<sup>240</sup> Search for Diabetes in Youth Study Group. The burden of diabetes mellitus among US Youth: prevalence estimates from the SEARCH for Diabetes in Youth Study. *Pediatrics* 2006;118:1510-1518.

<sup>241</sup> Sigal RJ et al. Physical activity/exercise and type 2 diabetes. A consensus statement from the American Diabetes Association. *Diabetes Care* 2006;29:1433-1438.

<sup>242</sup> Pavkow ME et al. Effect of youth-onset type 2 diabetes mellitus on incidence of end-stage renal disease and mortality in young and middle-aged Pima Indians. *J Am Med Ass* 2006;296:421-426.

<sup>243</sup> Perrin MC et al. Gestational diabetes as a risk factor for pancreatic cancer: a prospective cohort study. *BMC Med* 2007;5:25.

<sup>244</sup> Kieffer EC et al. Health behaviors among women of reproductive age with and without a history of gestational diabetes mellitus. *Diabetes Care* 2006;29:1788-1793.

<sup>245</sup> Expert Committee on the Diagnosis and Classification of Diabetes. Follow up report on the diagnosis of diabetes mellitus. *Diabetes Care* 2003;26:3160-3167.

number is projected to change to 37.3 million.<sup>246</sup> Medical care costs for persons with type 2 prediabetes are 32% higher than those for persons with normal fasting glucose levels and much of the additional cost associated with both type 1 and type 2 prediabetes is due to concurrent cardiovascular disease.<sup>247</sup>

The National Health and Nutrition Examination Survey (NHANES) for 1999-2002, found a crude prevalence rate for diabetes of 9.3% or 19.3 million people  $\geq 20$  y old based on Census 2000.<sup>248</sup> <sup>249</sup> This prevalence consisted of 6.5% diagnosed cases of diabetes and 2.8% undiagnosed diabetes cases. An additional 26% of people had prediabetes or impaired fasting glucose (IFG). These figures equate to 35.3% of the adult population in the US (73.3 million people) with either diabetes or IFG. The prevalence rose with age reaching 21.6% for those  $\geq 65$  y old. The prevalence of diagnosed diabetes was twice as high for non-Hispanic blacks and Hispanics compared to non-Hispanic whites, whereas the prevalence of undiagnosed diabetes was similar across race/ethnicity. The prevalence of diagnosed diabetes was similar by sex, but prevalences of undiagnosed diabetes and prediabetes were significantly higher in men. There was an inverse relationship between diabetes and education, with 12% of adults with less than a high school diploma having diabetes compared to 6% of those with a bachelor's degree or higher.

The overall death rate among male diabetics fell significantly (43%) during 1971-2000 as did deaths from heart disease (48%), but both rates remained unchanged for diabetic women.

Early detection and improved delivery of care, and better self-management are key strategies for preventing much of the burden of diabetes.<sup>250</sup> Therefore, in response to the epidemic of type 2 diabetes, New York City laboratories are required to report glycosylated hemoglobin values to the city's Department of Health (glycosylated hemoglobin value is the primary target for glycemic control).<sup>251</sup>

## Missouri

Since 1988, Missouri has observed a 29% increase in residents diagnosed with diabetes. The 2006 BRFSS reported that 8% of Missouri adults had diabetes. A significantly higher percentage of adults with less than a high school education (13%) had diabetes compared to those with more than a high school education (6%). Adults with lower income levels also were significantly more likely to have been diagnosed with diabetes than those of higher income levels. Forty-five percent (45%) of Missouri adults reported receiving a diabetes diagnosis at age 55 or older. Twenty-nine percent (29%) were currently taking insulin

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<sup>246</sup> Benjamin SM et al. A change in definition results in an increased number of adults with prediabetes in the United States. *Arch Intern Med* 2004;164:2386.

<sup>247</sup> Nichols GA, Brown JB. Higher medical costs accompany impaired fasting glucose. *Diabetes Care* 2005;28:2223-2229.

<sup>248</sup> Cowie CC et al. Prevalence of diabetes and impaired fasting glucose in adults in the US population. *Diabetes Care* 2006;29:1263-1268.

