Annual Total Medical Expenditures Associated with Hypertension by Diabetes Status in U.S. Adults

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Abstract

Introduction—Hypertension and diabetes, both independent risk factors for cardiovascular disease, often coexist. The hypertension-increased medical expenditures by diabetes status is unclear, however. This study estimated annual total medical expenditures in U.S. adults by hypertension and diabetes status.

Methods—The study population consisted of 40,746 civilian, non-institutionalized adults aged 18 years who participated in the 2013 or 2014 Medical Expenditure Panel Survey. The authors separately estimated hypertension-increased medical expenditures using two-part econometric and generalized linear models for the total; diabetes (*n*=4,396); and non-diabetes (*n*=36,250) populations and adjusted the results into 2014 U.S. dollars. Data were analyzed in 2017 and estimated the hypertension-increased medical expenditures by type of medical service and payment source.

Results—The prevalence of hypertension was 34.9%, 78.3%, and 30.1% for the total, diabetes, and non-diabetes populations, respectively. The respective mean unadjusted annual per capita medical expenditures were $5,225, $12,715, and $4,390. After controlling for potential confounders, hypertension-increased expenditures were $2,565, $4,434, and $2,276 for total, diabetes, and non-diabetes populations, respectively (all *p*<0.001). The hypertension-increased expenditure was highest for inpatient stays among the diabetes population ($1,730, *p*<0.001), and highest for medication among the non-diabetes population ($687, *p*<0.001). By payment source, Medicare ranked first in hypertension-increased expenditures for the diabetes ($2,753) and second for the non-diabetes ($669) populations (both *p*<0.001).

Conclusions—Hypertension-increased medical expenditures were substantial and varied by medical service type and payment sources. These findings may be useful as inputs for cost-effectiveness evaluations of hypertension interventions by diabetes status.

Introduction

In 2013–2014 the overall prevalence of hypertension among American adults aged 18 years was 29.3% (75.2 million people).[1,2] From 1980 to 2014, the number of people in the U.S. civilian, non-institutionalized population with diagnosed diabetes more than tripled, from 5.5 million to 21.9 million, and the rate of diagnosed diabetes increased among people of all age groups.[3,4] Both hypertension and diabetes are serious health problems requiring timely medical treatment, and they are also major risk factors for cardiovascular disease (CVD), the leading cause of death in the U.S.[5] In addition, many studies have demonstrated the tremendous economic burden associated with hypertension, diabetes, and CVD.[6–13] The health and economic burdens associated with hypertension, diabetes, and CVD suggest a pressing need to develop effective public health strategies to prevent and control these common health conditions.

Hypertension and diabetes often coexist.[14–20] For example, the prevalence of hypertension among people with diabetes has been estimated at more than 70%,[20] and the 2013–2014 Medical Expenditure Survey (MEPS) in the U.S. showed that this prevalence could be as high as 78%. The coexistence of hypertension and diabetes can markedly increase further an affected person's risk of CVD,[19] and thus comprehensive interventions, such as the use of various strategies to control hypertension among patients with diabetes are needed for dealing with these costly health conditions. Information on economic costs by hypertension and diabetes status should be useful in evaluating intervention programs.

The influence of hypertension on total medical expenditures by diabetes status is unclear, even though some studies have used hypertension as a risk factor for the economic burden of diabetes.[9–13] To the authors' knowledge, studies have not compared hypertension-induced medical expenditures between populations with and without diabetes. The present study estimates hypertension-increased expenditures by type of medical service (inpatient, outpatient, prescription medications, emergency room, and other medical services) and payment source (Medicare, Medicaid, private insurance, out of pocket, other public programs, and other sources) for adults with and without diabetes in the U.S.

