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Differences in Health Services Utilization and Costs between Antihypertensive Medication Users Versus Nonusers in Adults with Diabetes and Concomitant Hypertension from Medical Expenditure Panel Survey Pooled Years 2006 to 2009

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ABSTRACT

Objectives: To compare population-level baseline characteristics, individual-level utilization, and costs between antihypertensive medication users versus nonusers in adults with diabetes and concomitant hypertension. **Methods:** This longitudinal retrospective observational research used Medical Expenditure Panel Survey household component pooled years 2006 to 2009 to analyze adults 18 years or older with nongestational diabetes and coexistent essential hypertension. Two groups were created: 1) antihypertensive medication users and 2) no antihypertensive pharmacotherapy. We examined average annualized health care costs and emergency department and hospital utilization. Accounting for Medical Expenditure Panel Survey's complex survey design, all analyses used longitudinal weights. Logistic regressions examined the likelihood of utilization and anytihypertensive medication use, and log-transformed multiple linear regression models assessed costs and antihypertensive medication use. **Results:** Of the 3261 adults identified with diabetes, 66% (n = 2137) had concomitant hypertension representing 38.7 million individuals during 2006 to 2009. Significantly, the 16% (n = 338) no antihypertensive pharmacotherapy group showed greater mean nights hospitalized (3.6 vs. 1.7, $P = 0.0120$), greater all-cause hospitalization events per 1000 patient months (41 vs. 24, $P = 0.0.007$), and lower mean diabetes-related and hypertension-related ambulatory visits. After adjusting for confounders, non-antihypertensive medication users showed 1.64 odds of hospitalization, 29% lower total, and 27% lower average annualized medical expenses compared with antihypertensive medication users. **Conclusions:** In adults with diabetes and coexistent hypertension, we observed significantly greater hospitalizations and lower costs for the non antihypertensive pharmacotherapy group versus those using antihypertensive medications. The short-term time horizon greater hospitalizations with lower expenses among non-antihypertensive medication users with diabetes and concomitant hypertension warrant further study.

Keywords: antihypertensive medication, blood pressure, costs, diabetes, hypertension, utilization.

Introduction

Diabetes affects an estimated 25.8 million individuals approximating 8.3% of the 2010 resident US population, while another 7 million presumably have undiagnosed diabetes [1]. Risks associated with developing diabetes, prediabetes, and/or insulin resistance continue to rise [2]. Hypertension prevalence remains high among adults with diabetes despite several years' evidence for better outcomes from tight blood pressure (BP) control [3,4]. A reported 70% to 80% of those with type 2 diabetes have hypertension [5,6]. During the years 2005 to 2008, 67% of the adults with diabetes had BPs exceeding the accepted range for upper level normal [7].

Although discussion continues about optimal target BP levels [8–10], current guidelines recommend tight BP control for individuals with diabetes and concomitant hypertension [11–14]. Yet, several studies report suboptimal BP control [15–17], with only 38% of men and 25% of women with diabetes reaching target BP levels [18]. Poor BP control increases risks for cardiovascular events and microvascular complications [19–23], whereas lowering BP shows cardioprotective effects [24–27] and reduces eye complications [28]. Moreover, the cohort with type 2 diabetes, comorbid hypertension, and obesity in the US Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes reports significantly greater physician office visits and emergency department (ED) utilization despite 92% of the study respondents reporting having received antihypertensive medications [29].

Despite aggressive BP control guidelines and continued poor target BP levels in individuals with diabetes and coexistent hypertension, few studies assess differences between antihypertensive medication users and nonusers in individuals with

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diabetes and comorbid hypertension. In addition to diet and lifestyle, prescription medication remains central in hypertension management [30,31]. Few studies examine differences in health services utilization and costs in adults with diabetes and concomitant hypertension between those using BP-controlling medications and those not using antihypertensive pharmacotherapy. We lack important information about non-antihypertensive medication users in adults with diabetes and coexistent hypertension.

This study sought to address this gap by, first, quantifying population-level information about individuals with diabetes and coexistent hypertension and summarizing the differences between those prescribed antihypertensive medications and those reporting no antihypertensive medication use, and, second, to determine the likelihood for ED utilization and hospitalization and quantify the associated total and annual health care expenses between the two groups.

Methods

We conducted a retrospective observational longitudinal cross-sectional study covering the years 2006 to 2009 among Medical Expenditure Panel Survey household component (MEPS-HC) participants aged 18 years and older diagnosed with diabetes and concomitant hypertension. This research was approved by the University of Maryland, Baltimore Institutional Review Board, and classified as exempt from human subject research.

