Utilization of angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB) in patients diagnosed with diabetes: Analysis from the National Ambulatory Medical Care Survey

Sarai L. Ibrahim, Michael R. Jiroutek *, Melissa A. Holland, Beth S. Sutton

Department of Clinical Research, Campbell University College of Pharmacy & Health Sciences, 180 Main Street, PO Box 1090, Buies Creek, NC 27506

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ABSTRACT

Objective. The objective of this study was to determine if a difference exists in the proportion of visits for the prescribing of angiotensin converting enzyme inhibitors (ACEI), or angiotensin receptor blockers (ARBs) in diabetic patients during 2007–2010.

Methods. This retrospective, cross-sectional, observational study included adults diagnosed with diabetes mellitus from the National Ambulatory Medical Care Survey (NAMCS) during 2007–2010. Weighted chi-square tests and a multivariable logistic regression model were used to analyze associations between ACEI/ARB prescriptions and predictors of interest. Odds ratios and 95% confidence intervals were reported.

Results. An unweighted total of 13,590 outpatient ambulatory care visits were identified for adult patients with diabetes without contraindications to ACEIs or ARBs in the NAMCS for the years studied. No statistically significant increase in the proportion of visits with an ACEI/ARB prescription was identified for years 2007–2010 (28.1% in 2007 to 32.2% in 2010). Females (OR 0.78, 95% CI 0.69- 0.89), patients 18–39 years old (OR 0.56, 95% CI 0.43- 0.75), and Medicare users (OR 0.81, 95% CI 0.70- 0.94) were significantly less likely to receive an ACEI/ARB prescription. Patients with hypertension (OR 2.80, 95% CI 2.39-3.29), hyperlipidemia (OR 1.42, 95% CI 1.22-1.65), and ischemic heart disease (OR 1.36, 95% CI 1.10-1.70) were significantly more likely to receive an ACEI/ARB prescription.

Conclusions. Despite extensive evidence showing the benefits of ACEI/ARB medications in diabetic patients, disparities of treatment remain evident.

Introduction

Diabetes is a chronic disease that increasingly affects a growing percentage of the American population. Currently, it is the seventh leading cause of death in the United States, with 9.3% of the US population having a diagnosis (Centers for Disease Control and Prevention, 2014). Diabetes care is complex and requires an expansive range of interventions for improved disease outcomes. Concurrent disease states such as hypertension, hyperlipidemia, and ischemic heart disease (IHD) add to this complexity. The Standards of Medical Care in Diabetes, compiled annually by the American Diabetes Association (ADA), recommend that the first line treatment for patients with diabetes and hypertension should be an angiotensin-converting enzyme inhibitor (ACEI) or an angiotensin receptor blocker (ARB) (American Diabetes Association, 2010). ACE inhibitors are also recommended in patients with diabetes and known cardiovascular disease to reduce the risk of cardiovascular-related events and mortality (American Diabetes Association, 2010). Data from several clinical trials support these recommendations and provide insight for the treatment of diabetes complications in various subsets of the diabetic population (Eurich et al., 2004; Yusuf et al., 2000; Lindholm et al., 2002). More specifically, these medications have shown benefit beyond blood pressure optimization and have nephroprotective and cardioprotective properties (Fioretto and Solini, 2005; Parving et al., 2001; Viberti et al., 2002). Despite these recommendations and guidelines, previous research indicates that a large proportion of diabetes patients are not receiving these medications as indicated (Rosen, 2006). The Rosen study used data from the National Health and Nutrition Examination Survey and found national estimates of ACEI/ARB use in the elderly diabetic population to be no higher than 53%, despite risk factors indicating that the majority of all of these patients should be prescribed an ACEI/ARB. Additional data regarding national trends for ACEI/ARB

prescriptions in the diabetic population is lacking. The objective of the study was to determine if there was an association between the proportion of visits with a prescription for ACEI/ARB medications and the year of visit in adult diabetic patients who participated in the National Ambulatory Medical Care Survey (NAMCS) between the years 2007–2010. Additionally, several demographic and comorbidity variables were analyzed to determine their effect on receipt of medication.

Methods

Data Source

This study was a retrospective, cross-sectional, observational analysis of data collected in the NAMCS. The NAMCS is an annual, national probability sample of visits made to the offices of non-federally employed physicians classified by the American Medical Association or the American Osteopathic Association as "office-based, patient care". Physicians in the specialties of anesthesiology, pathology and radiology are excluded. Further details on the types of contact excluded can be found at (http://www.cdc.gov/nchs/ahcd/ahcd_scope. htm#namcs_scope). The survey has been conducted annually from 1973 to 1981, in 1985, and annually from 1989 to present. The multi-staged sample design is composed of 3 stages that involves probability samples of primary sampling units (PSUs), physician practices within PSUs, and patient visits within practices. Details of the sampling procedure can be found at (http://www.cdc.gov/nchs/ahcd/ahcd_scope.htm#namcs_scope).

