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Proportions and Trends of Adult Hospitalizations with Diabetes, United States, 2000–2018

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Abstract

Aims: To report the national proportions and trends of adult hospitalizations with diabetes in the United States during 2000–2018.

Methods: We used the 2000–2018 National Inpatient Sample to identify hospital discharges with any listed and primary diagnoses for diabetes, based on International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) and ICD-10-CM codes. We calculated proportions and trends of adult hospitalizations with diabetes, overall and by subpopulations. We used the Nationwide Readmissions Database to assess calendar-year and 30-day readmission rates.

Results: From 2000 to 2018, the proportion of hospitalizations among adults ≥18 years increased from 17.1% to 27.3% (average annual percentage change [AAPC] 2.5%; $P < 0.001$) for any listed diabetes codes and from 1.5% to 2.1% (AAPC 2.2%; $P < 0.001$) for primary diagnosis of diabetes. Men, non-Hispanic Black patients, and those from poorer zip codes had higher proportions of hospitalizations with diabetes codes.

Conclusion: In recent years, approximately one-quarter of adult hospitalizations in the United States had a listed diabetes code, increasing about 2.5% per year from 2000 to 2018. These data are important for benchmarking purposes, especially due to disruptions in health care utilization from the COVID-19 pandemic.

Keywords

National Inpatient Sample; Diabetes-related hospitalizations

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Author Contributions

Yan Zhang: study design, analysis, and writing.
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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Center for Disease Control and Prevention Diabetes.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic and long-lasting condition that affects approximately 37.1 million—or 14.7%— of U.S. adults, with a total direct and indirect estimated cost of $327 billion (1, 2). In 2019, 1.4 million new cases of diabetes—or 5.9 per 1,000 persons—were diagnosed among US adults aged 18 years or older (1). People with diabetes often have one or more complications, including cardiovascular disease or microvascular disease such as chronic kidney disease, diabetic retinopathy, and neuropathy (3, 4). In addition, patients with diabetes may experience acute events such as diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (5). All these conditions predispose people with diabetes to higher hospitalization rates than the general population.

The crude hospitalization rate due to diabetes as a primary diagnosis among U.S. adults with diagnosed diabetes was 23.7 per 1,000 adults in 2016 (6). The rate as either a primary or secondary diagnosis was 339.0 per 1,000 adults (6). However, the proportion and trend of hospitalizations in the United States with diabetes have not been reported. In this study, we reported the proportion and trend of any listed and primary listed adult diabetes hospitalizations in the United States, overall and by subgroups. These data are important for benchmarking purposes, especially due to worsening diabetes prevalence trends (1), rising direct and indirect costs due to diabetes (1), and disruptions in health care utilization from the COVID-19 pandemic (7).

2. METHODS

2.1. Data source

We used the 2000–2018 National Inpatient Sample (NIS) and 2010–2018 Nationwide Readmissions Database (NRD). NIS is a database containing nationally representative data on hospital inpatient stays from 48 states participating in the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project. NIS provides information on about seven million hospital stays, corresponding to more than 35 million hospitalizations annually (8). NIS used International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes before October 1, 2015, and 10th Revision (ICD-10-CM) codes thereafter. NIS also contains information on patient demographics, hospital location, payment sources, median income of the patient's zip code of residence, and patient disposition (i.e., where they went after their hospital stay). Like NIS, the NRD also uses ICD-9-CM and ICD-10-CM and contains verified patient linkage numbers that can be used to track a person across hospitals within a particular state and calendar year, thus allowing for hospital readmissions rate calculations. NRD represents approximately 35 million discharges each year (8).

2.2. Definitions

We identified all hospitalizations with diabetes codes among adults aged ≥18 years from 2000 to 2018. From 2000 to 2015, we used ICD-9-CM code 250. Per AHRQ recommendation, the 2015 estimates only included hospitalizations with ICD-9-CM codes from January through September due to the transition to ICD-10-CM codes

on October 1, 2015. Starting in 2016, ICD-10-CM codes E10, E11, or E13 were used to identify hospitalizations with diabetes. We examined diabetes primary diagnosis hospitalizations (diabetes ICD code listed first on the patient's record) and any listed diabetes hospitalizations (diabetes ICD code listed on the patient's record as a primary or secondary diagnosis). Counties with a population size of ≥50,000 residents were considered metropolitan; those with 2500–49,999 were considered micropolitan. Counties with <2500 residents were considered rural. Expected primary payers included Medicare, Medicaid, private insurance, self-pay (uninsured), and other (Worker's Compensation, TRICARE, CHAMPVA, Title V, and other government programs). Income level was defined by year-specific quartile classification of the estimated median household income of residents in the patient's zip code. Patient disposition included discharge to home; transfer to a short-term hospital, other intermediate care facility, or home health care; left against medical advice; or died. Hospital census regions included Northeast, Midwest, South, and West (8).

