

# Background and Methods

## GEOGRAPHIC VARIATION IN THE USE OF HEALTH CARE

In the late 1930s, a British pediatrician discovered significant variation in the rate of tonsillectomy across regions of England.<sup>1</sup> Since that time, studies have documented variation in the use of physician expenditures, hospital stays, and various medical procedures across large and small geographic areas within the United States and across countries.<sup>2 3 4 5 6 7</sup> Some of the greatest variation in surgical procedures has been observed for radical prostatectomy, while hospitalizations for hip fracture have demonstrated much lower variability (Table 1.1).<sup>8</sup>

**Table 1.1. Variation in Selected Medical Surgery and Hospital Admissions Across the 306 Hospital Referral Regions in the United States**

### Medical Surgery/Hospitalization

#### Very High Variation

- Radical Prostatectomy
- Lower Extremity Bypass
- Carotid Endarterectomy
- Hospitalization for Forearm Fracture
- Back Surgery

#### High Variation

- Knee Replacement
- Transurethral Prostatectomy
- Mastectomy
- Hospitalization for Ankle Fracture
- Coronary Artery Bypass Grafting

#### Moderate Variation

- Colectomy for Colorectal Cancer
- Hospitalization for Hip Fracture

Source: *The Dartmouth Atlas of Health Care, 1998*

Although many explanations for these variations have been proposed, the evidence supporting them is limited. One of the more frequently cited hypotheses is the physician practice style (or professional uncertainty) hypothesis.<sup>9</sup> This hypothesis asserts that the extent of variation is larger for conditions with a greater degree of physician uncertainty in terms of the diagnosis and/or treatment of the condition. In other words, when there is greater uncertainty about the appropriate care, a physician's own beliefs about the need for and effectiveness of care will determine the care received. Consider the example of prostate cancer. No strong evidence is extant concerning the survival of men who are treated with radiation or surgery versus those who select watchful waiting. Furthermore, when prostate cancer is detected early, many men never exhibit symptoms of the disease, yet there are substantial side effects from either surgery or radiation.<sup>8</sup> Thus, physicians develop their own opinions about what constitutes appropriate treatment, leading to significant variation in the use of radical prostatectomy across the United States.

While the physician practice style hypothesis is intuitively appealing, this explanation has been criticized on several grounds.<sup>10</sup> First and foremost, it cannot be assumed that any unexplained variation represents differences in physician practice styles. For example, even when comparing contiguous areas with similar sociodemographic characteristics, other factors could remain unexplained, such as underlying differences in disease severity at the time care is sought, as has been demonstrated in at least one study.<sup>11</sup>

Others have hypothesized that patient preferences contribute to the observed variation.<sup>12</sup> Many of the variation studies have focused on the medical model, which ascribes disease, and hence, medical care to biology and physiology and emphasizes the physician's role. Yet, the patient, through his or her preferences, may contribute to the variation as well. Longo has pointed out that patient preferences become particularly relevant as we move away from the study of surgical interventions toward a chronic care model in which the patient plays a large role in interventions that will help to manage a chronic disease.<sup>13</sup>

In summary, the variation in the use of numerous medical procedures and surgeries is well documented, but the reasons for such variation are less definitive. Although the physician practice style and patient preference are intuitive and appealing explanations, more empirical work is needed to support them.

Accordingly, while studies of geographic variation in the use of medical care have raised questions about the cost, benefits, and accessibility of health care, researchers have only begun to understand what strategies, if any, are needed to address such variation.

## GEOGRAPHIC VARIATION IN USE OF PRESCRIPTION DRUGS

Despite the wealth of studies on geographic variation in the use of medical procedures and surgeries, variation in the use of prescription medications is a relatively unstudied phenomenon, particularly in the United States. All else being equal, one might expect to see less variation in the use of prescription drugs than other medical procedures because, unlike other medical procedures, prescription drugs must undergo rigorous evaluation prior to being approved for use in the United States. Specifically, drugs must be proven both safe and efficacious via randomized placebo-controlled clinical trials. Once approved, a drug has specific indications for use, including recommended doses. Furthermore, many products, particularly those that have been on the market for years, also have clear contraindications.

Despite such a rigorous review process in the United States, there exists some evidence of geographic variation in prescription use in both the United States and abroad.<sup>14 15 16 17 18 19</sup> Within the United States, regional variation in the pharmaceutical management of acute myocardial infarction has been well established,<sup>20 21 22</sup> consistently showing greater use of beta-blockers in the Northeast among patients discharged from the hospital after a myocardial infarction. The National Committee for Quality Assurance tracks very limited prescription drug information by region for the health plans that participate in the program, and the National Ambulatory Medical Care Survey (NAMCS) provides physician-reported drug information by the four regions of the country. One study that used the NAMCS found that patients with known hyperlipidemia were more likely to be prescribed pharmacological treatment if they lived in the Northeast.<sup>23</sup> A more recent effort aimed at understanding geographic variation in prescription use comes from the data of BlueCross BlueShield of Michigan (BCBSM) and examined variations in prescription drug use across hospital service areas in Michigan for nine therapy classes.<sup>24</sup> Among adults, the greatest variation was observed for antihistamine and antianxiety medications, while the lowest variation was found for the use of beta blockers and selective serotonin reuptake inhibitors (SSRIs).

