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Age and Sex Differences in Hospitalizations Associated with Diabetes

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Abstract

Aim: To evaluate national trends in hospitalizations and hospital charges associated with diabetes over a recent 14-year period.
Methods: We evaluated hospital discharges with a primary or secondary diagnosis of diabetes (250.xx)in the Nationwide Inpatient Sample (1993–2006). Outcomes included population-adjusted estimates of hospital discharges and hospital charges (2006 $U.S.).
Results: Overall, discharges associated with diabetes increased 65.3% (1,384/100,000 in 1993, 2,288/100,000 in 2006) over the 14-year period ($p < 0.001$ test for trend). The largest increase in hospitalizations occurred among adults 30–39 years of age, representing a 102% increase. Among young adults, increases among women were ~1.3 times greater compared with men, for the 20–29 year (63% vs. 46%) and 30–39 year (118% vs. 85%) age groups, even after excluding pregnancy-related hospitalizations. Overall, women had higher rates of hospitalizations associated with diabetes compared with men, but there was evidence of an age by sex interaction, with higher rates of hospitalizations among women in the younger age groups and among men in the older age groups. Annual inflation-adjusted total charges for hospitalizations with diabetes increased 220% over the period.
Conclusions: Large increases in diabetes hospitalizations occurring among adults aged 30–39 years and young women signal a shift in the hospital burden of diabetes.

Introduction

A number of studies have documented rising rates of diabetes among people in the United States.[1–5] Specifically, recent epidemiological data suggest dramatic increases in diabetes prevalence among young adults[2] and pregnant women.[6] Previous studies examining hospitalizations associated with diabetes in the United States have focused on specific populations, such as adult[7,8] or pediatric populations,[9,10] have examined hospitalizations at a single point in time,[8,9] or have looked at trends just among those with diabetes. To our knowledge, only one study examined trends in hospitalization rates associated with diabetes of all ages[11] and focused on overall trends rather than comparisons between age-based and sex-based strata.

We, therefore, sought to evaluate the potential increasing burden of hospitalizations and hospital charges associated with diabetes across age strata spanning birth through 80+ years for the U.S. population using the Nationwide Inpatient Sample (NIS), a nationally representative annual sample of hospital discharges. Based on our previous work that showed higher hospitalization rates among females with diabetes compared with males with diabetes under the age of 29 years,[10] as well as a recent report by Lawrence et al.[6] demonstrating an increasing incidence of diabetes during pregnancy, we hypothesized that women of reproductive age would have higher rates of hospitalizations compared with men with diabetes. Furthermore, given recent epidemiological data demonstrating dramatic increases in diabetes among younger adults,[4] we also hypothesized that there would be larger increases in hospitalizations among younger vs. older adults with diabetes.

Materials and Methods

Data sources

The NIS is the largest all-payer inpatient database for the United States[12] and is based on an approximately 20%

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stratified probability sample of hospitals in states that participate in the Healthcare Cost and Utilization Project, allowing for inference of findings to the national level. The NIS is conducted annually and contains information about disease (presented as *International Classification of Disease, 9th revision, Clinical Modification* (ICD-9) codes) as well as hospital charges and has been used in a variety of studies[13,14] for assessing trends in hospitalizations and hospital charges in the United States.

Study population

The subpopulation of interest included discharges with ICD-9 codes for diabetes (250.xx) as a primary diagnosis or as a secondary diagnosis for all individuals for the years 1993–2006. We excluded gestational diabetes diagnostic codes so that this analysis would be comparable with other previously published studies. Studies have shown 91% accuracy using administrative codes for a diagnosis of diabetes for adults[15] and 74% accuracy for children.[16]

Data analysis

Discharge-level weights for each year were used to estimate national hospitalization rates and total charges, with their corresponding standard error estimates. Our objective was to look at the overall burden of diabetes hospitalizations for the U.S. population; therefore, we used U.S. Census population estimates as our denominator for assessing hospitalization rates rather than estimates of the population of individuals with diabetes. Hospitalization rates were standardized to the concurrent national population using U.S. Census data for each respective year (1993–2006), consistent with the methodology used in previous studies.[17,18] We present the number of hospitalizations per 100,000 resident population (overall and for sex-specific and age-specific strata for each respective year based on Census estimates), which was computed by the formula:

$$(100,000^{*}\#\ \text{discharges})/\text{resident population}$$

Because Census population estimates change over time for example, the number of 10–19-year-olds in the United States population was ~38,000 in 1993 vs. ~42,000 in 2006—standardization must be performed to ensure accurate comparison of diabetes hospitalization rates over time.