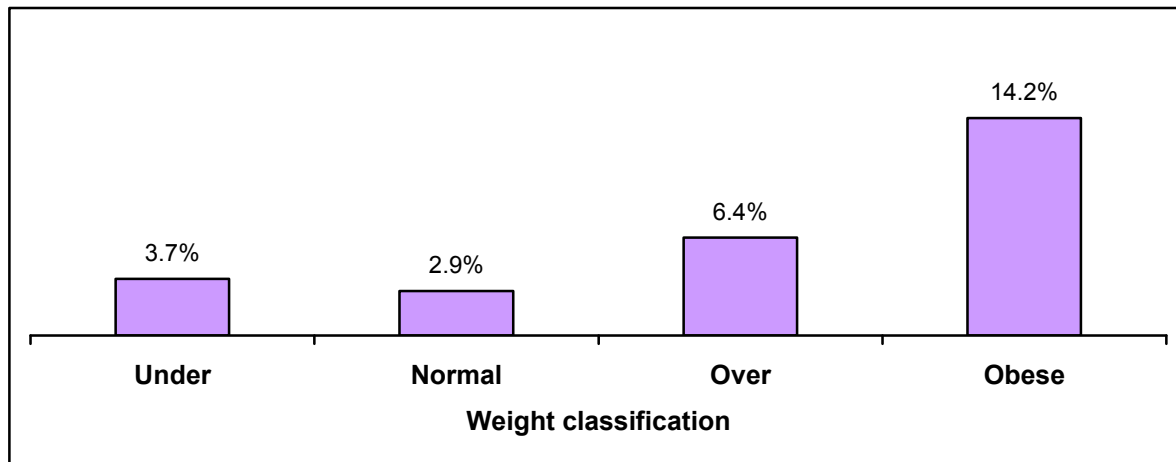
<sup>249</sup> National Center for Health Statistics. Summary health statistics for US adults: National Health Interview Survey 2004. *Vital Health Stat Series* 2005;10(228). [www.cdc.gov/nchs](http://www.cdc.gov/nchs).

<sup>250</sup> Mukhtar Q et al. Prevalence of receiving multiple preventive-care services among adults with diabetes – United States, 2002-2004. *MMWR* 2005;54:1130-1133.

<sup>251</sup> Steinbrook R. Facing the diabetes epidemic – mandatory reporting of glycosylated hemoglobin values in New York City. *New Engl J Med* 2006;354:545-548.

and 72% were taking pills to help control their diabetes. The prevalence of diabetes among Missourians is highest among persons who are overweight or obese (Figure 84).

**Figure 84 Prevalence of diabetes among Missourians by weight, 2000-2004**



There were 7,798 deaths from diabetes in Missouri between 2001 and 2005, with 7.7% of those deaths occurring among Kansas City residents. For the time period, the age-adjusted death rate statewide was 25.4 per 100,000 population and in Kansas City it was 28.3. While 82% of the deaths in Missouri occurred among whites, their age-adjusted death rate was less than half that for blacks, 23.3 and 51.1, respectively. There were 87 deaths among Hispanics with 36% of those individuals were Kansas City residents.

## ***Kansas City***

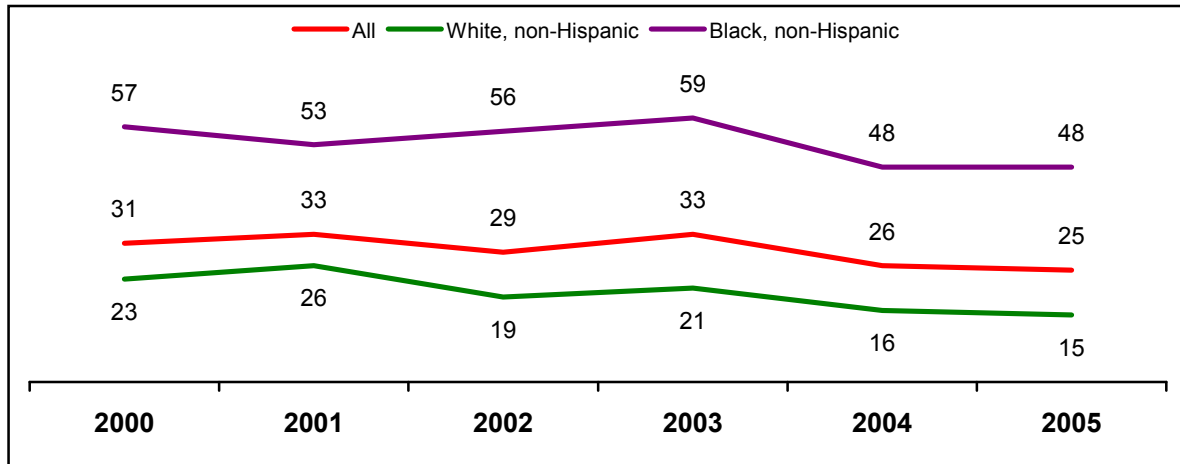
According to 2003 BFRSS data, 10.3% of Kansas City residents reported that a physician had diagnosed them as having diabetes, compared to regional prevalence rate of 7.5% and a statewide rate of 7.1%. A 2004 telephone survey commissioned by the Kansas City Health Department had 13.1% of respondents report that they were diabetic.<sup>252</sup>