Methods

Study Sample

This study used the most recent comprehensive nationally representative survey of health status, use of health care, medical expenditures, payment sources, and health insurance coverage for the U.S. civilian non-institutionalized population, the MEPS. Data were pooled from the 2013 and 2014 MEPSs to increase the sample size for the population with hypertension and diabetes. The MEPS is sponsored by the U.S. Agency for Healthcare Research and Quality and the Centers for Disease Control and Prevention. Respondents to the MEPS are drawn annually from a subsample of households that participated in the immediately preceding National Health Interview Survey, which is administered by the National Center for Health Statistics of the Centers for Disease Control and Prevention. Each year, the MEPS samples about 39,000 individuals from the National Health Interview Survey. From the full-year consolidated data file for the 2013 and 2014 MEPSs, the authors

identified 40,746 adult men and non-pregnant women aged 18 years for the analyses (excluded pregnant women, *n*=1,297). Detailed descriptions of the MEPS survey design, sample design, and methods used to minimize sources of non-sampling errors have been published elsewhere.[21,22] The MEPS has been used extensively for research on various health economics topics, including the economic burden of hypertension, diabetes, and CVD.[6,9,23–30]

Information on medical expenditures was obtained from household interviews, with the data obtained subsequently confirmed through physician's offices, hospitals, and records of insurance coverage based on actual payment. Expenditures were categorized into five service types: inpatient, outpatient, emergency room visit, prescription medications, and other medical services, such as medical equipment for home health care and other miscellaneous items or services. By payment sources, the expenditures were grouped into Medicare, out of pocket, private insurance, Medicaid, and other sources such as Veterans Administration, other public and unclassified sources. All expenditures of 2013 were adjusted to 2014 U.S. dollars using the gross domestic product deflator.[31] In addition to the detailed information on expenditures by service types and payment sources, the MEPS contained a variety of socioeconomic variables and health risk factors that can be controlled for in regression analysis (Appendix Table 1, available online).

Measures

Hypertension was defined as ever having been diagnosed as having high blood pressure other than during pregnancy. Diabetes was defined as ever having been diagnosed with diabetes excluding gestational diabetes. With the MEPS, there are two ways to identify certain health conditions, such as hypertension and diabetes. One uses the full-year consolidated files to identify persons who ever had a health condition, and another uses ICD-9 diagnosis codes in the medical condition files to identify persons who used any medical services related to that condition during the survey period. The first method was used to define hypertension and diabetes to be consistent with those used in the literature. [4,26,29,30]

Statistical Analysis

The authors compared medical expenditures between hypertensive and normotensive adults for the total, diabetes, and non-diabetes populations separately. Because of the nature of the MEPS medical expenditure data (e.g., zero expenditures for some respondents and skewness), a two-part econometric model and generalized linear model (GLM) were employed for estimating the medical expenditures associated with hypertension for the three study samples (total, with diabetes, no diabetes). These approaches have frequently been used by researchers in studying information on medical costs.[23,26,29] For the situation with a significant number of zero expenditures, the authors used a two-part model consisting of a logit model to estimate the probability of an individual having had any medical expenditures and a GLM for the individuals with positive medical expenditures with a log link to estimate the amount of medical expenditure associated with hypertension. Finally, based on the two-part regression results, hypertension-increased expenditure for the total, diabetes, and no-diabetes populations were derived separately. For those with a small number of zero medical

expenditures, GLM with a log link and gamma distribution was used for estimating hypertension-increased medical expenditures. Specifically, the regression results were used to predict the mean annual expenditures for people with hypertension and those without. For each individual the expenditure was predicted twice, once by assuming this person had hypertension and another by assuming this person had normal blood pressure. The difference between the two predicted annual mean expenditures was the hypertension-increased expenditure. That is, the hypertension-increased expenditure is calculated as the incremental expenditure comparing people with hypertension and those without, rather than as hypertension treatment expenditures. For each study sample (total, with diabetes, no diabetes), the authors ran the same two-part model or GLM to estimate hypertension-increased expenditures by five service types and five payment sources, respectively. There was no further subpopulation analysis.