Total hospital charges were standardized to $2006 U.S. using the Consumer Price Index (CPI), which is the yearly price index generated by the Bureau of Labor Statistics. The overall CPI was used because of concerns that the medical care CPI does not accurately capture the cost of healthcare for third-party payers, who pay the majority of claims for hospital services.[19] Hospital discharge and charge calculations were repeated for females after excluding pregnancy-related conditions (ICD9 630–676 or DRG 370–376).

To evaluate for significant increases in hospitalizations and total charges, we performed variance-weighted tests for linear and curvilinear trends. Such tests do not assume homogeneity of variance and, therefore, incorporate the standard errors of the discharge estimates for each year. In order to accurately extrapolate these findings to nationally representative estimates, sampling weights must be employed. Not using the weights will lead to inaccurate national estimates. Taylor series linearization was used for variance estimation, and all estimates reported are weighted. We used the statistical program STATA 9.0. Percent increase in diabetes hospitalizations for specific age and sex strata were calculated as follows:

$$\begin{aligned}\%\ \text{Increase} = &(\text{population-adjusted hospitalizations}_{2006} \\ &- \text{population-adjusted hospitalizations}_{1993})/ \\ &(\text{population - adjusted hospitalizations}_{1993})\end{aligned}$$

Percent increases in overall hospitalizations in the NIS were also calculated for comparison.

In order to obtain the most common five diagnoses for years 1993 and 2004, we used primary diagnosis (DXCCS1) data grouped using the Clinical Classification Software (CCS) beginning in 1998 for 2006 and the Clinical Classification for Health Policy Research software (CCHRR) used before 1998 for 1993. As a subanalysis, we also evaluated the top five diagnoses for the overall population as well as stratified by gender across age groups. This project was classified as exempt by the University of Michigan Institutional Review Board.

Results

For 1993 and 2006, the NIS sample included data for 6,538,976 and 8,074,825 unweighted discharges, respectively, representing 34,714,530 and 39,450,216 discharges annually. Table 1 shows the sample characteristics of discharges for the overall population and for individuals with diabetes for both years.

Trends in hospitalizations associated with diabetes

Overall rates of hospitalizations associated with diabetes increased 65.3% (1,384/100,000 in 1993, 2,288/100,000 in 2006) over the 14-year period ($p < 0.001$ test for linear trend), with significant increases in hospitalizations among individuals aged 10–80+ years ($p < 0.001$).

Age-specific and sex-specific rates and trends

Starting in 1993, women compared with men had higher rates of hospitalizations associated with diabetes even after exclusion of hospitalizations associated with pregnancy, and these differences persisted through 2006 (Fig. 1). Rates of hospitalizations were highest among the oldest age strata, with evidence of a sex-by-age interaction (Fig. 2). For the year 2006, diabetes-associated hospitalization rates were higher among females compared with males for the age strata <50 years and lower among women compared with men for the age strata ≥50 years.

Figure 3 shows the relative percentage increase in hospitalizations for the period for each sex and age group. There were increases across all age and sex groups, but the largest increase in hospitalizations occurred primarily among adults aged 30–39 years, representing a 102% increase. Furthermore, relative to males, increases among females 20–39 years were approximately 1.3-fold higher, even after excluding hospitalizations related to pregnancy/childbirth. These differences were slightly reduced but similar after exclusion of hospitalizations related to pregnancy (59% increase for women 20–29 years and 110% increase for women 30–39 years). These trends in hospitalizations associated with diabetes contrast in

Table 1. Selected Characteristics of Entire Sample Overall and for Individuals with Diabetes in 1993 and 2006

	1993[a]		2006[a]	
	Total hospitalizations n (%)	*Hospitalizations with diabetes* n (%)	*Total hospitalizations* n (%)	*Hospitalizations with diabetes* n (%)
Total	6,538,976 (100.0)	662,779 (10.3)	8,074,825 (100.0)	1,400,854 (17.4)
Age, years				
<20 y	1,357,510 (20.7)	7,627 (1.1)	1,473,210 (18.3)	11,717 (0.9)
20–29	755,046 (11.5)	13,241 (2.0)	817,757 (10.1)	24,752 (1.8)
30–39	778,174 (11.8)	27,658 (4.2)	780,914 (9.7)	57,354 (4.1)
40–49	552,663 (8.4)	54,280 (8.2)	810,440 (10.1)	139,316 (9.9)
50–59	551,021 (8.5)	95,008 (14.3)	958,266 (11.9)	254,993 (18.2)
60–69	812,785 (12.5)	167,199 (25.2)	976,875 (12.1)	311,944 (22.2)
70–79	982,291 (15.2)	192,542 (29.1)	1,102,190 (13.7)	340,648 (24.3)
80+	747,527 (11.6)	105,198 (15.9)	1,147,144 (14.3)	260,001 (18.7)
Female	3,801,214 (58.2)	360,677 (54.7)	4,721,215 (58.6)	747,720 (53.4)
Insurance type				
Medicare	2,241,472 (34.8)	412,982 (62.6)	3,004,546 (37.4)	857,551 (61.4)
Medicaid	1,193,183 (18.3)	59,640 (8.9)	1,572,240 (19.6)	146,562 (10.5)
Private	2,444,818 (37.6)	148,583 (22.5)	2,750,515 (34.1)	298,971 (21.3)
Other	607,786 (9.3)	38,742 (5.9)	733,931 (9.0)	95,611 (6.8)