2.3. Statistical Analysis

We reported the crude proportion of any listed and primary diagnoses for adult hospitalizations with diabetes from 2000 to 2018. The 2015 Q1–Q3 NIS data were weighted to represent estimates for the entire year. We also stratified by age group, sex, race/ethnicity, facility location (metropolitan/micropolitan/rural), primary payer, zip code level income quartile, disposition, and U.S. region. Since 2012, NIS used a systematic sampling design to select approximately 20% sample of discharges, about seven million hospital stays from all hospitals, representing more than 35 million hospitalizations annually in the United States. From 1998 to 2011, NIS selected all discharges from a sample of hospitals. Because of the method change, NIS recalculated the weights for years prior to 2012 to allow for the analysis of trends over time (8). We calculated proportions, overall and by subgroup, by using the weighted number of hospitalizations with diabetes codes in the numerator divided by the weighted number of all adult hospitalizations, overall and within the respective strata. All proportions were presented as percentages. To compare with changes in the prevalence of diabetes, we also reported the prevalence in diagnosed diabetes from 2000 to 2018, obtained from the Centers for Disease Control and Prevention's United States Diabetes Surveillance System (6) and analyzed the trend.

Finally, we evaluated the contribution of readmissions to changes in diabetes hospitalizations. Using NRD we assessed changes in 30-day and calendar-year readmission rates for hospitalizations with any listed diabetes diagnosis. Readmissions were evaluated at the person level; any patient who had a repeat hospitalization with a diabetes diagnosis, within the calendar year or ≤30-day time periods, was considered a patient with readmission and was counted in the numerator. All unique patients with any listed diabetes diagnosis, including primary listed diagnosis, in a given calendar year were included in the denominator. For the 30-day analysis, patients with their first hospitalization in December in any given year and no subsequent hospitalization in that month were excluded from the numerator and denominator since they did not have the opportunity to be assessed for the full 30 days. For 2015, we assessed ICD-9-CM codes for the first three quarters of the year in NRD and ICD-10-CM codes for the final quarter.

We used SAS-Callable SUDAAN (RTI International, Research Triangle Park, NC) to account for the complex sampling design of NIS and Joinpoint Trend Analysis Software (version 4.2.0.2) to analyze trends from 2000 to 2018, overall and stratified by demographic and socioeconomic factors. Joinpoint was also used to analyze diagnosed diabetes trends. Joinpoint regression uses permutation tests to identify statistically significant changes in linear trends in either direction or magnitude (9). We calculated annual percentage change (APC) for each trend segment and the average annual percentage change (AAPC) for the overall trend. The race/ethnicity variable in NIS was incomplete prior to 2012 (>20% missing), so we calculated trends by race/ethnicity from 2012 to 2018. Analyses by income and metropolitan/micropolitan/rural status started from 2003 due to changes in methodology and availability of data. Trends were considered statistically significant with a two-sided *P* value <0.05.

3. RESULTS

3.1. Hospitalizations with any listed diabetes code

The weighted number of adult hospitalizations related to diabetes as any listed diagnosis increased steadily from 4,975,000 in 2000 to 8,252,000 in 2018 (Table 1). During this period, the proportion of adult hospitalizations with diabetes also increased steadily from 17.1% in 2000 to 27.3% in 2018, while the proportions of the U.S. adult population with diagnosed diabetes increased from 5.9% in 2000 to 10.1% in 2018 (6). The proportion of adult hospitalizations with diabetes varied by sociodemographic subgroups, payer, and hospital region, ranging from 4.9% (those aged 18–44 in 2000) to 39.0% (those aged 65–74 in 2018) (Table 1). Hospitalizations with diabetes were lowest among people aged 18–44 years and highest among those aged 65–74 years. Men, non-Hispanic Blacks, and those with Medicare as the primary payer had consistently higher proportions of hospitalizations with diabetes than women, members of other racial-ethnic groups, and those with other payers (Table 1, Figure 1).

Over the 19-year-period, an increasing trend in the proportion of adult hospitalizations with diabetes listed anywhere on the discharge record was observed overall and across all subgroups (average annual percent change [AAPC] range: 1.3% to 3.4%), although the magnitude of increase was not constant over time (Figure 1, Table 1). From 2000 to 2018, the overall proportion of adult hospitalizations with diabetes increased an average of 2.5% per year (*P* for AAPC <0.001). During 2000–2011, this proportion increased at an annual rate of 3.0% (*P* for APC <0.001) and then continued to increase at a slower rate of 1.8% per year after 2011 (*P* for APC <0.001). A similar pattern of greater increases in proportions during the earlier years and slower but significant increases around 2011 was also observed for all subgroups except people who died in the hospital, where the proportion remained flat from 2000 to 2006, then increased thereafter (Table 1, Figure 1).