The regression analyses included age, sex, race/ethnicity, marital status, education, geographic region, family income, insurance status, smoking status, body weight, and perceived general health status as the main control variables. For analyzing medical expenditures, some major comorbidities or a comorbidity index, such as the Charlson comorbidity index, should be controlled. However, hypertension is a health condition as well as an independent risk factor for many chronic diseases, including heart disease and stroke. Controlling major comorbidities or Charlson comorbidity index will potentially underestimate the expenditure that is associated with hypertension.[23,26] The authors believe that for this analysis on the general population including smoking, body weight, and self-reported health status are sufficient for estimating the total medical expenditures. Data were analyzed in 2017, and Stata, version 14, was used for all the analyses.

Results

The prevalence of hypertension was 34.9% in the general population, 78.3% for persons with diabetes, and 30.1% for people without diabetes (Table 1). Prevalence increased sharply with age in all three groups, with a particularly high prevalence (all above 54%) seen in the diabetes population even in the youngest age group (18– 44 years). Overall, prevalence was slightly higher for men than for women. By race/ethnicity, non-Hispanic blacks had the highest prevalence, reaching 83.5% for blacks with diabetes. People with obesity had a much higher prevalence of hypertension than people of normal weight, at 82.5% for people with obesity and diabetes.

The mean unadjusted annual medical expenditure for the general population was $5,225 (SE=102), and hypertensive persons had more than twice the expenditure of normotensives ($8,854 [SE=210] vs $3,276 [SE=93]; Table 2). In the diabetes population, the estimate for those with hypertension was $13,929 (SE=541). In general, expenditures increased sharply with age, but even at a young age (18–44 years) they were high for people with both diabetes and hypertension ($9,943 [SE=1,317]). Medical expenditures were higher for men than for women for people with diabetes, but higher for women than men for those without diabetes. Overall, non-Hispanic whites and blacks had higher expenditures than Hispanics, and such differences were seen throughout the populations without diabetes and in most cases in the population with that disorder. The patterns of higher expenditures for hypertensive versus

normotensive persons were for the most part similar across various population groups as well as across service types and payment sources, and the majority of the differences were statistically significant.

The mean adjusted annual medical expenditure associated with hypertension was estimated at $2,565 for the overall study sample, $4,434 for the population with diabetes, and $2,276 for those without diabetes (all $p<0.001$). By service type, in the overall study population, the hypertension-increased expenditure was highest for inpatient care ($767), followed by prescription medication ($758) and outpatient services ($595, all $p<0.001$ vs those who were normotensive; Table 3). In the population with diabetes, the hypertension-increased expenditure was highest for inpatient care ($1,730), followed by medication ($1,272) and outpatient services ($926, all $p<0.001$). In the population without diabetes, the hypertension-increased expenditure was highest for prescription medication ($687), followed by outpatient services ($565) and inpatient care ($468, all $p<0.001$).

By payment source, for the total population, hypertension-increased expenditure was paid most often by the Medicare program ($1,159), followed by private insurance ($736) and other sources ($254, all $p<0.001$ vs those who were normotensive; Table 3). Increased Medicare payment again ranked first for the population with diabetes ($2,753), followed by private insurance ($1,346) and out of pocket ($395, all $p<0.001$). For the population without diabetes, the hypertension-increased expenditures paid by private insurance were $716, followed by Medicare ($669) and Medicaid ($312). It is worth noting that for the population without diabetes, although private insurance payment ranked first, at $716, Medicare payment was also high, accounting for nearly one third of the total expenditures ($669 of $2,276).

Discussion

These results confirmed that hypertension is a high-prevalence condition in the U.S. About one third of U.S. adults had this condition in 2013–2014, similar to the rate of 32.2% from the 2007 MEPS.[26] And these results further suggest an alarmingly high prevalence of hypertension in the diabetes population of 78%. The latter figure is consistent with the findings from a report on the economic costs of diabetes in the U.S.[20] The coexistence of hypertension and diabetes presents a formidable public health challenge that underscores the need for developing comprehensive intervention programs focusing on both health conditions. For adults with diabetes, aggressive treatment of hypertension is recommended. [32] Clearly, hypertension prevention should be a public health priority, especially among people with diabetes.