[a]*n*, unweighted number; (%), weighted percentage.

magnitude and, in some cases, direction with trends in overall hospitalization rates for adults over the same period, which were relatively stable for all adults (2.2% decrease), decreased 7.0% for adults 20–29, and increased just 0.2% for adults 30–39 years.

Primary diagnoses associated with diabetes hospitalizations

The ranking of the five most common primary diagnoses associated with diabetes-associated hospitalizations for the overall population and for individuals aged 20–39 years is shown in Table 2. Rankings for each of the age groups for the overall population and stratified by gender are shown in Appendix Tables 1,2, and 3 (supplemental material available online at www.liebertonline.com). There were no notable differences for the overall population either by year or by sex. Cardiovascular disease (CVD) accounted for a substantial proportion of hospitalizations in the older age groups, whereas psychiatric disorders accounted for a substantial proportion of hospitalizations in the younger age groups. The overall proportion of hospitalizations for diabetes with complications was higher for male compared with female patients. Among individuals 20–39 years, affective psychoses represented the second most common diagnosis for women (after excluding hospitalizations related to pregnancy), and schizophrenia represented the fifth most common diagnosis for men.

Hospital charges

Annual overall hospital charges increased 220% in inflation-adjusted terms, from $62.5 billion in 1993 to $200.1 billion in 2006. Medicare ($123.8 billion) accounted for the largest

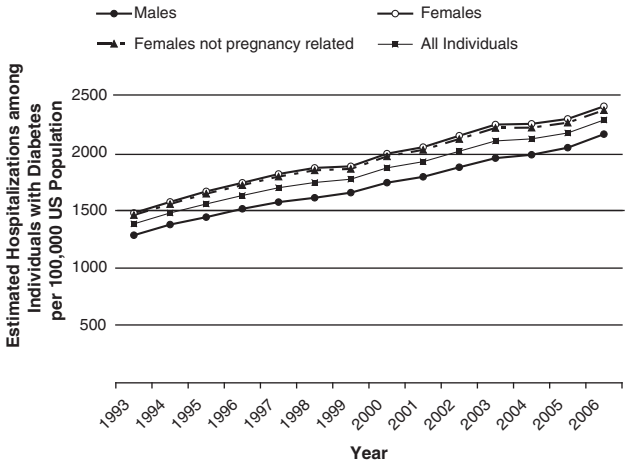

FIG. 1. Overall and sex-specific increases in population-adjusted hospitalizations among individuals with diabetes ($p < 0.001$ test for linear trend for overall population; $p < 0.001$ for all age strata except individuals 0–9 years).

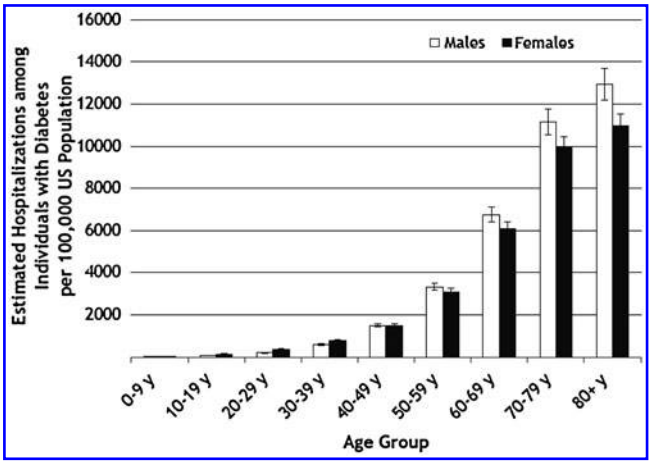

FIG. 2. Sex-specific population-adjusted hospitalization rates associated with diabetes by age group for the year 2006. Bars indicate 95% confidence intervals.