3.2. Hospitalizations with a primary diagnosis of diabetes

The proportion of hospitalizations with a primary diagnosis of diabetes in the United States increased from 1.5% in 2000 to 2.1% in 2018 with AAPC of 2.2% (*P* < 0.001) (Table 2). During 2000–2014, the proportion increased at an annual rate of 1.3% (*P* for APC < 0.001)

and then continued to increase at a greater rate of 5.5% per year after 2014 (*P* for APC < 0.001). A similar pattern of slower increases in proportions during 2000–2014 and then greater increases after 2014 was also observed for many subgroups, including men, women, rural residence, Medicare beneficiaries, those living in zip codes with lower household income, and the West (Figure 2). The trend in in-hospital mortality showed a slight increase from 0.5 in 2014 and 2016 to 0.6 in 2018 (an increase of 8.1% per year after 2014, *P* for APC = 0.049) but an average decrease of 1.7% per year for the entire period (*P* for AAPC = 0.049) (Table 2).

3.3. Prevalence of diagnosed diabetes and hospital readmission rates

From 2000 to 2009 the prevalence of diagnosed diabetes increased with an APC of 4.4% (*P* < 0.001) and then continued to increase at a slower rate of 1.2% per year after 2009 (*P* for APC = 0.001) (Table 1). Calendar-year readmission rates with any listed diabetes diagnosis decreased from 32.8% in 2010 to 31.7% in 2018 (AAPC −0.5%, *P* < 0.001), and 30-day readmissions decreased from 18.9% in 2010 to 18.1% in 2018 (AAPC −0.5%, *P* = 0.004) (Table 1 and Figure 1).

4. DISCUSSION

Between 2000 and 2018, the proportion of hospitalizations for any listed diabetes codes among adults increased by a 2.5% annual average to 27.3% in 2018, and for a primary diagnosis of diabetes by a 2.2% annual average to 2.1% in 2018, in part explained by the increasing prevalence of diabetes during this time. Men, non-Hispanic Black patients, and those receiving care in poorer zip codes had higher proportions of hospitalizations with a diabetes code, both any listed and primary diagnoses. Nonetheless, overall proportion of hospitalizations with any listed diabetes codes decelerated after 2011, whereas the proportion of hospitalizations with a primary diabetes code accelerated after 2014.

These findings are consistent with those of a National Center for Health Statistics (NCHS) data brief on emergency department (ED) visits by patients with diabetes (10). In 2015, Hall et al. found that almost one-quarter of ED visits among adults ≥45 years were by people with diabetes. Like us, they also found an increased trend in the proportion of ED visits that were by patients with diabetes. The data brief, however, differed in their proportion of some subpopulations hospitalized with diabetes codes. For example, the NCHS data brief reported the highest proportion of ED visits for patients with diabetes in the ≥75 years age group followed by the 65–74 age group. We found the reverse was true, which is more consistent with the prevalence of diabetes in each of those age groups. This difference suggests that a greater proportion of patients with diabetes in the 65–74 age group compared to the ≥75 years age group may be admitted to the hospital from the ED. We also found that men, non-Hispanic Blacks, and Medicare recipients had higher proportions of any listed diabetes codes in their hospitalizations. These groups have a higher diagnosed diabetes prevalence, so this was expected (1,6,11). In addition to differences in disease prevalence, health care utilization also differs by subpopulation and affects our findings. For example, Taylor et al. found that ED visit rates were two to three times higher for non-Hispanic Blacks than for non-Hispanic Whites (12). This was explained by multiple factors including

barriers in access to care, greater disease severity, and differences in health care seeking behavior. Hospital readmissions, however, do not appear to explain the increased trend in hospitalizations with diabetes codes. Both calendar-year and 30-day readmission rates with any listed diabetes code decreased during the study period.

Interestingly, the proportion of hospitalizations with any listed or primary listed diabetes codes differed by subpopulation. Accordingly, a substantially lower proportion of those aged 18–44 years had any listed diabetes codes while that was not the case for the primary listed codes. A greater proportion of the primary listed codes was for acute complications of diabetes such as DKA, which are known to occur more frequently in the younger adult age group (5). This age group may also have more people with type 1 diabetes, who are also known to have higher rates of DKA than older age groups (13). In 2018, Fingar et al. found that the largest proportion of hospitalizations involving type 1 diabetes was for patients aged 18–34 years, while for hospitalizations for type 2 diabetes, the largest proportion was among patients aged 65–84 years (14). Similarly, the primary payer with the highest proportion of hospitalizations with diabetes codes differed depending on code location (primary versus any listed). For any listed diabetes codes, Medicare recipients had the highest proportion of admissions, while for primary listed diabetes codes the uninsured had the highest proportion. While the high prevalence of diabetes among the Medicare-insured population explains the former (6,11), it is less clear why uninsured adults have a higher proportion of primary listed diabetes codes. This may be because the uninsured are less likely to receive preventive services and optimal chronic disease management and may be more vulnerable to acute complications such as DKA (15).

The proportion of hospitalizations with any listed or primary listed diabetes codes differed by disposition type. A higher proportion of any listed diabetes codes was found for a disposition to skilled nursing facilities/home health care or death. These patients were likely older and/or more ill, and it is not surprising that they had a comorbid condition of diabetes. However, among those with primary listed codes, the highest proportion was for leaving against medical advice. It is concerning that many patients with acute diabetes conditions are leaving the hospital against medical advice, likely without full optimization of their glycemic state (16).