The data collected included information on patient demographics, reasons for visit, vital signs, continuity of care, diagnosis for the visit, diagnostic screening services, health education, non-medication treatment, medications and immunizations, provider type, visit disposition, and time spent with provider. On average, for the years 2007–2010, approximately 68% of physicians sampled met the criteria required for database eligibility. The eligibility criteria include office based physicians who are principally engaged in patient care activities that are non-federally employed and are not in specialties of anesthesiology, pathology, or radiology. Of the eligible (in-scope) physicians, the average unweighted response rate was approximately 60% (McCaig and Burt, 2012).

NAMCS datasets from 2007 to 2010 were included in this study. Patients that were 18 years of age or older with an International Classification of Diseases, Ninth Revision (ICD-9) code for diagnosis of diabetes (249.00–250.93) in any of the diagnoses fields (DIAG1-DIAG3) or a 'Yes' response to the DIABETES variable were included in the final analysis dataset. Pregnant patients (ICD-9 code v22.2) or those diagnosed with angioedema (ICD-9 code 995.1) were excluded. Across the four years included in this study, a total of 13,590 raw patient visit records met the inclusion/exclusion criteria.

The survey data were analyzed using the sampled visit weight that is the product of the corresponding sampling fractions at each stage in the sample design. The sampling weights have been adjusted by NCHS for survey nonresponse as appropriate within each database, yielding an unbiased national estimate of visit occurrences, percentages, and characteristics (McCaig and Burt, 2012).

Because of the complex sample design, sampling errors were determined using the SAS SURVEYFREQ and SURVEYLOGISTIC procedures which take into account the clustered nature of the sample (Centers for Disease Control and Prevention, 2014).The appropriate SAS procedure options (NOMCAR and DOMAIN) to address missing data and to utilize domains to determine accurate variance estimates were implemented in the analyses as recommended by the NCHS.

This data was previously collected, de-identified and cleaned by the CDC and is available to the public at ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Datasets/NAMCS/. The study was submitted to the Campbell University Institutional Review Board (IRB) and received an exemption.

Outcome Variable

The outcome variable of interest was ACEI/ARB prescription (Yes versus No), where the denominator was the number of cases meeting the inclusion/exclusion criteria. ACEI/ARB prescription was defined by a code of '042' or '056' for any of the level 2 Multum database drug category variables (http://www.multum.com 2013).

Independent Variables

The choice of independent variables was made based on factors determined to be relevant to ACEI/ARB prescription in diabetics but was limited by the data available in the NAMCS surveys. The selected variables and information on their coding is located in Table 1. Note that tobacco use was excluded from all analyses due the high percentage (>30%) of missing data.

Statistical analysis

A series of weighted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) were analyzed and reported to determine whether there was any association between ACEI/ARB prescription (Yes vs. No) and each of the independent variables shown in Table 1 in adult patients with diabetes. The term 'weighted' refers to the NCHS determined survey design weights that allow extrapolation of the raw data to national estimates.

A multivariable logistic regression model was also constructed for ACEI/ARB prescription in order to evaluate the predictive value of each independent variable, adjusting for covariates of interest. As a primary

Table 1
Demographics/Patient Characteristics of Diabetic Patients in the NAMCS, 2007-2010[a].

Variable	Number of Patient Visits (%)
Race	
Other	15,380,788 (4.7)
Black	49,212,081 (14.9)
White	265,913,006 (80.5)
Sex	
Female	240,904,506 (53.5)
Male	209,517,989 (46.5)
Ethnicity	
Hispanic/Latino	41,692,227 (12.8)
Not Hispanic/Latino	284,077,272 (87.2)
Age Group	
18–39	31,603,090 (7.0)
40–54	97,941,690 (21.7)
55 +	320,877,715 (71.2)
Payment Type	
Other[b]	23,173,473 (5.3)
Medicaid	36,537,103 (8.3)
Medicare	201,495,671 (45.9)
Private	178,194,033 (40.6)
Region	
Midwest	99,830,986 (22.2)
Northeast	79,311,364 (17.6)
West	85,928,435 (19.1)
South	185,351,710 (41.2)
Hypertension	
Yes	288,771,724 (64.1)
No	161,650,771 (35.9)
Ischemic Heart Disease	
Yes	48,481,513 (10.8)
No	401,940,982 (89.2)
Hyperlipidemia	
Yes	185,793,309 (41.2)
No	264,629,186 (58.8)
Chronic Renal Failure	
Yes	25,925,596 (5.8)
No	424,496,899 (94.2)

[a] Weighted data. Reference groups are listed last for each variable.
[b] Other insurance type includes worker's compensation, self-payment, and no charge.