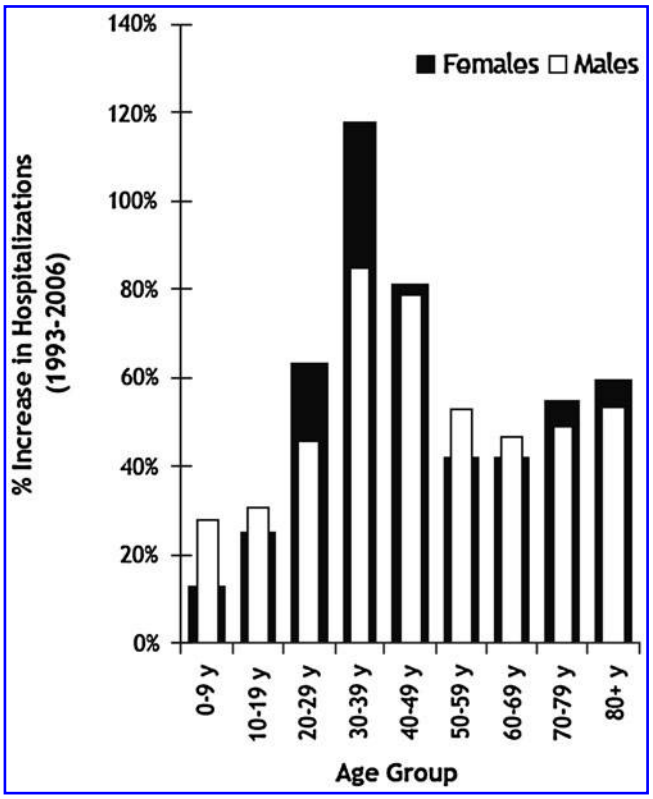

FIG. 3. Relative percentage increases in hospitalizations between 1993 and 2006 for all age and sex strata.

share of hospital charges by payer type in 2006, followed by private payers ($43.2 billion) and Medicaid ($20.8 billion).

Discussion

Our study presents an examination of temporal trends in hospitalizations and hospital charges affected by diabetes for age-specific and sex-specific strata across the entire U.S. population. We report significant increases in hospitalizations associated with diabetes, in particular for younger adults, over a recent 14-year period despite the fact that overall hospitalizations for young adults have decreased or remained relatively stable over the same period. According to the Centers for Disease Control and Prevention (CDC), people with diabetes are much less likely to be hospitalized compared with a decade ago.[11] Therefore, the increases in population-adjusted rates of hospitalizations may reflect increasing diabetes prevalence in the adult population. Consistent with our hypothesis, we found that the largest increases in hospitalizations associated with diabetes occurred among adults 30–39 years of age, which may well be related to increases in the prevalence of diabetes among this age group. One previously published study based on nationally representative data from the Behavioral Risk Factor Surveillance System (BRFSS) found that the largest increase in diabetes (70% increase) occurred among people aged 30–39 years over a similar time period (1990–1998).[2]

The larger increases in hospitalizations that we saw among young women aged 20–39 years compared with men, even after excluding hospitalizations associated with pregnancy and childbirth, could potentially be due to increases in dia-

TABLE 2. TOP FIVE PRIMARY DIAGNOSES AMONG DISCHARGES ASSOCIATED WITH DIABETES IN 1993 AND 2006 FOR ALL INDIVIDUALS OVERALL AND FOR MALES AND FEMALES (OVERALL AND AGED 20–39 YEARS)

	Overall population (1993)		*Overall population (2006)*		*Males all ages (2006)*		*Females all ages (2006)*		*Males 20–39 years (2006)*		*Females 20–39 years*[b] *(2006)*	
Rank	*Diagnosis*	*%*[a]	*Diagnosis*	*%*	*Diagnosis*	*%*	*Diagnosis*	*%*	*Diagnosis*	*%*	*Diagnosis*	*%*
1	Diabetes mellitus with complications	10.5	Diabetes mellitus with complications	7.5	Diabetes mellitus with complications	8.3	Diabetes mellitus with complications	6.9	Diabetes mellitus with complications	29.8	Diabetes mellitus with complications	24.0
2	Coronary atherosclerosis	8.7	Congestive heart failure	6.4	Coronary atherosclerosis	7.4	Congestive heart failure	6.2	Skin and subcutaneous tissue infections	5.2	Affective disorders	4.1
3	Congestive heart failure	7.9	Coronary atherosclerosis	5.9	Congestive heart failure	6.6	Coronary atherosclerosis	4.6	Pancreatic disorders	3.9	Skin and subcutaneous tissue infections	3.9
4	Acute myocardial infarction	4.3	Pneumonia	3.9	Pneumonia	4.0	Pneumonia	3.8	Nonspecific chest pain	3.5	Nonspecific chest pain	3.2
5	Pneumonia	3.8	Nonspecific chest pain	3.3	Acute myocardial infarction	3.6	Nonspecific chest pain	3.5	Schizophrenia and related disorders	2.9	Other nutritional, endocrine, and metabolic disorders	2.8