In Kansas City the overall age-adjusted death rates due to diabetes remained stable between 25 and 33 deaths/100,000 population (Figure 85). Annual rates for non-Hispanic blacks were 2-3 times higher than those for non-Hispanic whites. The overall and non-Hispanic white rates were well below the Yr 2010 objective of 45 deaths/100,000 population, while the rates for non-Hispanic blacks exceeded the objective each year. The death rate for non-Hispanic blacks remained stable between 1996-2000 and 2001-2005, while it decreased 14% for non-Hispanic whites (Figure 86). In 2005, diabetes was 9<sup>th</sup> leading cause of death among Kansas City residents with 103 persons dying. It was the 10<sup>th</sup> leading cause of

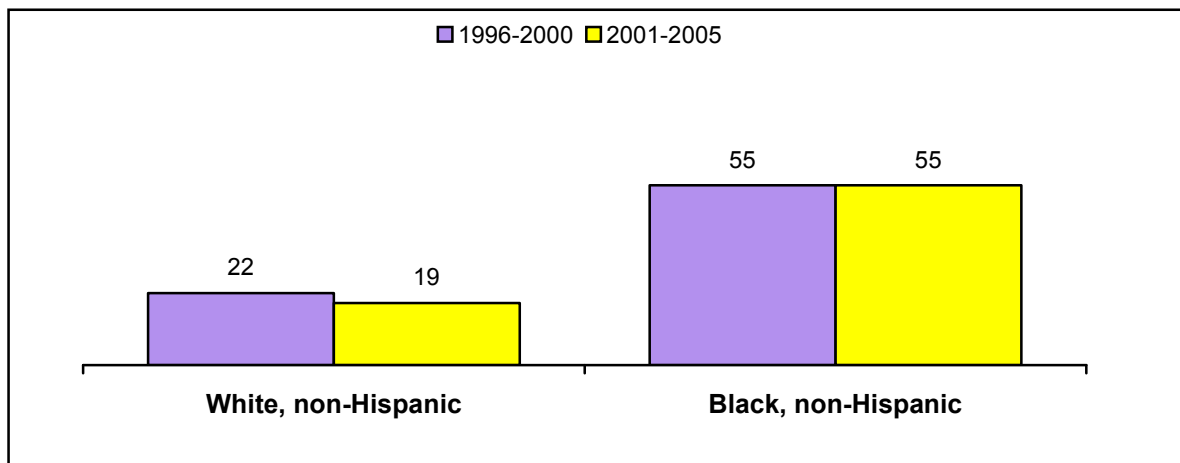
<sup>252</sup> Kansas City Health Department.. 2004 Health Assessment Survey. [www.kcmo.org/health](http://www.kcmo.org/health).

death among non-Hispanic whites and 4<sup>th</sup> leading cause for non-Hispanic blacks. The average age at death was 69.8 years of age.

**Figure 85 Age-adjusted death rates per 100,000 population due to diabetes, Kansas City, Mo**



**Figure 86 Age-adjusted death rates per 100,000 population due to diabetes, by race/ethnicity, Kansas City, Mo**



An earlier analysis of diabetic deaths in Kansas City found that almost one-third of deaths due to diabetes were premature as the individuals died before the age of 65 y old.<sup>253</sup> This situation had not changed during the period 2001-2005 (Table 87). Among males who died from diabetes, 41.3% of the deaths were premature compared to only 27.7% of deaths among females.