The trend in the proportion of diabetes hospitalization codes also differs by code placement. Although the proportion for both any listed and primary increased overall, there is a deceleration after 2011 for any listed and an acceleration after 2014 for primary. The deceleration after 2011 is likely due, in part, to the flattening in diagnosed diabetes prevalence after 2009 (17). The flattening was preceded by a sharp increase in prevalence that started in 1990. Surveillance artifact is also a consideration since the NIS sampling method changed after 2011. The acceleration in the proportion of primary diabetes hospitalization codes after 2014 may be due to the increase in certain acute diabetic complications, including DKA and hyperglycemic hyperosmolar state (6,18,19). This increase started in 2009 and was driven by those aged 18–44 years. Although the overall acceleration started in 2014, among those aged 18–44 years, the increase was apparent starting in 2007.

The increasing trend in the proportion of in-hospital deaths among adults hospitalized with any listed diabetes code is particularly concerning and contradicts trends reported in the literature. For example, Hall et al. reported an 8% decrease in overall in-hospital mortality from 2000 to 2010 (20). All select primary listed conditions showed a reduction in in-hospital mortality over time except for sepsis, for which in-hospital mortality increased 17%. Fingar et al. found that in 2018, the most common primary listed condition for hospitalizations among persons with type 2 diabetes was septicemia (14). The septicemia cases may be driving the increasing trend in in-hospital mortality in our data. In the early 2000s, Gohil et al. described an artificial increase in septicemia hospitalizations because of policy and coding changes (21). However, they reported an increase in less severe cases and a decrease in mortality, which contradicts what we found in our data. From 2000 to 2015, Harding et al. found an increasing trend in some infections among adults with diabetes, including septicemia (22).

For primary diabetes diagnoses codes, in-hospital mortality declined from 2000 to 2014. This is consistent with the CDC's Morbidity and Mortality Weekly Report on DKA, which reported an AAPC reduction of 6.8% over that same period (18). However, from 2014 to 2018, we saw a reversal in the in-hospital mortality trend for adults with primary listed diabetes codes, increasing at an APC of 8.1%. Further exploration into the mortality trends of both any listed and primary listed diabetes codes would be valuable.

5. LIMITATIONS

This report had several limitations. First, NIS contains event-level and not patient-level data. Many of the hospitalizations were readmissions rather than new admissions from unique patients. However, our 30-day and 1-year readmission analyses provide insight on the impact of readmissions on these estimates and trends, and we found readmissions to be decreasing from 2010 to 2018. Also, although NIS is the largest administrative dataset for U.S. inpatient admissions and is nationally representative, federal hospitals are not included in the sample, so the sample excludes a small segment of the U.S. population. Finally, our analysis did not make a distinction between type 1 and type 2 diabetes because of potential misclassification.

6. CONCLUSIONS

In summary, over 25% of hospitalizations from 2014 onward have a diabetes diagnoses code listed. We report an overall increasing proportion of hospitalizations with diabetes codes in both the any listed and primary diagnosis positions. The proportions vary by subpopulations and are generally consistent with differences in disease prevalence among these subpopulations. Readmission rates have decreased over time and thus are not the cause of this increase. Diagnosed diabetes prevalence has increased but not enough to explain the increase in the proportion of hospitalizations with diabetes codes in both any listed and primary positions. The recent resurgence in acute and chronic diabetes complications may be contributing to the increase. These data and trends may be useful for comparison purposes as we see the future effects of the COVID-19 pandemic on health care utilization practices.