[a]All percentages are weighted.
[b]Rates were calculated after excluding discharges related to pregnancy.

betes prevalence and may be greater for women vs. men in this age group, particularly given higher rates of obesity for women vs. men documented in these age groups.[20] However, we are unaware of any studies that have evaluated both sex-specific and age-specific trends in diabetes prevalence in the United States over this period. One study using National Health and Nutrition Examination Survey (NHANES) data from a similar time period (1988–2002) reported greater increases in diabetes prevalence among men (7.9% to 10.2%) than in women (7.8% to 8.5%), but because this study combined adults of all ages, we speculate that larger increases in diabetes prevalence among young adult women compared with young adult men may have been masked by opposite trends in the older age groups.[21] This hypothesis is supported by data from Hillier and Pedula,[22] who studied patients with new-onset type 2 diabetes in a health maintenance organization between 1996 and 2000 and found that patients were more likely to be female if they had diabetes onset at a younger age (<45 years) but were more likely to be male if they had diabetes onset at older ages (≥45 years).

Another possibility is that the greater rate of hospitalizations among women compared with men is due to greater morbidity among women than men with diabetes. Studies have shown that women with diabetes have low use of diabetes-related preventative care, are less likely to receive aggressive medical management, and experience worse outcomes after hospitalization for CVD.[23–27] Furthermore, for those aged 20–39 years, affective diagnoses for women and schizophrenia for men were among the top five primary diagnoses associated with diabetes hospitalizations. The high prevalence of affective disorders among younger women may be a reflection of the fact that both younger age and female gender are associated with increased risk of depression among patients with diabetes,[28,29] which can be associated with increased healthcare use and expenditures for people with diabetes.[30]

Despite the higher rates of hospitalizations among women, men were more likely to have complications of diabetes mellitus, particularly between the ages of 20 and 39 years, although differences were not large. This finding contrasts with previous reports that have noted equivalent[31] or poorer control of diabetes among young women compared with men.[32] The high rates of schizophrenia diagnoses among younger men is of particular interest, given the recently publicized association of atypical neuroleptics with incident type 2 diabetes.[33]

We found that population-adjusted hospitalizations were greater in elderly men than in elderly women with diabetes in 2006. We are unaware of previous studies that examined hospitalizations in elderly men vs. women among adults with diabetes. A cross-sectional examination of NHANES data from 1999 to 2002 found that elderly people with diabetes were more likely to be female than male,[34] suggesting that greater rates of comorbid disease among men, rather than greater diabetes prevalence in men, caused more frequent hospitalizations in men with diabetes. Consistent with this explanation, male sex has been associated with higher comorbidity and all-cause mortality among older managed care enrollees with diabetes.[35] Particularly among the elderly, greater hospitalization rates in men may reflect other factors less directly related to illness that may favor more frequent hospitalization in elderly men, such as low socioeconomic status.[36] Despite these findings, the percent increase in hospitalizations between 1993 and 2006 was greater in elderly women than in men, suggesting that the burden of disease may be shifting.

We note that population-adjusted hospitalization rates were higher for men compared with women in most age strata, although overall population-adjusted hospitalization rates were higher for women across all years. This was accounted for by the fact that fewer men survive into their 70s and 80s, resulting in a lower Census population estimate for the denominator.

Finally, the dramatic increase in hospital charges related to diabetes over the 14-year study period is significant. Although the financial burden of diabetes hospitalizations is shared equally by private and public payers among younger people,[10] Medicare bears a disproportionate burden of the costs for older people with diabetes. As rates of diabetes continue to increase, particularly among younger cohorts of individuals, the future economic burden on Medicare will only escalate as these people age. In aggregate, these trends may serve as a compelling economic rationale for third-party payers in the public and private sectors to focus on diabetes prevention, particularly among younger adults in the population.

Limitations

We elected to perform our analysis starting in 1993, given that hospital data were drawn from a much larger sample of states for the NIS starting that year. We, however, speculate that increases in hospitalizations associated with diabetes were occurring before 1993, as the CDC reported increases in diabetes between 1988–1994 and 1999–2002.[21] Therefore, the increases that we report over this period likely represent a trend that has been occurring over a much longer period of time.