The current results for medical expenditure by hypertension and diabetes status provide much needed information that indicates the great economic burden associated with these health conditions. Based on the national weighted number of persons with diabetes and hypertension (16.16 million) and this study's estimated mean annual hypertension-increased medical expenditures of $4,434, the national burden of hypertension among people with diabetes was estimated at $71.6 billion in 2013–2014. Similarly, the national burden of hypertension among people without diabetes was estimated at $126.7 billion. Thus, the total

national burden of hypertension could be as high as $198.3 billion in 2014 U.S. dollars. Although not directly comparable, high medical expenditures associated with hypertension have been reported in the literature. Using 1998 MEPS data, Graden[30] estimated the total direct medical expenditures for people with self-reported hypertension at $173 billion. Another study using a variety of data sets reported healthcare spending attributable to hypertension at $108.8 billion in 1998.[33]

Hypertension-associated medical expenditures were substantial and higher in persons with diabetes than those without. By type of medical service utilization, the population with diabetes incurred much higher spending for inpatient services and prescription medications than for outpatient services, contrasting sharply with the population without diabetes, where the costs of prescription medication were the highest at $687, but close with the costs of outpatient and inpatient services in size ($565 and $468). More important, the estimate for inpatient care for those with diabetes ($1,730) was 3.7 times as high as it was for the population without diabetes ($468).

These findings have implications for the development of interventions and program evaluations. For example, focusing on investigating the use of inpatient services and prescription medications is the key to controlling the medical expenditures of the population with diabetes, whereas for the population without diabetes, prescription medication and outpatient services should be the focal point for controlling medical expenditures. For both populations with and without diabetes, hypertension-increased expenditures are mainly because of medications. The literature has shown that prescription medications accounted for 430% of the total medical expenditures in diabetes and 25% in non-diabetes populations. [29] Furthermore, expenditures on medications increased by more than three times from 1987 to 2011 in persons with diabetes. The substantial hypertension-associated expenditures overall and in prescription medications, plus the high prevalence of hypertension, imply that hypertension imposes a large financial burden on the healthcare system and further underscores the need for hypertension prevention.

By source of payment, this study found that Medicare was the most important source, especially for the population with diabetes, higher than any other payment sources for hypertension-increased medical expenditures. This finding suggests the need to manage hypertension better among the population with diabetes, as doing so would appear to have great potential for alleviating the economic burden on public insurance programs. Programs for improving the quality of care, such as incorporating hypertension management in the care of the population with diabetes and aggressive hypertension treatment among diabetes populations, might be viable economically.[32,34]

Several strengths of this study are worth noting. First, data are from the most recent comprehensive national survey, MEPS, which not only provides nationally representative information regarding the patterns of healthcare utilization in the U.S. but also yields high-quality data on medical expenditures. The medical expenditures were based on payments rather than charges and were obtained by face-to-face interviews and confirmed by healthcare providers and insurance plans. Having high-quality expenditure data and a large, nationally representative sample were critical in developing scientifically sound estimates of

hypertension-increased medical expenditures. Second, a two-part econometric model was used, which was plausible for analyzing medical expenditures developed using a survey of the general population, where there are many people who incur no medical expenditures at all in a given year and where such data are often skewed. Additionally, the MEPS contained various demographic and socioeconomic variables that were used as controls in the regression models.

Third, the authors not only analyzed hypertension-associated medical expenditures by diabetes status but also investigated expenditures by types of medical service. These explorations provided detailed information on expenditures by hypertension and diabetes status. These detailed presentations of expenditures should be useful in developing various interventions for managing hypertension and diabetes among various targeted populations. Finally, the use of five payment sources enabled the authors to derive the burden for public programs, such as Medicare and Medicaid. This study found that Medicare ranked first for hypertension-increased medical expenditures among the population with diabetes.

