Trends in Antihypertensive Drug Therapy of Ambulatory Patients by US Office-Based Physicians

Cheryl R. Nelson, Dee A. Knapp

Abstract—This study assessed trends from 1980 to 1995 in ambulatory patients’ antihypertensive drug therapy by US office-based physicians for visits in which hypertension was the principal diagnosis and compared these trends with the respective guidelines given in 5 Joint National Committee (JNC) Reports on Detection, Evaluation, and Treatment of High Blood Pressure published around the same time period. Data from the National Center for Health Statistics’ National Ambulatory Medical Care Surveys for 1980, 1985, 1990, and 1995 were used. From 1980 to 1995, there was no significant trend in the percentage of hypertension visits that did not mention any antihypertensive drug (20% to 27%). Further analyses focused on those hypertension visits in which at least 1 antihypertensive drug was used. Across the years, antihypertensive drug visits mentioning calcium channel blockers or ACE inhibitors significantly increased; those noting diuretics significantly decreased. However, in 1995, antihypertensive drug visits that included a diuretic and/or a β-adrenergic blocker equalled 53%; these are the antihypertensive drug classes preferred by the JNC V. Physician antihypertensive drug prescribing was generally consistent with the basic antihypertensive drug guidelines of the JNC reports. (Hypertension. 2000;36:600-603.)

Key Words: antihypertensive agents ■ hypertension, essential ■ drug therapy

Hypertension has been the most frequent principal diagnosis for ambulatory patients by US office-based physicians for more than a decade (National Ambulatory Medical Care Surveys [NAMCS]). In 1995, it accounted for 3.2% of these visits. The purpose of this study was to (1) assess NAMCS trends from 1980 to 1995 in ambulatory patients’ antihypertensive drug therapy by US office-based physicians at visits in which hypertension was the principal diagnosis and (2) compare these trends with the respective guidelines given in the 5 Joint National Committee (JNC) reports published around the same time period. These were 1975 to 1976, JNC I; 1980, JNC II; 1984, JNC III; 1988, JNC IV; and 1993, JNC V. The most recent, JNC VI, was published in 1997.

There have been other national surveys that have evaluated antihypertensive drug prescribing trends. However, NAMCS data have the advantages of methodological and analytical consistencies, coverage of the time periods necessary to measure the effects of the first 5 JNC reports, and the ability to assess antihypertensive drug pattern characteristics during patient visits.

Methods

NAMCS is a national, probability-sample survey conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention. It collects data on medical care services provided by office-based physicians during ambulatory patient visits. To assess a 15-year trend in antihypertensive drug therapy, 1980, 1985, 1990, and 1995 NAMCS data were used. NAMCS medication data were first collected in 1980. Detailed information on NAMCS sampling and data collection is given in other NAMCS references.

Only patient visits having a principal (first-listed) diagnosis of essential hypertension (ICD-9-CM code 401) were included for this study. The JNC reports were used to identify and classify the antihypertensive drugs. To analyze antihypertensive drug prescribing, the following coding procedures were performed. Each hypertension visit in which at least 1 antihypertensive drug was mentioned was counted as an antihypertensive drug visit. On the NAMCS data collection forms, physicians could record the antihypertensive drugs prescribed during the visit by using either generic drug names or brand names. Where brand names were listed, each generic name (active ingredient) component of the drug product was coded separately. Then, each occurrence of an antihypertensive generic name was categorized to its major antihypertensive drug class. If a particular antihypertensive drug class occurred more than once for a visit, it was counted only once. For the first analysis, antihypertensive drug class occurrences, the frequency of occurrence for each antihypertensive drug class across all antihypertensive drug visits was computed. The second analysis focused on antihypertensive drug class patterns. For each antihypertensive drug visit, the pattern of the different antihypertensive drug class(es) prescribed concomitantly was tallied; then, the frequency across all visits associated with each unique pattern was computed.