The distribution of diabetes deaths by zip code for the period 2000-2004 is shown in Tables 88

<sup>253</sup> Kansas City, Missouri, Health Department. *Diabetes assessment. Kansas City, Missouri, residents. 1990-1998.* 2000. 25 p.

and 89.

**Table 87 Diabetes deaths by age, race and ethnicity, Kansas City, Mo, 2001-2005**

Age	White, non-Hispanic	Black, non-Hispanic	Hispanic	Asian	Total
15-19 y	1	0	0	0	1
20-29 y	0	5	0	0	5
30-39 y	7	6	0	1	14
40-49 y	14	26	3	0	43
50-59 y	33	44	4	1	82
60-69 y	47	61	7	1	116
70-79 y	81	85	11	4	181
>80	93	58	6	0	157
<b>Total</b>	<b>276</b>	<b>285</b>	<b>31</b>	<b>7</b>	<b>599</b>

Diabetes has been ranked among the 10 leading causes of death in the US since 1932. It was 6<sup>th</sup> in 2004 with an age-adjusted death rate of 24.8 which was 3.6% lower than that for 2003.<sup>254</sup> However, mortality statistics alone clearly understate the impact of diabetes. Because people die of the complications of diabetes rather than the disease itself, diabetes is underreported as the underlying or even contributing cause of death. It is estimated that diabetes is listed on the death certificates of less than half of the decedents who actually had diabetes.<sup>255</sup> The leading causes of death for persons with diabetes are heart disease (55%), diabetes (13%), cancers (13%), cerebrovascular disease (10%), and pneumonia/influenza (4%). The risk of cardiovascular disease mortality is 2 to 4 times that of persons without diabetes.<sup>256</sup>

The Kansas City Health Department conducted an analysis of causes of death associated with heart disease, cancer, and stroke for 2001-2003.<sup>257</sup> Death certificates list four causes of death: the immediate cause, the cause leading to the immediate cause of death, the next antecedent cause of death, and the underlying cause of death. The analysis only looked at the first three causes. For deaths due to heart disease, diabetes was listed on the death certificate as the cause leading to the immediate cause of death 11.7% of the time. Similarly for deaths due to stroke diabetes was listed 6.9% of the time. For individuals whose immediate cause and cause leading to the immediate cause were both listed as cancer, diabetes was listed as the next antecedent cause of death 4.2% of the time.

<sup>254</sup> Minino AM et al. Deaths: final data for 2004. *Nat Vital Stat Reports* 2007;55(19). [www.cdc.gov/nchs](http://www.cdc.gov/nchs)

<sup>255</sup> Sayhad SH et al. Review of performance of methods to identify diabetes cases among vital statistics, administrative, and survey data. *Ann Epidemiol* 2004;14:507-116.

<sup>256</sup> Donaho SM et al. Diabetes and mortality following acute coronary syndromes. *J Am Med Ass* 2007;298:765-775.

<sup>257</sup> Kansas City, Missouri, Health Department. Causes of death associated with heart disease, cancer, and stroke. *Community & Hospital Letter* 2005;25(7):1-2. [www.kcmo.org/health](http://www.kcmo.org/health)