We note that the trends we report may be overestimated because of multiple factors. First, discharges from the NIS can include multiple hospitalizations for a single person; therefore, increases in population-adjusted rates of diabetes hospitalizations could well be related to increases in the severity of illness associated with diabetes (resulting in multiple hospitalizations for individuals) as well as an increased number of individuals with diabetes. Second, as a result of increasing awareness of type 2 diabetes during the period, providers may have been more likely to record a diagnosis of diabetes with hospitalizations. Finally, the definition of diabetes changed from having a fasting blood glucose of 140 mg/dL to having a fasting blood glucose of 126 mg/dL, in 1997, and the increased hospitalization rates could reflect the greater number of people subsequently diagnosed with diabetes according to the new criterion.[37]

Although we previously conducted a study of diabetes hospitalizations between 1993 and 2004 using the NIS, that study was exclusively focused on a subset of individuals, namely, children and young adults. We were unable to evaluate trends by diabetes type, particularly in children, as administrative coding by diabetes type may be subject to greater variability. Finally, because obesity as a comorbid diagnosis is likely undercoded, we were unable to quantify the extent to which obesity-related trends are affecting trends in type 2 diabetes prevalence.

Implications

Additional population-based studies are needed to better understand whether the differential increase in diabetes-related hospitalizations among young women of reproductive age and among young adults more broadly represents increasing incidence and prevalence of diabetes vs. an increasing burden of comorbid disease. The findings of these studies will have significant policy implications for care delivery and healthcare financing as these populations age.

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Disclosure Statement

The authors have no conflicts of interest to declare.

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(*Appendices follow*→)

Appendix Table 1. Top Five Primary Diagnoses Among Discharges Associated with Diabetes for Overall Population Across Specific Age Groups for 1993 and 2006. All Percentages Are Weighted

Age group	*1993*	*%*	*2006*	*%*
0–9 years	Diabetes mellitus with complications	64.4	Diabetes mellitus with complications	52.2
	Diabetes mellitus without complications	12.2	Diabetes mellitus without complications	30.5
	Other endocrine disorders	2.4	Fluid and electrolyte disorders	2.0
	Pneumonia	2.2	Epilepsy; convulsions	1.5
	Fluid and electrolyte disorders	1.8	Pneumonia	1.2
10–19 years	Diabetes mellitus with complications	68.0	Diabetes mellitus with complications	61.0
	Diabetes mellitus without complications	6.6	Diabetes mellitus without complications	10.0
	Affective disorders	1.5	Affective disorders	2.3
	Other endocrine disorders	1.4	Skin and subcutaneous tissue infections	2.0
	Skin and subcutaneous tissue infections	1.2	Complication of device; implant or graft	1.4
20–29 years	Diabetes mellitus with complications	50.8	Diabetes mellitus with complications	42.3
	Skin and subcutaneous tissue infections	2.5	Skin and subcutaneous tissue infections	3.8
	Pneumonia	2.3	Affective disorders	3.1
	Complication of device, implant or graft	2.3	Pancreatic disorders (not diabetes)	2.8
	Fluid and electrolyte disorders	2.0	Schizophrenia and related disorders	2.4
30–39 years	Diabetes mellitus with complications	30.1	Diabetes mellitus with complications	20.8
	Skin and subcutaneous tissue infections	3.7	Skin and subcutaneous tissue infections	4.8
	Complication of device, implant or graft	3.0	Nonspecific chest pain	4.2
	Pancreatic disorders (not diabetes)	2.7	Affective disorders	3.5
	Pneumonia	2.6	Pancreatic disorders (not diabetes)	3.2
40–49 years	Diabetes mellitus with complications	17.7	Diabetes mellitus with complications	12.1
	Coronary atherosclerosis	8.1	Nonspecific chest pain	5.9
	Nonspecific chest pain	4.0	Coronary atherosclerosis and other heart disease	5.1
	Skin and subcutaneous tissue infections	3.8	Skin and subcutaneous tissue infections	4.3
	Congestive heart failure; nonhypertensive	3.2	Congestive heart failure; nonhypertensive	3.1
50–59 years	Coronary atherosclerosis	11.8	Diabetes mellitus with complications	8.0
	Diabetes mellitus with complications	11.4	Coronary atherosclerosis and other heart disease	7.6
	Congestive heart failure; nonhypertensive	5.9	Nonspecific chest pain	4.9
	Acute myocardial infarction	4.6	Congestive heart failure; nonhypertensive	4.8
	Nonspecific chest pain	3.4	Acute myocardial infarction	3.1
60–69 years	Coronary atherosclerosis	11.3	Coronary atherosclerosis and other heart disease	8.2
	Congestive heart failure; nonhypertensive	8.3	Congestive heart failure; nonhypertensive	6.4
	Diabetes mellitus with complications	7.9	Diabetes mellitus with complications	5.3
	Acute myocardial infarction	4.9	Pneumonia	3.6
	Acute cerebrovascular disease	3.6	Nonspecific chest pain	3.3
70–79 years	Congestive heart failure; nonhypertensive	9.9	Congestive heart failure; nonhypertensive	7.8
	Coronary atherosclerosis	8.9	Coronary atherosclerosis and other heart disease	6.2
	Diabetes mellitus with complications	6.2	Pneumonia	4.6
	Acute myocardial infarction	4.8	Diabetes mellitus with complications	4.4
	Acute cerebrovascular disease	4.5	Acute myocardial infarction	3.2
80 and above	Congestive heart failure; nonhypertensive	11.2	Congestive heart failure; nonhypertensive	9.7
	Pneumonia	6.5	Pneumonia	6.0
	Diabetes mellitus with complications	5.9	Diabetes mellitus with complications	4.1
	Acute cerebrovascular disease	5.2	Urinary tract infections	3.7
	Coronary atherosclerosis	5.2	Septicemia (except in labor)	3.5