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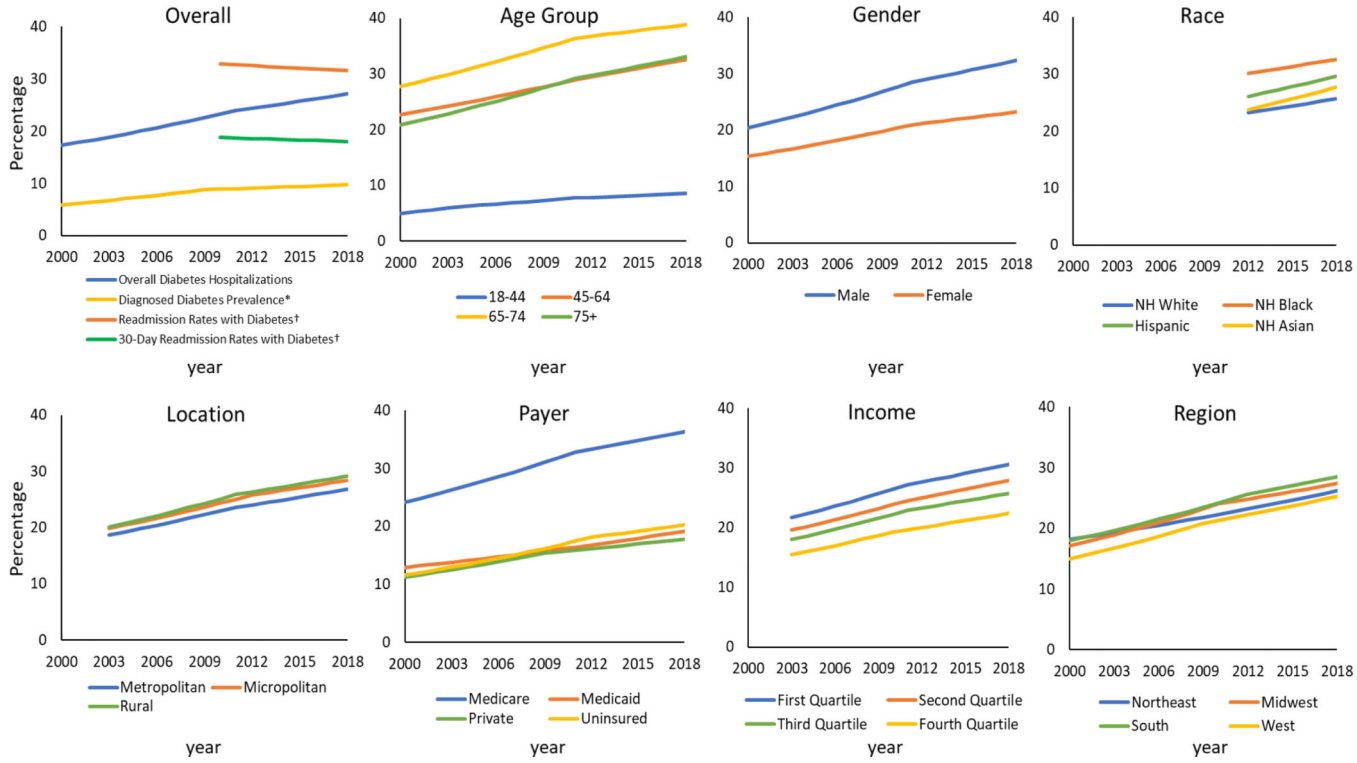

Figure 1.

Trends in proportion of adults with any listed hospitalizations with diabetes, National Inpatient Sample 2000 to 2018

NH = non-Hispanic

* Crude proportions of diagnosed diabetes from U.S. Diabetes Surveillance System (National Health Interview Survey 2000–2018)

† Readmission with diabetes was calculated with Nationwide Readmissions Database

All average annual percentage changes are statistically significant at $P < 0.001$, except for 30-day readmissions where $P = 0.004$.

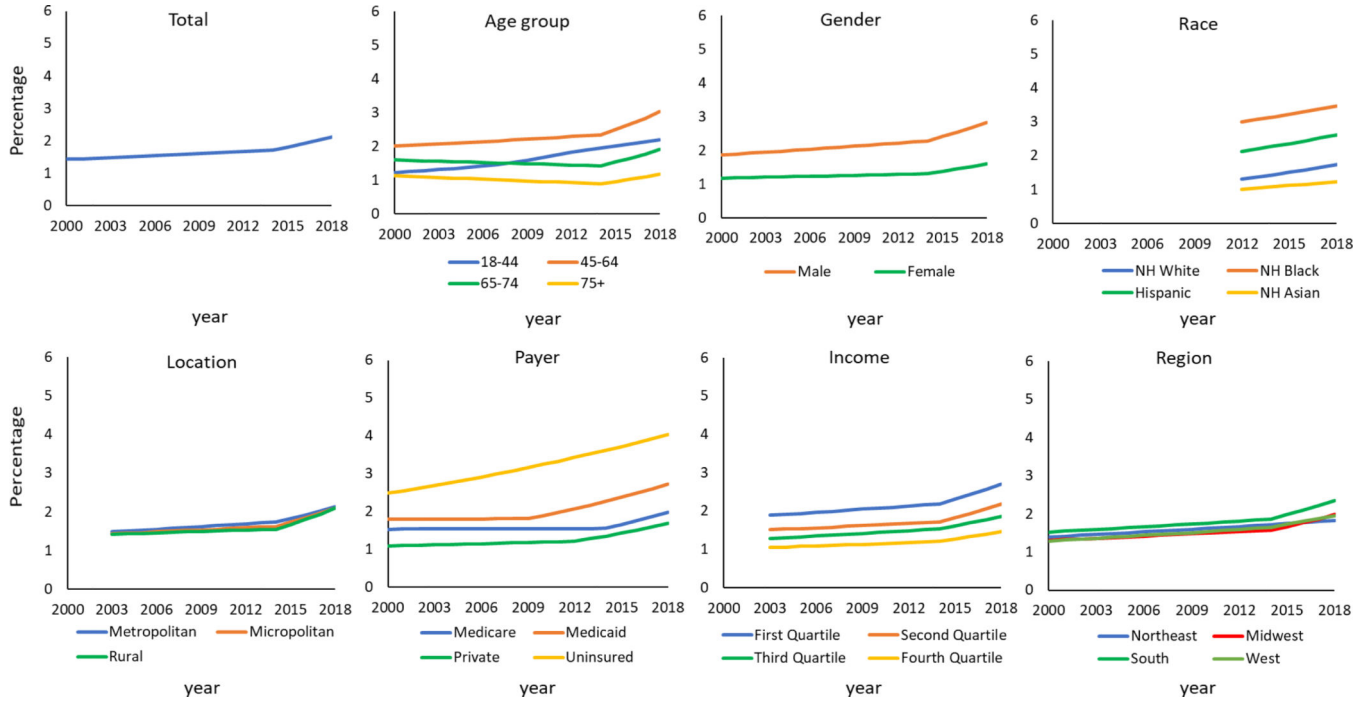

Figure 2.