## DIABETES

**Table 88 Deaths (N=625) due to diabetes among Kansas City, Mo, residents by zip code, 2001-2005**

Zip code	Total deaths	Male	Female	White, non-Hispanic	Black, non-Hispanic	Zip code	Total deaths	Male	Female	White, non-Hispanic	Black, non-Hispanic
64101	0	0	0	0	0	64134	24	11	13	13	8
64102	0	0	0	0	0	64136	7	2	5	5	0
64105	2	1	1	2	0	64137	8	5	3	3	4
64106	10	5	5	2	7	64138	16	6	10	9	7
64108	15	10	5	2	9	64139	6	1	5	4	2
64109	24	13	11	2	22	64145	11	4	7	5	4
64110	19	6	13	3	14	64146	2	2	0	2	0
64111	13	7	6	5	8	64147	0	0	0	0	0
64112	4	4	0	4	0	64149	0	0	0	0	0
64113	6	3	3	6	0	64150	0	0	0	0	0
64114	44	24	20	37	4	64151	14	7	7	14	0
64116	12	7	5	12	0	64152	4	4	0	3	0
64117	12	4	8	11	0	64153	1	1	0	1	0
64118	23	8	15	22	0	64154	3	2	1	3	0
64119	16	9	7	13	0	64155	14	4	10	13	0
64120	3	2	1	2	0	64156	1	1	0	1	0
64123	11	5	6	7	1	64157	2	1	1	1	1
64124	18	8	10	13	1	64158	0	0	0	0	0
64125	5	3	2	4	0	64160	0	0	0	0	0
64126	12	2	10	7	5	64161	0	0	0	0	0
64127	34	16	18	9	23	64163	0	0	0	0	0
64128	42	18	24	2	39	64164	1	1	0	1	0
64129	10	6	4	8	1	64165	0	0	0	0	0
64130	84	36	48	4	80	64167	0	0	0	0	0
64131	25	14	11	8	17	64192	0	0	0	0	0
64132	28	8	20	2	28	All others	2	2	0	2	0
64133	11	8	3	9	2						

\* Zip codes 64121, 64141, 64148, 64168, 64171, 64172, 64179, 64188, 64190, 64191, 64195, 64196, and 64199 are associated with post office box numbers; zip codes 64144, 64170, 64180, 64183, 64184, 64185, 64187, 64193, 64194, 64197, 64198, 64944, and 64999 are associated with unique entities, and zip codes 64012, 64030, 64079, and 64081 are associated with Belton, Grandview, Platte City, and Lee's Summit, respectively.

**Table 89** Distribution of diabetes deaths by zip code and rate per 1,000 population, Kansas City, Mo, 2001-2005

		<u>Rate per 1,000 population</u>			
<u>0.0-0.9</u>	<u>1.0-1.9</u>	<u>2.0-2.9</u>	<u>3.0-3.9</u>	<u>4.0-4.9</u>	<u>=&gt;5.0</u>
64012	64106	64108	64120		64030
64079	64109	64125	64130		64136
64081	64110	64128			64139
64101	64114	64145			64164
64102	64116				
64105	64118				
64111	64123				
64112	64124				
64113	64126				
64117	64127				
64119	64129				
64133	64131				
64137	64132				
64147	64134				
64149	64138				
64150	64146				
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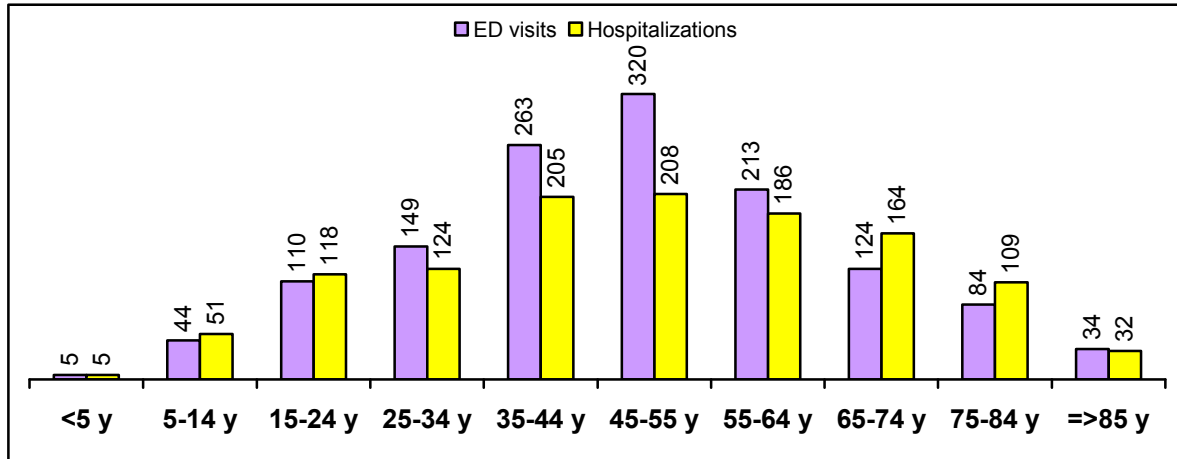
### ***Emergency Department & Hospital***

According to various reports by the National Center for Health Statistics ([www.cdc.gov/nchs](http://www.cdc.gov/nchs)), in 2005, individuals with diabetes made 94.3 million visits to their physicians, 219,000 visits to emergency departments, and experienced 585,000 hospitalizations due to their disease. In 2003, among persons receiving home health care, 7.9% were diabetic and among persons in nursing homes, 17.2% were diabetic.