Limitations

Its considerable strengths notwithstanding, two limitations associated with this study should be considered when interpreting these results. First, although the MEPS is the largest nationally representative survey in the U.S. monitoring national health status, healthcare utilization, and medical spending, the survey population was limited to non-institutionalized, civilian men and women. Because rates of both hypertension and diabetes are closely related with aging, and aging populations are more likely to reside in nursing homes or other institutions that the MEPS does not cover, these estimates should be interpreted as conservative. Second, although the MEPS has been a panel survey since 1996 and the 2013 and 2014 MEPS data were pooled for this analysis, the nature of the survey and analytic sample still allow only a cross-sectional analysis. Thus, no causal relationship should be assumed.

Conclusions

The authors succeeded in conducting a comprehensive analysis of hypertension-increased medical expenditures by employing an advanced econometric modeling technique using a large nationally representative survey. The results indicate that hypertension increases medical expenditures substantially, especially among the diabetes population. This study found that in the general population the increased expenditure was similar for the use of inpatient services, prescription medication, and outpatient services, but in the population with diabetes the use of inpatient services and prescription medication ranked first and second and sizably higher than for any other particular service type. A large proportion of the higher expenditure due to hypertension was financed by Medicare programs, again particularly in the population with diabetes. These findings suggest that interventions to reduce the impact of hypertension in the population with diabetes may be economically viable because they can potentially control medical expenditures, especially alleviating the burden on Medicare programs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Prevalence of Hypertension[a] (Weighted % [SE]) in U.S. Adults, 2013–2014 Medical Expenditure Panel Survey

Variables	Overall (N=40,746; weighted n=205,490,266)	With diabetes (n=4,496; weighted n=20,623,245)	Without diabetes (n=36,250; weighted n=184,867,021)	p-value[d]
Total	34.94 (0.45)	78.33 (1.00)	30.10 (0.44)	<0.001
Age, years				<0.001
18–44	13.81 (0.39)	54.87 (3.07)	12.78 (0.40)	
45–64	42.09 (0.73)	75.83 (1.55)	37.38 (0.75)	
>65	69.60 (0.8830)	86.30 (1.15)	64.57 (1.06)	
Sex				0.009
Male	36.49 (0.59)	79.50 (1.34)	31.76 (0.63)	
Female	33.44 (0.62)	77.23 (1.46)	28.48 (0.61)	
Race/ethnicity				<0.001
Non-Hispanic white	36.63 (0.60)	79.85 (1.33)	32.14 (0.59)	
Non-Hispanic black	42.82 (0.83)	83.50 (1.87)	36.95 (0.86)	
Hispanic	25.48 (0.68)	71.69 (1.42)	20.12 (0.63)	
Other race	26.76 (1.13)	70.40 (3.19)	21.39 (1.07)	
Married				<0.001
Yes	37.42 (0.62)	76.88 (1.45)	32.60 (0.62)	
No	32.25 (0.68)	80.22 (1.40)	27.44 (0.66)	
Education				<0.001
Less than high school	37.81 (0.93)	81.22 (1.66)	30.49 (1.01)	
High school graduate	40.84 (0.83)	81.43 (1.66)	35.15 (0.85)	
More than high school	31.73 (0.54)	75.13 (1.61)	27.92 (0.51)	
Geographic region				<0.001
Northeast	33.03 (1.09)	73.80 (2.51)	28.61 (1.06)	
Midwest	35.08 (0.96)	80.78 (2.37)	30.06 (0.91)	
South	38.49 (0.75)	81.30 (1.45)	33.20 (0.74)	
West	30.59 (0.93)	73.67 (2.09)	26.42 (0.91)	
Family income[b]				<0.001
Low	37.86 (0.68)	80.28 (1.42)	31.77 (0.71)	
Middle	33.97 (0.73)	78.28 (1.67)	29.03 (0.73)	
High	33.49 (0.61)	76.18 (1.76)	29.69 (0.61)	
Any health insurance				<0.001
Yes	36.99 (0.50)	78.82 (1.06)	31.93 (0.48)	
No	21.44 (0.77)	71.60 (3.23)	18.74 (0.71)	
Current smoker				<0.001
Yes	36.66 (1.08)	71.52 (3.34)	33.39 (1.06)	
No	34.61 (0.49)	79.42 (1.02)	29.46 (0.49)	