Appendix Table 2. Top Five Primary Diagnoses Among Discharges Associated with Diabetes for Males Across Specific Age Groups for 1993 and 2006. All Percentages Are Weighted

Age group	*1993*	*%*	*2006*	*%*
0–9 years	Diabetes mellitus with complications	62.5	Diabetes mellitus with complications	51.4
	Diabetes mellitus without complications	12.5	Diabetes mellitus without complications	30.0
	Pneumonia	2.4	Fluid and electrolyte disorders	2.1
	Fluid and electrolyte disorders	1.9	Epilepsy; convulsions	2.0
	Other endocrine disorders	1.9	Pneumonia	1.3
10–19 years	Diabetes mellitus with complications	66.4	Diabetes mellitus with complications	62.5
	Diabetes mellitus without complications	7.6	Diabetes mellitus without complications	12.2
	Other endocrine disorders	1.9	Affective disorders	1.7
	Pneumonia	1.4	Skin and subcutaneous tissue infections	1.7
	Affective disorders	1.4	Complication of device; implant or graft	1.1
20–29 years	Diabetes mellitus with complications	53.0	Diabetes mellitus with complications	47.2
	Skin and subcutaneous tissue infections	2.5	Skin and subcutaneous tissue infections	4.3
	Pneumonia	2.5	Pancreatic disorders (not diabetes)	3.2
	Complication of device; implant or graft	1.9	Schizophrenia and related disorders	2.8
	Fluid and electrolyte disorders	1.9	Affective disorders	2.4
30–39 years	Diabetes mellitus with complications	32.3	Diabetes mellitus with complications	23.6
	Skin and subcutaneous tissue infections	4.0	Skin and subcutaneous tissue infections	5.5
	Pancreatic disorders (not diabetes)	3.6	Nonspecific chest pain	4.3
	Complication of device; implant or graft	3.1	Pancreatic disorders (not diabetes)	4.1
	Coronary atherosclerosis	2.9	Schizophrenia and related disorders	2.9
40–49 years	Diabetes mellitus with complications	19.2	Diabetes mellitus with complications	13.7
	Coronary atherosclerosis	9.3	Coronary atherosclerosis and other heart disease	6.3
	Acute myocardial infarction	4.3	Nonspecific chest pain	5.6
	Skin and subcutaneous tissue infections	4.1	Skin and subcutaneous tissue infections	4.9
	Nonspecific chest pain	3.9	Congestive heart failure; nonhypertensive	3.5
50–59 years	Coronary atherosclerosis	13.7	Coronary atherosclerosis and other heart disease	9.5
	Diabetes mellitus with complications	11.5	Diabetes mellitus with complications	8.8
	Acute myocardial infarction	6.2	Congestive heart failure; nonhypertensive	5.3
	Congestive heart failure; nonhypertensive	5.6	Nonspecific chest pain	4.4
	Skin and subcutaneous tissue infections	3.5	Acute myocardial infarction	4.1
60–69 years	Coronary atherosclerosis	12.6	Coronary atherosclerosis and other heart disease	10.0
	Congestive heart failure; nonhypertensive	8.2	Congestive heart failure; nonhypertensive	6.7
	Diabetes mellitus with complications	7.6	Diabetes mellitus with complications	5.7
	Acute myocardial infarction	5.8	Acute myocardial infarction	4.0
	Acute cerebrovascular disease	3.9	Pneumonia	3.5
70–79 years	Congestive heart failure; nonhypertensive	9.8	Congestive heart failure; nonhypertensive	8.0
	Coronary atherosclerosis	9.3	Coronary atherosclerosis and other heart disease	7.4
	Diabetes mellitus with complications	6.1	Pneumonia	5.0
	Acute myocardial infarction	5.3	Diabetes mellitus with complications	4.4
	Pneumonia	4.7	Acute myocardial infarction	3.7
80 and above	Congestive heart failure; nonhypertensive	11.1	Congestive heart failure; nonhypertensive	9.8
	Pneumonia	7.7	Pneumonia	6.9
	Diabetes mellitus with complications	5.8	Diabetes mellitus with complications	4.2
	Coronary atherosclerosis	5.3	Coronary atherosclerosis and other heart disease	3.8
	Acute cerebrovascular disease	5.2	Acute myocardial infarction	3.7