During 2005, in Kansas City, diabetes was responsible for 1,346 emergency department visits and 1,202 hospitalizations. Figure 87 shows the number of emergency department visits and hospitalizations by age group.

In April 2006, the Missouri Department of Health and Senior Services released updated diabetes data ([www.dhss.mo.gov/ASPsDiabetes/Main.php?cnty=521](http://www.dhss.mo.gov/ASPsDiabetes/Main.php?cnty=521)). Between 1999 and 2003, 5,212 hospital admissions occurred among Kansas City residents for which diabetes was the principal diagnosis and

**Figure 87 Emergency department (ED) visits and hospitalizations due to diabetes by age, Kansas City, Mo, 2005**



50,919 admissions were it was either the principal or secondary diagnosis. For the admissions with diabetes as the principal diagnosis, the rate of age-adjusted admissions per 10,000 population for non-Hispanic blacks was 2.86 times that for non-Hispanic whites (41.7 and 14.6, respectively). These rates were similar to statewide rates of 13.3 for whites and 41.9 for blacks. For emergency department visits in 2003 with diabetes as the principal diagnosis, the non-Hispanic black:non-Hispanic white disparity ratio in age-adjusted rates per 1,000 population was 5.4 (6.5 non-Hispanic blacks, 1.2 non-Hispanic whites). The rate for non-Hispanic whites was similar to that for non-Hispanic whites statewide (1.1) while the rate for non-Hispanic blacks was 1.4 times higher than the statewide rate for non-Hispanic blacks (4.6).

In 2003, admissions with diabetes as the principal diagnosis resulted in 5,440 days of care provided with hospital charges of \$17,952,226. There were 2,385 days of care provided to whites with hospital charges of \$8,004,154 and 2,759 days of care provided to blacks with hospital charges of \$9,127,338. For the 1,272 emergency department visits in 2003 the hospital charges were \$1,489,210 (363 visits by whites and \$450,466 in charges; 825 visits by blacks and \$943,639 in charges).

In addition to the above, there were 2,831 admissions with a diabetes related lower extremity condition listed as the principal diagnosis, and 705 individuals (304 of whom were non-Hispanic white and 325 non-Hispanic black) underwent lower extremity amputation as a result of their diabetes. The age-adjusted amputation rate for non-Hispanic blacks (5.9 per 10,000 population) was nearly three times that for non-Hispanic whites (rate of 2.0). The amputation rate of whites was similar to the statewide rate of 2.1 for non-Hispanic whites while that for

Quality improvement for diabetes treatment is a major issue both from an individual patient perspective and from a disparities perspective. The Kansas City Quality Improvement Consortium has developed standards against which it measures individual physician performance for management of diabetes and other health conditions ([www.kcqic.org](http://www.kcqic.org)). Its annual report cards for diabetes indicate



growing improvements in management of individual patients.<sup>258</sup> Similar reviews elsewhere suggest that successful quality improvement can contribute to reducing health disparities in diabetes care.<sup>259</sup> The Missouri Department of Health and Senior Services reported that quality improvement efforts statewide have allowed Missouri to achieve the Yr 2010 goal of at least 65% of persons with diabetes receiving two or more A1C blood tests in a year.<sup>260</sup>

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<sup>258</sup> Bavely A. Diabetes report cards: care make strides. *Kansas City Star* 2/08/06.

<sup>259</sup> Sequist TD et al. Effect of quality improvement on racial disparities in diabetes care. *Arch Intern Med* 2006;166:675-681.

<sup>260</sup> Missouri Department of Health and Senior Services. Missouri recognized for efforts to address diabetes. Press release, 4/05/06.