Trends in proportion of adults with primary listed hospitalizations with diabetes, National Inpatient Sample 2000 to 2018

NH = non-Hispanic

All average annual percentage changes are statistically significant at P <0.05 except for age group 75+ (P value=0.525).

Table 1.

Proportions and trends of any listed hospitalizations with diabetes among all adult hospitalizations, overall and by age group, gender, race, hospital location, payer, income, disposition, and census region, National Inpatient Sample 2000 to 2018

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	Percent Change**	Joinpoint Year††	APC 1st Period/P value‡‡	APC 2ed Period/P value‡‡	APC 3rd period/ P value‡‡	AAPC/P value‡‡.
Diabetes population, N in 10,000s *	1186	1339	1513	1711	1865	2097	2132	2187	2310	2516	112.1					
Diagnosed Diabetes prevalence, % *	5.9	6.5	7.0	7.8	8.3	9.1	9.1	9.1	9.4	10.1	71.2	2009	4.4	1.2/0.001		2.8
Hospitalizations with any listed diabetes, N in 1,000s	4975	5571	6003	6547	6950	7242	7507	7490	7833	8252	65.9					
Hospitalizations with any listed diabetes, %	17.1	18.4	19.4	20.7	21.7	23.1	24.4	25.2	25.9	27.3	59.7	2011	3.0	1.8		2.5
1-year readmission with diabetes, %†	N/A	N/A	N/A	N/A	N/A	32.8	32.5	32.0	32.0	31.7	−3.3		−0.5			−0.5
30 day readmission with diabetes, %†	N/A	N/A	N/A	N/A	N/A	18.9	18.6	18.3	18.2	18.1	−4.2		−0.5/0.004			−0.5/0.004
Age group, years																
18–44	4.9	5.6	6.2	6.7	7.0	7.6	7.8	8.0	8.2	8.5	73.6	2004/2011	6.0	3.0	1.4	3.0
45–64	22.3	23.8	24.9	26.1	26.6	27.9	29.5	30.4	31.3	32.7	46.6	2011	2.3	1.7		2.0
65–74	27.7	29.4	30.6	32.2	33.3	35.2	36.8	37.5	37.9	39.0	41.0	2011	2.5	0.9		1.9
75+	20.9	22.3	23.5	25.0	26.3	28.3	29.8	30.8	31.7	33.1	58.6	2011	3.1	1.8		2.6
Gender																
Men	20.1	21.8	23.0	24.5	25.8	27.2	29.0	30.1	31.0	32.5	61.3	2011	3.1	1.9		2.6
Women	15.2	16.3	17.1	18.3	19.0	20.4	21.3	21.8	22.3	23.4	54.3	2011	2.9	1.5		2.3
Race/ethnicity																
Non-Hispanic White	N/A	N/A	N/A	N/A	N/A	N/A	23.2	24.0	24.6	25.7	10.8		1.7			1.7
Non-Hispanic Black	N/A	N/A	N/A	N/A	N/A	N/A	30.1	30.9	31.4	32.7	8.4		1.3			1.3
Hispanic	N/A	N/A	N/A	N/A	N/A	N/A	26.2	27.0	28.1	29.6	13.2		2.1			2.1