The standard errors used in tests of significance were calculated by means of generalized linear models for predicting the relative standard error for estimates, based on the linear relation between the actual standard error, as approximated by SUDAAN software, and the size of the estimate.
A weighted least-squares regression method was adapted to analyze selected trends for NAMCS years 1980, 1985, 1990, and 1995. The determination of statistical significance was based on the 2-tailed $z$-test, with a critical value of 1.96 (0.05 level of significance). The determination of statistical differences between estimates used the Bonferroni inequality to establish the critical value (0.05 level of significance), based on a 2-tailed $t$-test.

**Results**

The estimated number and percent of hypertension visits in which at least 1 antihypertensive drug was mentioned were, respectively, 1980, 19,985,000 (79.5%); 1985, 19,770,000 (75.9%); 1990, 20,040,000 (73.4%); and 1995, 17,510,000 (77.6%). There was no significant trend for these percentages.

**Antihypertensive Drug Therapy**

Figure 1 shows the antihypertensive drug class occurrences. With the exception of the $\beta$-adrenergic/$\alpha$-blocker and $\alpha_1$-adrenergic antagonist drug classes, trends for all other antihypertensive drug class occurrences were significant. Calcium channel blocker visits increased from 1.9% in 1985 to 39.8% in 1995; ACE inhibitor/receptor blocker visits increased from 6.4% to 37.0%, respectively. The first ACE inhibitor and calcium channel blocker were approved in the United States in 1981 and 1982, respectively. The remaining antihypertensive drug classes decreased.

For each year, the 5 most frequently occurring antihypertensive drug class patterns are shown in Figure 2. Examples of the interpretation of Figure 2 are as follows: in 1980, 37.9% of antihypertensive drug visits used the diuretic drug class without any other antihypertensive drug classes, whereas 13.6% used centrally acting $\alpha_2$-agonist and diuretic drug classes concomitantly without any other antihypertensive drug classes. Across the years, the number of single-drug class antihypertensive drug patterns among the top 5 patterns increased, from 2 such patterns in 1980 to 3 in 1985 to 4 in 1990 and 1995. From 1980 to 1995, none of the top 5 antihypertensive drug patterns included more than 2 different antihypertensive drug classes used concomitantly. During 1980 to 1995, antihypertensive drug patterns consisting of only 3 different antihypertensive drug classes used concomitantly occurred in $\approx$8.4% of the antihypertensive drug visits (not shown in Figure 2). Of the top 5 antihypertensive drug class patterns that occurred throughout 1980 to 1995, only one pattern had a significant trend: Diuretics alone were prescribed during 11.6% of antihypertensive drug visits in 1995, a significant decline from the 37.9% use in 1980. On the basis of percentage of antihypertensive drug visits, diuretics and $\beta$-adrenergic/$\alpha$-blockers, either alone or concomitantly with other antihypertensive drug classes, dominated the top 5 antihypertensive drug class patterns across the years, except for 1995. Survey year 1990 marked the first occurrence of the ACE inhibitor/receptor blocker and calcium channel blocker antihypertensive drug classes among the top 5 patterns, and in 1995 they led the prescribing patterns.

**Figure 1.** Antihypertensive drug class occurrences by percent of antihypertensive drug visits: United States, 1980, 1985, 1990, 1995. Denominators for percents are number of yearly antihypertensive drug visits: 1980, 19,985,000; 1985, 19,770,000; 1990, 20,040,000; 1995, 17,510,000. JNC I-V2–6 publication dates are indicated.

**Figure 2.** For each year, 5 most frequently occurring antihypertensive drug class patterns by percent of antihypertensive drug visits: United States, 1980, 1985, 1990, 1995. Only diuretic-alone pattern had significant trend (red color). See Figure 1 for denominators of percents.