MEPS-HC is a subsample from the previous year's National Health Interview Survey sponsored by the National Center for Health Statistics to collect household and individual-level information about the civilian noninstitutionalized US population. The MEPS sampling frame uses an overlapping panel design to conduct interviews during five separate in-person rounds over 2 years to gain information about health care usage, expenditures, insurance coverage, source of payment, access to care, and quality. Inferences using weighted MEPS-HC data provide national estimates representative of the civilian noninstitutionalized US population [32].

We included panel 11 (2006–2007), panel 12 (2007–2008), and panel 13 (2008–2009) from the MEPS public use longitudinal data files. MEPS public use files were merged and complete panel periods pooled while preserving sample weights. We restricted our sample to those with diagnoses for diabetes and essential hypertension identified by the MEPS medical conditions file variable "CCCODEX" labeled clinical classification code [33,34]. MEPS derived the CCCODEX variable by using the Clinical Classifications Software (CCS) disease categorization scheme for *International Classification of Diseases, 9th Revision, Clinical Modification* (*ICD-9-CM*) codes developed by the Healthcare Cost and Utilization Project under the auspices of the Agency for Health-Care Research and Quality. CCS collapsed *ICD-9-CM*'s multitude of codes into fewer clinically meaningful categories. To identify those with diabetes mellitus, we used the CCS codes "49," diabetes without complications, and "50," diabetes with complications. For essential hypertension, we used the CCS code "98," which aggregated the *ICD-9-CM* diagnosis codes 401.1 and 401.9 into a single category [35]. We excluded subjects who became ineligible to participate in the survey as designated by MEPS longitudinal weights of 0 or less, as well as women with gestational diabetes, and individuals younger than 18 years of age.

Antidiabetic and antihypertensive medication use was identified by using MULTUM therapeutic class codes from the MEPS prescribed medicines files. We then divided the cohort into two groups: 1) subjects using antihypertensive medications and 2) subjects not using antihypertensive medications.

To derive health care expenses, we first measured health services utilization by averaging the total number for each separate office-based and outpatient event and each unique prescription drug fill as well as the number of ED visits and hospitalization events per 1000 patient months during the 2-year panel period. A total expense for each event measured total health care expenses per individual by summing all health services utilization and prescription drug expenses over the 2-year period. Medical utilization expenses summed only health services utilization expenses without prescription drug expenses. Diabetes- and hypertension-related utilization and drug expenses were identified from medical condition and event files. Annualized average total, medical utilization, prescription drug, and disease-specific expenses were calculated for analysis.

Covariates used for baseline descriptive analysis included sociodemographic characteristics and clinically relevant factors. We used the Deyo adaptation of the Charlson comorbidity index (CCI) as a measure of risk adjustment and disease burden [36]. To construct the CCI for this cohort, we restricted comorbidities to secondary diagnosis not related to diabetes or hypertension [37]. Overall perceived health status was assessed by using the MEPS health and well-being variable labeled "health in general" with an MEPS-assigned variable name "ADGENH" derived from the SF-12 v2 survey. After reviewing this variable's sample distribution, we collapsed this variable's categories for "excellent" and "very good" into one level labeled "excellent-very good," kept the category "good" as is and used the label "good," and collapsed the categories signifying "fair" and "poor" into another labeled "fair-poor."

MEPS public use files provided only three-digit *ICD-9-CM* codes giving broad diagnostic categories. MEPS public use files used either the three-digit "250" *ICD-9-CM* code for diabetes omitting the five-digit subclassifications needed to classify individuals with diabetes as type 1 or type 2 or the CCS codes described earlier. To address this limitation, we included a variable for diabetes medication use based on pharmacological treatment guidelines outlined by the American Diabetes Association [38]. We assumed that insulin approximated only type 1 diabetes; oral antidiabetic (OAD) approximated only type 2 diabetes; insulin + OAD indicated diabetes disease severity; and no antiglycemic medication use approximated those controlled by diet and exercise.

Antihypertensive medication use versus none was our primary independent variable. The outcomes of interest were the likelihood of ED utilization and in-patient hospitalization, and annualized average total health care and medical expenses per subject. Descriptive and basic statistics described the population's baseline attributes and compared outcomes between antihypertensive medication users versus none. Logistic regression models were applied to assess the association between the likelihood for ED utilization or hospitalization and antihypertensive medication use. Because the cost data were skewed, linear regression models with log transformation were used to assess the association between annualized average total or medical expenses and antihypertensive medication use [39]. Because other factors besides hypertension or antihypertensive medication use may affect utilization, such as well-being, we conducted additional subgroup analysis to examine the differences in medical utilization among patients with various perceived health statuses and comorbidity levels.

All data analyses applied longitudinal weights for estimates accounting for the complex survey design and were performed by using SAS 9.2 (SAS institute, Cary, NC). The level of statistical significance was set a priori at $\alpha = 0.05$ for all analyses.

Results

As shown in Figure 1, from the total diabetes sample (n = 3261), approximately 66% (n = 2137) had diabetes and coexistent