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	Percent Change**	Joinpoint Year††	APC 1st Period/P value‡‡	APC 2ed Period/P value‡‡	APC 3rd period/ P value‡‡	AAPC/P value‡‡.
Non-Hispanic Asian ≠	N/A	N/A	N/A	N/A	N/A	N/A	23.8	24.4	25.9	27.8	16.8		2.6			2.6
Hospital location																
Metropolitan	N/A	N/A	19.2	20.5	21.4	22.8	24.1	24.9	25.7	27.0	42.4	2011	2.9	1.9		2.4
Micropolitan	N/A	N/A	20.1	21.5	22.9	24.2	25.8	26.7	27.3	28.6	40.9	2012	2.9	1.6		2.4
Rural	N/A	N/A	20.4	21.6	23.2	25.2	26.3	27.3	28.0	29.4	42.3	2011	3.2	1.7		2.5
Payer																
Medicare	24.1	25.7	27.0	28.5	29.7	31.7	33.4	34.3	35.1	36.4	50.9	2011	2.8	1.5		2.3
Medicaid	12.7	13.3	14.2	14.8	15.4	16.2	17.0	17.6	18.2	19.1	49.7		2.2			2.2
Private	11.1	12.2	12.9	13.9	15.0	16.0	16.0	16.6	17.1	18.0	62.0	2009	3.5	1.6		2.6
Uninsured	11.3	12.8	13.5	14.6	15.5	16.8	18.1	18.7	19.2	20.5	80.3	2012	3.8	1.9		3.2
Other §	12.1	13.1	14.5	16.0	17.2	17.7	18.7	19.9	21.2	22.2	83.5	2006	4.7	2.8		3.4
Household income//																
First quartile (poorest)	N/A	N/A	22.2	23.6	24.8	26.0	27.7	28.6	29.2	30.8	38.2	2011	2.8	1.7		2.3
Second quartile	N/A	N/A	20.1	21.3	22.3	23.9	25.1	25.9	26.7	28.1	42.0	2011	2.8	1.9		2.4
Third quartile	N/A	N/A	18.5	19.7	20.7	22.1	23.4	23.9	24.6	26.0	42.5	2011	3.0	1.9		2.4
Fourth quartile (wealthiest)	N/A	N/A	15.7	17.3	17.9	19.3	20.1	20.6	21.4	22.5	43.9	2010	3.2	1.9		2.5
Disposition																
Routine (home)	14.9	16.1	16.7	17.9	18.8	19.7	20.7	21.0	21.6	22.6	51.8	2010	2.8	1.5		2.2
SNF or home health¶	24.0	25.3	26.4	27.9	28.7	30.6	32.6	33.4	34.4	36.1	50.5	2012	2.6	1.7		2.3
AMA	13.9	15.9	17.7	19.4	20.9	21.8	23.2	24.0	24.9	25.5	84.2	2006/2013	5.9	2.7	1.4	3.4
Died	20.1	21.0	20.7	20.9	21.8	25.8	28.5	29.6	30.8	31.9	58.9	2006/2011	−0.1/0.936	6.4	2.0	2.5
U.S. region#																
Northeast	17.9	18.6	19.4	21.5	20.6	22.2	23.5	24.0	25.0	26.1	45.6		2.0			2.0
Midwest	16.5	18.4	20.1	20.7	21.6	24.1	24.9	25.5	26.3	27.5	66.6	2010	3.5	1.7		2.7

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	Percent Change**	Joinpoint Year††	APC 1st Period/P value‡‡	APC 2ed Period/P value‡‡	APC 3rd period/ P value‡‡	AAPC/P value‡‡.
South	18.1	19.3	19.9	21.3	23.3	24.1	25.7	26.6	27.1	28.6	58.4	2012	3.0	1.7		2.6
West	14.8	16.3	17.2	18.7	19.7	21.0	22.3	23.0	24.1	25.3	71.3	2009	3.8	2.1		2.9

All numbers and proportions were weighted to all hospitalizations nationally. Proportions were based on no missing data, which were <5% for all stratifying variables. AMA, left against medical advice; N/A, not available; SNF, skilled nursing facility; APC, annual percentage change; AAPC, average annual percentage change.

*Data come from U.S. Diabetes Surveillance System, National Health Interview Survey (NHIS 2000–2018).

†Calculated with National Readmission Data (NRD 2010–2018).

‡Includes Pacific Islanders.

§Includes Worker's Compensation, TRICARE, CHAMPVA, Title V, and other government programs.

//Median household income for patient's zip code.

¶Includes transfer to other short-term hospital.

#As defined by the U.S. Census Bureau.

**Percent change between 2000 and 2018 except from 2003 to 2018 for urban/rural status and income, and from 2012 to 2018 for race.

††Year in which trend changed in magnitude or direction.

‡‡All APC and AAPC *P* values < 0.001 except where indicated.

Table 2.

Proportions and trends of primary listed hospitalizations with diabetes among all adult hospitalizations, overall and by age group, gender, race, hospital location, payer, income, disposition, and census region, National Inpatient Sample 2000 to 2018

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	Percent Change¶	Joinpoint Year#	APC 1st Period/P value**	APC 2ed Period/P value**	APC 3rd period/P value**	AAPC/P value**
Hospitalizations with primary listed diabetes, N in 1,000s	432	446	467	488	489	508	513	521	548	647	49.8					
Hospitalizations with primary listed diabetes, %	1.5	1.5	1.5	1.5	1.5	1.6	1.7	1.8	1.8	2.1	44.2	2014	1.3	5.5		2.2
Age group, years																
18–44	1.2	1.3	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2	79.6	2007/2012	2.6	4.7	3.1	3.3
45–64	2.2	2.1	2.1	2.1	2.1	2.2	2.3	2.4	2.5	3.0	41.1	2014	1.1	6.5		2.3
65–74	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.5	1.5	1.9	20.2	2014	−0.9	7.8		1.0
75+	1.1	1.1	1.1	1.1	1.0	1.0	0.9	0.9	0.9	1.2	9.3	2014	−1.7	7.1		0.2/0.525
Gender																
Men	1.9	1.9	2.0	2.0	2.0	2.1	2.2	2.3	2.4	2.9	47.9	2014	1.4	5.6		2.3
Women	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.4	1.6	33.7	2014	0.8	5.0		1.8
Race/ethnicity																
Non-Hispanic White	N/A	N/A	N/A	N/A	N/A	N/A	1.3	1.4	1.5	1.8	32.6		4.7/0.001			4.7/0.001
Non-Hispanic Black	N/A	N/A	N/A	N/A	N/A	N/A	3.1	3.1	3.2	3.5	14.6		2.5/0.005			2.5/0.005
Hispanic	N/A	N/A	N/A	N/A	N/A	N/A	2.2	2.2	2.3	2.7	22.5		3.6/0.006			3.6/0.006
Non-Hispanic Asian*	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.1	1.1	1.3	25.5		3.3/0.016			3.3/0.016
Hospital location																
Metropolitan	N/A	N/A	1.5	1.6	1.6	1.7	1.7	1.8	1.8	2.1	42.5	2014	1.5	5.0		2.4
Micropolitan	N/A	N/A	1.5	1.5	1.5	1.4	1.6	1.7	1.8	2.1	40.8	2014	1.2/0.031	6.5		2.6
Rural	N/A	N/A	1.5	1.4	1.5	1.5	1.5	1.6	1.7	2.1	47.4	2014	0.8/0.013	7.8		2.6
Payer																