(*Appendix continues*→)

Appendix Table 3. Top Five Primary Diagnoses Among Discharges Associated with Diabetes for Females Across Specific Age Groups for 1993 and 2006. All Percentages Are Weighted

Age group	*1993*	*%*	*2006*	*%*
0–9 years	Diabetes mellitus with complications	66.2	Diabetes mellitus with complications	53.2
	Diabetes mellitus without complications	11.8	Diabetes mellitus without complications	30.2
	Other endocrine disorders	2.8	Fluid and electrolyte disorders	1.9
	Pneumonia	1.9	135: Intestinal infection	1.6
	Fluid and electrolyte disorders	1.7	154: Noninfectious gastroenteritis	1.2
10–19 years	Diabetes mellitus with complications	69.1	Diabetes mellitus with complications	59.9
	Diabetes mellitus without complications	5.9	Diabetes mellitus without complications	8.3
	Affective disorders	1.7	Affective disorders	2.8
	Urinary tract infections	1.5	Skin and subcutaneous tissue infections	2.2
	Other mental conditions	1.3	Complication of device; implant or graft	1.6
20–29 years	Diabetes mellitus with complications	48.8	Diabetes mellitus with complications	38.3
	Urinary tract infections	3.2	Affective disorders	3.7
	Complication of device; implant or graft	2.6	Skin and subcutaneous tissue infections	3.4
	Skin and subcutaneous tissue infections	2.5	Urinary tract infections	3.1
	Pneumonia	2.2	Pancreatic disorders (not diabetes)	2.4
30–39 years	Diabetes mellitus with complications	27.8	Diabetes mellitus with complications	18.1
	Skin and subcutaneous tissue infections	3.4	Affective disorders	4.2
	Affective disorders	2.9	Skin and subcutaneous tissue infections	4.1
	Complication of device; implant or graft	2.9	Nonspecific chest pain	4.0
	Urinary tract infections	2.7	Other nutritional; endocrine; and metabolic disorders	3.1
40–49 years	Diabetes mellitus with complications	16.3	Diabetes mellitus with complications	10.5
	Coronary atherosclerosis	6.9	Nonspecific chest pain	6.1
	Nonspecific chest pain	4.2	Coronary atherosclerosis and other heart disease	3.9
	Skin and subcutaneous tissue infections	3.4	Skin and subcutaneous tissue infections	3.6
	Congestive heart failure; nonhypertensive	3.2	Asthma	3.1
50–59 years	Diabetes mellitus with complications	11.3	Diabetes mellitus with complications	7.3
	Coronary atherosclerosis	10.0	Coronary atherosclerosis and other heart disease	5.6
	Congestive heart failure; nonhypertensive	6.2	Nonspecific chest pain	5.5
	Nonspecific chest pain	3.9	Congestive heart failure; nonhypertensive	4.4
	Acute myocardial infarction	3.0	Pneumonia	3.1
60–69 years	Coronary atherosclerosis	10.1	Coronary atherosclerosis and other heart disease	6.5
	Congestive heart failure; nonhypertensive	8.4	Congestive heart failure; nonhypertensive	6.1
	Diabetes mellitus with complications	8.1	Diabetes mellitus with complications	5.0
	Acute myocardial infarction	4.1	Nonspecific chest pain	3.9
	Acute cerebrovascular disease	3.3	Pneumonia	3.7
70–79 years	Congestive heart failure; nonhypertensive	9.9	Congestive heart failure; nonhypertensive	7.6
	Coronary atherosclerosis	8.6	Coronary atherosclerosis and other heart disease	5.2
	Diabetes mellitus with complications	6.3	Diabetes mellitus with complications	4.4
	Acute cerebrovascular disease	4.5	Pneumonia	4.2
	Acute myocardial infarction	4.3	Cardiac dysrhythmias	3.0
80 and above	Congestive heart failure; nonhypertensive	11.3	Congestive heart failure; nonhypertensive	9.6
	Diabetes mellitus with complications	5.9	Pneumonia	5.4
	Pneumonia	5.8	Urinary tract infections	4.4
	Acute cerebrovascular disease	5.3	Diabetes mellitus with complications	4.0
	Coronary atherosclerosis	5.2	Septicemia (except in labor)	3.5