Variables	Overall (N=40,746; weighted *n*=205,490,266)	With diabetes (*n*=4,496; weighted *n*=20,623,245)	Without diabetes (*n*=36,250; weighted *n*=184,867,021)	*p*-value[d]
Body weight[c]				
Normal	20.91 (0.63)	65.69 (2.59)	19.05 (0.586)	<0.001
Overweight	35.63 (0.69)	76.72 (1.63)	31.44 (0.72)	
Obese	49.93 (0.72)	82.46 (1.34)	42.93 (0.76)	
Self-rated health status				<0.001
Excellent	16.37 (0.63)	68.55 (4.52)	15.18 (0.63)	
Very good	31.00 (0.6510)	71.19 (2.19)	28.38 (0.66)	
Good	44.2 (0.69)	79.07 (1.51)	38.70 (0.72)	
Fair or poor	61.47 (0.95)	83.22 (1.45)	53.14 (1.11)	

[a]Hypertension was identified by participants' response to "whether the person had ever been diagnosed as having high blood pressure other than during pregnancy." Diabetes was identified by participants' response to "whether the person had ever been diagnosed with diabetes excluding gestational diabetes."

[b]For family income variable, low=family income <200% of poverty line; middle=family income 200%-400% of poverty line; high=family income 4400% of poverty line.

[c]For body weight variable, normal=BMI (defined as weight in kilograms divided by height in meters squared) <25; overweight=BMI 25-30; obese=BMI 430.

[d]Chi-square test was used to test the distribution difference of categories between individuals with and without diabetes.

Table 2

Mean Annual Unadjusted Total Medical Expenditure (SE) (2014 $) in U.S. Adults by Hypertension and Diabetes Status, 2013–2014 Medical Expenditure Panel Survey