**Figure 3.** Antihypertensive drug visits using $\beta$-adrenergic/$\alpha$-blocker (B) and/or diuretic (D) vs those using calcium channel blocker and/or ACE inhibitor/receptor blocker but without B or D class: United States, 1990, 1995. Between-group comparisons for each year were significant, and each within-group trend from 1990 to 1995 was significant. See Figure 1 for denominators of percents.
First Two Recommended Pharmacological Treatment Steps by Major Antihypertensive Drug Class: JNC I–V

<table>
<thead>
<tr>
<th>JNC Report Comparisons</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>JNC I (1975 to 1976)² and JNC II (1980)³ recommendations were compared with the 1980 NAMCS, JNC III (1984)⁴ with the 1985 NAMCS, JNC IV (1988)⁵ with the 1990 NAMCS, and JNC V (1993)⁶ with the 1995 NAMCS. The Table abstracts the recommended initial antihypertensive drug treatments of JNC I-V.²–⁶ The 1975 to 1976 JNC I and the 1980 JNC II³ were identical in their antihypertensive drug–prescribing guidelines at the drug class level; diuretics were recommended as the step 1 drug class. The 1980 NAMCS (Figure 2) showed physicians’ antihypertensive drug class–prescribing patterns were generally consistent with these JNC guidelines. The diuretic class used alone was prescribed in 37.9% of the antihypertensive drug visits. Of the top 5 patterns, 35.2% of the antihypertensive drug visits used diuretics concomitantly with one of the step 2 drug classes. β-adrenergic blockers alone were mentioned in 6.3% of the antihypertensive drug visits; JNC II³ noted that for a younger patient with “rapid heart rate and/or high pulse pressure,” this drug class could be appropriate for step 1 drug therapy.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion**

From 1980 to 1995, 20.5% to 26.6% of hypertension visits had no mention of antihypertensive drug therapy. How much of this was true nonantihypertensive drug prescribing versus...
item nonresponse is not known. An unknown portion of true nonantihypertensive drug prescribing could have been for those cases in which nonpharmacological treatment (lifestyle modification) alone was being used.

An aforementioned study\(^\text{10}\) found a decline in diuretic and \(\beta\)-blocker dispensed prescriptions and an increase in calcium antagonist and ACE inhibitor dispensed prescriptions between 1992 and 1995. Our study (Figure 2) noted a similar decrease in monotherapy in which JNC V’s\(^\text{6}\) preferred drug classes of diuretics or \(\beta\)-adrenergic blockers were used (monotherapy visits of these two classes together equalled 44.2\% of antihypertensive drug visits in 1980 versus 19.6\% in 1995). However, in 1995, Figure 3 showed visits including a diuretic and/or \(\beta\)-adrenergic blocker were prescribed in 53.1\% of antihypertensive drug visits. Thus, the two preferred antihypertensive drug classes were still prescribed in a little more than half of the antihypertensive drug visits but usually not as monotherapy (53.1\% minus 19.6\% monotherapy equals 33.5\%). Since NAMCS does not ascertain medication history, it was not known in what temporal order the antihypertensive drugs were prescribed for those visits involving 2 or more antihypertensive drugs. In summary, from 1980 to 1995, physician antihypertensive drug prescribing was generally consistent with the basic antihypertensive drug guidelines of JNC I-V. However, NAMCS does not contain the information that could impute the amount of causality attributable to the JNC reports on these trends.

**Acknowledgment**

This article was written while Cheryl Nelson was a statistician in the Ambulatory Care Statistics Branch, Division of Health Care Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention.

**References**


Downloaded from http://hyper.ahajournals.org/ by guest on December 25, 2017
Trends in Antihypertensive Drug Therapy of Ambulatory Patients by US Office-Based Physicians
Cheryl R. Nelson and Dee A. Knapp

Hypertension. 2000;36:600-603
doi: 10.1161/01.HYP.36.4.600

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://hyper.ahajournals.org/content/36/4/600

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Hypertension can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Hypertension is online at:
http://hyper.ahajournals.org/subscriptions/