	2000	2002	2004	2006	2008	2010	2012	2014	2016	2018	Percent Change¶	Joinpoint Year#	APC 1st Period/P value**	APC 2ed Period/P value**	APC 3rd period/P value**	AAPC/P value**
Medicare	1.6	1.5	1.6	1.6	1.5	1.6	1.6	1.6	1.7	2.0	27.8	2014	0.1/0.613	6.3		1.4
Medicaid	1.8	1.7	1.8	1.8	1.9	1.9	2.0	2.3	2.4	2.7	50.4	2009	0.1/0.842	4.6		2.4
Private	1.1	1.2	1.1	1.1	1.2	1.2	1.2	1.4	1.4	1.7	52.0	2012	0.9/0.008	5.5		2.4
Uninsured	2.5	2.6	2.7	2.9	3.0	3.2	3.6	3.5	3.7	4.0	60.9		2.7			2.7
Other†	1.7	1.5	1.6	1.9	1.8	2.0	2.0	1.8	1.8	2.0	21.9		1.0/0.013			1.0/0.013
Household income‡																
First quartile (poorest)	N/A	N/A	2.0	2.0	2.0	2.1	2.1	2.2	2.3	2.7	39.1	2014	1.3/0.002	5.4		2.3
Second quartile	N/A	N/A	1.5	1.6	1.5	1.6	1.7	1.8	1.8	2.2	45.1	2014	1.2	6.1		2.5
Third quartile	N/A	N/A	1.3	1.3	1.4	1.4	1.5	1.6	1.6	1.9	43.6	2014	1.7	5.0		2.5
Fourth quartile (wealthiest)	N/A	N/A	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.5	37.3	2014	1.3	4.9		2.2
Disposition																
Routine (home)	1.4	1.4	1.4	1.4	1.5	1.6	1.6	1.7	1.8	2.0	47.1	2005/2014	0.4/0.606	2.3	4.1	2.2
SNF or home health§	1.9	1.9	1.9	1.9	1.7	1.7	1.7	1.8	1.8	2.4	24.0	2014	−0.6/0.06	7.6		1.2
AMA	2.7	2.7	3.1	3.4	3.6	3.7	4.3	4.4	4.6	5.0	85.6		3.6			3.6
Died	0.8	0.7	0.7	0.6	0.5	0.5	0.5	0.5	0.5	0.6	−25.1	2009/2014	−5.6	−2.0/0.417	8.1/0.049	−1.7/0.049
U.S. region//																
Northeast	1.5	1.5	1.5	1.7	1.5	1.6	1.6	1.6	1.7	2.0	32.5		1.5			1.5
Midwest	1.4	1.4	1.4	1.3	1.3	1.5	1.6	1.6	1.7	2.0	47.5	2014	1.3	5.9		2.3
South	1.6	1.6	1.6	1.6	1.7	1.8	1.8	1.9	2.0	2.4	47.9	2014	1.5	6.0		2.4
West	1.4	1.3	1.4	1.4	1.4	1.5	1.6	1.7	1.7	2.0	43.8	2014	1.8	4.4		2.3

All numbers and proportions were weighted to all hospitalizations nationally. Proportions were based on no missing data, which were <5% for all stratifying variables. AMA, left against medical advice; N/A, not available; SNF, skilled nursing facility; APC, annual percentage change; AAPC, average annual percentage change.

*Includes Pacific Islanders.

†Includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs.

‡Median household income for patient's zip code.

[§]Includes transfer to other short-term hospital.

[//]As defined by the U.S. Census Bureau.

[¶]Percent change between 2000 and 2018 except from 2003 to 2018 for urban/rural status and income, and from 2012 to 2018 for race/ethnicity.

[#]Year in which trend changed in magnitude or direction.

[‡]Median household income for patient's zip code.

[**]All APC and AAPC *P* values < 0.001 except where indicated.