Variables	Total population			Population with diabetes			Population without diabetes		
	Overall (N=40,746)	Hypertensive (n=13,951)	Normotensive (n=26,795)	Overall (n=4,496)	Hypertensive (n=3,526)	Normotensive (n=970)	Overall (n=36,250)	Hypertensive (n=10,425)	Normotensive (n=25,825)
Total	5,225 (102)	8,854 (210)	3,276 (93)	12,715 (492)	13,929 (594)	8,327 (759)	4,390 (91)	7,381 (206)	3,102 (91)
Age, years									
18–44	2,452 (91)	4,709 (302)	2,090 (96)	8,637 (1,132)	9,943 (1,317)	7,048 (1,886)	2,298 (93)	4,149 (323)	2,026 (94)
45–64	6,148 (205)	8,666 (392)	4,317 (180)	12,359 (853)	13,724 (1,023)	8,076 (1,183)	5,279 (179)	7,231 (379)	4,114 (175)
>65	9,802 (215)	10,912 (256)	7,261 (351)	14,024 (562)	14,703 (660)	9,751 (814)	8,532 (248)	9,389 (318)	6,971 (381)
Sex									
Male	4,736 (147)	8,287 (306)	2,696 (119)	12,920 (758)	14,088 (885)	8,392 (1,224)	3,837 (132)	6,692 (313)	2,508 (115)
Female	5,702 (138)	9,457 (297)	3,815 (121)	12,521 (636)	13,774 (787)	8,272 (924)	4,930 (122)	8,131 (273)	3,655 (121)
Race/ethnicity									
Non-Hispanic white	5,911 (138)	9,400 (268)	3,894 (129)	13,738 (679)	14,791 (799)	9,567 (1,117)	5,098 (126)	8,009 (274)	3,719 (127)
Non-Hispanic black	4,804 (211)	7,886 (389)	2,496 (189)	11,162 (671)	12,076 (796)	6,535 (772)	3,886 (202)	6,519 (386)	2,344 (188)
Hispanic	3,071 (162)	6,948 (453)	1,745 (96)	10,454 (1,061)	12,462 (1,322)	5,367 (672)	2,214 (108)	4,666 (333)	1,596 (90)
Other race	4,021 (271)	8,141 (773)	2,516 (215)	11,851 (1,705)	13,129 (2,102)	8,811 (2,986)	3,058 (190)	6,122 (609)	2,224 (163)
Service type									
Inpatient	1,229 (58)	2,301 (129)	654 (45)	3,257 (307)	3,774 (377)	1,389 (288)	1,003 (52)	1,874 (126)	628 (44)
Outpatient	1,847 (46)	2,839 (81)	1,315 (46)	3,707 (173)	3,961 (210)	2,789 (302)	1,640 (46)	2,513 (86)	1,264 (47)
Medication	1,304 (40)	2,429 (90)	699 (31)	4,269 (254)	4,593 (300)	3,097 (385)	973 (28)	1,801 (66)	616 (29)
Emergency room	224 (8)	321 (14)	172 (10)	382 (27)	416 (32)	258 (40)	207 (8)	294 (17)	169 (10)
Others	621 (24)	964 (55)	437 (18)	1,100 (93)	1,185 (80)	794 (298)	567 (24)	900 (66)	424 (14)
Payment source									
Medicare	1,579 (53)	3,483 (114)	555 (36)	5,512 (290)	6,368 (358)	2,417 (287)	1,140 (44)	2,646 (113)	491 (35)
Out-of-pocket	721 (16)	1,049 (31)	545 (15)	1,206 (49)	1,305 (60)	849 (51)	667 (17)	975 (36)	534 (15)
Private insurance	1,959 (62)	2,620 (133)	1,604 (68)	3,231 (318)	3,396 (387)	2,635 (480)	1,817 (62)	2,395 (136)	1,568 (68)
Medicaid	505 (28)	878 (58)	305 (27)	1,672 (172)	1,678 (165)	1,649 (482)	375 (23)	646 (53)	258 (23)
Others	462 (27)	824 (66)	267 (16)	1,094 (103)	1,181 (122)	777 (193)	391 (26)	720 (74)	250 (15)

Table 3

Estimated Hypertension-Increased Annual Total Medical Expenditure (95% CI) (2014 $) for U.S. Adults by Diabetes Status, [a] 2013–2014 Medical Expenditure Panel Survey

Categories	Total population (N=40,746)	Population with diabetes (n=4,496)	Population without diabetes (n=36,250)	p-value for diabetes vs no diabetes
Total[b]	2,565 (2521, 2609)	4,434 (4329, 4538)	2,276 (2237, 2315)	<0.001
Service type				
Inpatient	767 (745, 788)	1,730 (1671, 1788)	468 (457, 480)	<0.001
Outpatient	595 (587, 602)	926 (902, 951)	565 (558, 572)	<0.001
Medication	758 (747, 769)	1,272 (1243, 1301)	687 (677, 697)	<0.001
Emergency room	82 (80, 84)	179 (175, 183)	59 (58, 60)	<0.001
Others	233 (229, 237)	363 (351, 375)	218 (214, 222)	<0.001
Payment source				
Medicare	1,159 (1117, 1201)	2,753 (2655, 2852)	669 (646, 692)	<0.001
Out-of-pocket	220 (218, 223)	395 (385, 406)	182 (180, 184)	<0.001
Private insurance	736 (719, 754)	1,346 (1283, 1408)	716 (698, 734)	<0.001
Medicaid	197 (183, 211)	317 (296, 337)	312 (293, 332)	0.608
Others	254 (251, 258)	226 (219, 232)	277 (273, 282)	<0.001

[a] Regression estimation for total expenditure, expenditure for outpatient service and prescription medication, and payment source of out-of-pocket for population with diabetes used a generalized linear model (GLM) with log link and gamma distribution because of the small number of zero expenditures. All other estimations used a two-part model.

[b] Total does not equal to the sum of service types or sum of payment sources because of separate regression estimates.