No research has examined variation in prescription use across states within the United States. To fill this void, Express Scripts developed this atlas to provide richer insights into use of pharmaceuticals. This effort is particularly important because of the increased role of pharmaceuticals as a central treatment modality for many chronic diseases, the rising cost of pharmaceuticals, and the continued, if not growing, potential for adverse drug reactions from new drug entities.

Against this backdrop, the atlas examines variation in prescription drug use by state among Express Scripts members for some of the most commonly used therapy classes. It is important to note that these findings are not meant to be representative of the entire U.S. population. Rather, these findings reflect the experience of providing pharmacy benefits to commercially insured members. These results can be used by plan sponsors to provide regional benchmarks of prescription drug use and by policymakers and researchers to identify areas for intervention and further study.

# Methods

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## SAMPLE

The study population was a random sample of Express Scripts members who were commercially insured (i.e., excluded Medicare+Choice, Medicaid, or workman's compensation) with an integrated retail and mail benefit administered through Express Scripts. Only members who were continuously enrolled for the entire year of 2000 were studied to allow for meaningful prevalence of use data. Separate analyses were conducted for adults (i.e., age 18-64) and children (i.e., up to and including age 17). While the initial sample included members from all 50 states and the District of Columbia, results were only presented for those states with sample sizes of at least 1,500 members for adults and 1,000 for children. The final sample size for adults and children was 527,512 and 194,538, respectively. More than 700 different client groups were represented in the sample. Key demographic and pharmacy plan design characteristics are shown by state in each map.

To examine the stability of regional patterns from year to year, overall use in 1999 is shown for a random sample of adult members who were continuously enrolled in 1999 ( $n = 732,172$ ).

## THERAPY CLASSES

Therapy classes are groups of pharmaceutical agents that are chemically or therapeutically related. Products were grouped into therapy classes according to the first two digits of the 14-digit Generic Product Identifier (GPI) code as classified by Medispan/First DataBank.<sup>25</sup> Therapy classes examined were those that are among the top 25 most commonly used and are consistently covered under the pharmacy benefit. The latter criteria excluded oral contraceptives and dermatologicals.

Therapy classes examined for adults included penicillins, cephalosporins, macrolides, corticosteroids, estrogens, antidiabetics, thyroid, beta blockers, calcium channel blockers, antihypertensives, diuretics, antihyperlipidemics, antihistamines, decongestants, cough/cold/allergy, antiasthmatics, gastrointestinal, antianxiety, antidepressants, narcotic analgesics, antirheumatics, anticonvulsants, and ophthalmics. The cardiovascular class included antihypertensives, beta blockers, calcium channel blockers, and diuretics. For discussion purposes, classes were defined as chronic if the mean number of prescriptions per utilizer per year (PUPY) was 6 or greater.

Four of the most commonly used therapy classes among children were studied: penicillins, cephalosporins, macrolides, and cough/cold/allergy.\* In addition, given previous evidence of geographic variation in use of stimulant medications for the treatment of attention deficit hyperactivity disorder (ADHD) among school-aged children<sup>26,27</sup>, ADHD stimulant use among children age 5 to 14 was studied.

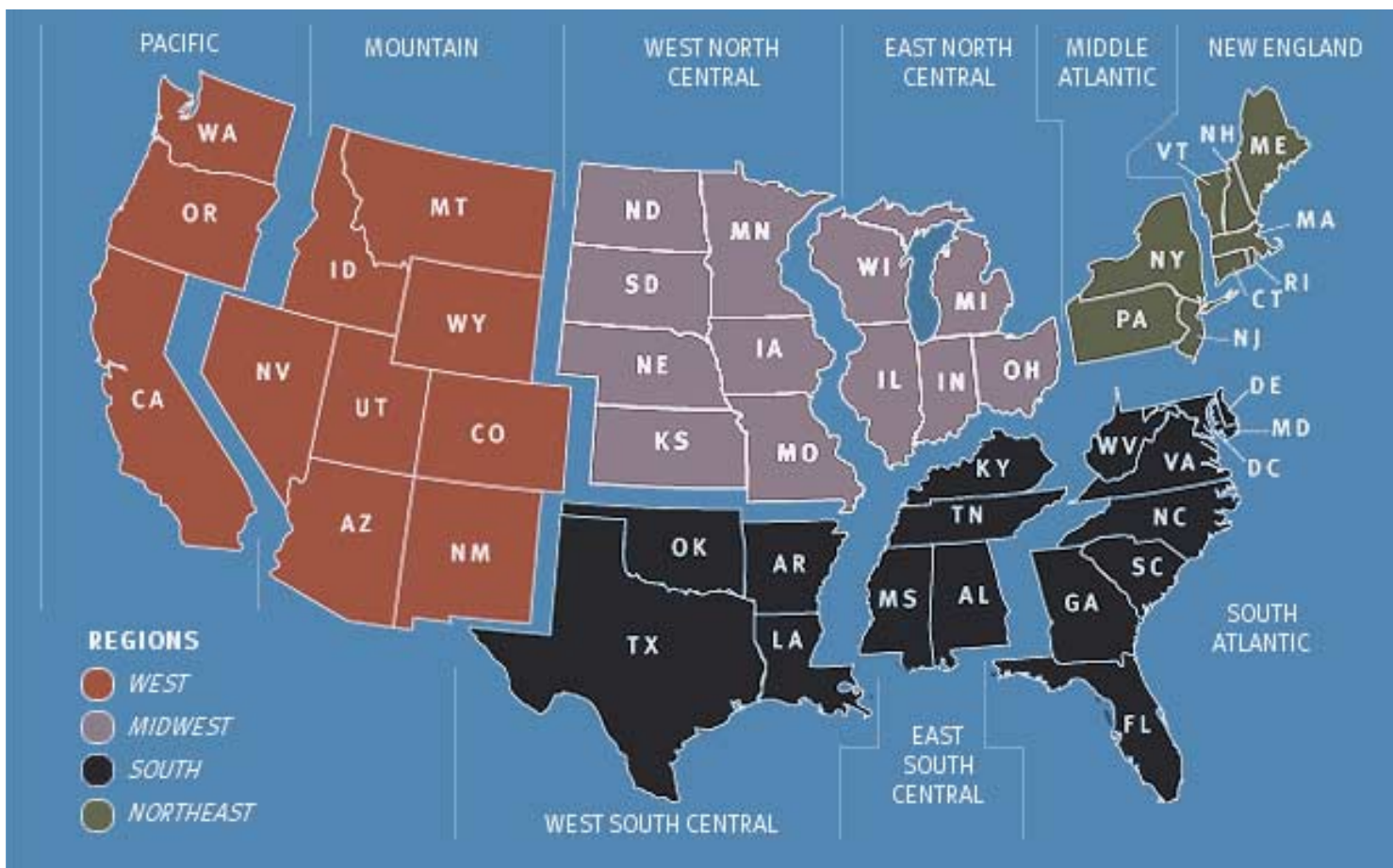
## CALCULATION OF ADJUSTED RATES

For overall prescription use, the mean per-member per-year (PMPY) utilization was reported. Mail-order prescriptions were converted to 30-day equivalents. For overall use and for each therapy class, prevalence rates were reported. Prevalence was defined as the number of members with one or more prescription claims for a particular drug class divided by the number of eligible members. All rates were adjusted for age and sex using the direct standardization method with the overall study population as the reference sample.<sup>28</sup> To provide adjusted rates, members were stratified into different age/gender strata, and the observed utilization by stratum was multiplied by the percentage of the overall population represented in each stratum. Standard deviations are not shown, but estimates are believed to be of acceptable precision. For example, observing a median-sized state ( $N = 7,814$ ) and our lowest reported utilization rate of approximately 2 per 100, the precision would be  $\pm 7.9\%$  of the true rate. For the highest reported utilization rate of 19 per 100, the precision would be  $\pm 2.6\%$  for a state of median size.

Results are discussed by U.S. Census Bureau Regions (Northeast, South, Midwest, West) and Division (New England, Middle Atlantic, South Atlantic, East North Central, East South Central, West South Central, West North Central, Mountain, Pacific) (Figure 1.1).

\*The top five therapy categories were selected from the 2000 ESI Drug Trend Report and were based upon PMPY utilization across the age groups of interest.

Figure 1.1. U.S. Census Bureau Regions and Divisions



### MEASURES OF VARIATION AND ASSOCIATION

For each therapy class, three statistics that measure variation in drug use across states were examined, including the weighted coefficient of variation (CV), the Systematic Component of Variation (SCV), and the ratio of the Interquartile Range (IQ). The weighted CV is the ratio of the standard deviation of the prevalence rates to the mean rate among the states, weighted by the population in each state.<sup>7</sup> While the limitations of the CV are recognized,<sup>29</sup> it is included to allow for comparisons to other studies that have calculated a CV as the measure of variation. The SCV estimates variance across geographic regions that cannot be explained by the variation within the region. A detailed explanation of the SCV is provided by McPherson and colleagues.<sup>30</sup> The IQ ratio represents the ratio of the rate in the state ranked at the 75th percentile divided by the rate in the state ranked at the 25th percentile. The statistical significance of the CV and SCV were assessed.<sup>31</sup>

The association between disease prevalence and drug use was examined using the  $R^2$  statistic when the relevant prevalence data was available.  $R^2$  is the proportion of total variation for one variable that is explained by variation in another variable and it ranges from 0 to 1. The higher the  $R^2$ , the more closely related are the two variables.