

# Running the Numbers

*A Periodic Feature to Inform North Carolina Health Care Professionals  
About Current Topics in Health Statistics*

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## Emergency Department and Hospital Utilization for Treatment of Chronic Pain in North Carolina

Pain is one of the most common reasons people seek medical attention. The articles in this issue of the NCMJ describe some of the most common causes of chronic pain, options for treatment, and some of the unintended consequences of treatment. One possible way to get a handle on chronic pain is through prevention, which requires understanding the causes of chronic pain. In addition, it is important to determine the most efficacious and cost-effective methods of treating chronic pain (eg, medication, surgery, or acupuncture), as well as optimal treatment locations (eg, the emergency department [ED], inpatient hospital setting, or ambulatory care setting).

The burdens and costs of chronic pain are enormous. The Institute of Medicine of the National Academies estimates that 100 million people in the United States live with chronic pain at a total economic cost of \$560 billion–\$630 billion annually. Only about half of that amount is spent on medical care; the other half represents indirect costs from lost productivity [1]. Among civilian, noninstitutionalized individuals of all ages, the percentage of sampled individuals who reported having received a prescription for pain medication within the past 30 days increased 25% between 1988–1994 and 2005–2008, from 7.2% to 9%, respectively [2]. Although most pain complaints are managed in a primary care setting or other ambulatory care setting (eg, orthopedic, neurology, or rheumatology practices), utilization of hospitals and EDs for treatment of pain is much more costly and may be associated with more severe pain.

In this paper we report the number of people who received treatment for pain in EDs and hospitals in North Carolina in 2010, as well as the number of ED visits and hospital admissions for pain, by indication. We also provide information on the sociodemographic characteristics of patients who were hospitalized for a pain-related indication.

Finally, we report 5-year trends in knee and hip replacement surgery; from those trends, we project how many such surgeries will be needed in North Carolina in 2030.

We obtained the data for this study from the utilization databases for inpatient discharges and emergency departments. The Cecil G. Sheps Center for Health Services Research at the University of North Carolina at Chapel Hill is under contract with the North Carolina Division of Health Service Regulation to maintain these databases for use in research and state health planning. The databases are updated yearly by Truven Health Analytics.

Based on his clinical experience and a review of the literature, the lead author of this study compiled a list of common pain diagnoses related to inpatient hospitalizations or ED visits and determined the corresponding ICD-9 codes (found in the *International Classification of Diseases*, Ninth Edition). This list of ICD-9 codes was reviewed by 2 physician colleagues with expertise in pain management. The list of ICD-9 codes used for this analysis included codes for common chronic pain complaints (eg, limb pain, back pain, headache, dental pain) and codes for certain surgical procedures, but it did not include ICD-9 codes for pain complaints that would likely be the result of an acute primary medical process (eg, abdominal pain, pelvic pain). Using SAS software, the hospital discharge and ED databases were queried to determine the frequency of utilization of hospitals and EDs for each ICD-9 code. Fourth and fifth digits of the codes were included in the queries, and

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then categories were collapsed for simplicity. We chose to focus on ED and inpatient hospital utilization because of the high cost of services in these 2 clinical settings and the readily available aggregate data. For inpatients, we also calculated frequencies for aggregate pain complaints by race, ethnicity, age, and payer.

The inpatient database was queried to obtain counts of hip and knee replacement surgeries by year for the 5-year period 2006–2010. Rates of hip and knee replacement surgeries (the number of surgeries per 10,000 population) were then calculated for predefined age groups using US Census Bureau intercensal estimates [3]. Using estimates from the North Carolina Office of State Budget and Management [4], the rates of hip and knee replacement surgeries calculated for 2010 were applied to population estimates for 2030. A linear trend analysis (Microsoft Excel) was used to estimate projected rates of hip and knee replacement surgeries for 2030, and those rates were applied to population estimates for 2030.

Table 1 highlights the large volume of people with pain diagnoses who presented in the state's EDs and hospitals in 2010. A total of 254,060 hospitalizations involving 178,662 unique patients were related to pain complaints in 2010. The most common pain diagnoses for inpatient hospitalization were pain in limb (38.3%), back pain (12.8%), chronic pain (12.8%), lower-extremity

joint replacement (12.8%), and headache (10.1%). In addition, a total of 873,828 ED visits by 764,656 unique patients involved at least 1 of the pain diagnoses included in our search. The most common pain diagnoses for ED visits were headaches (29.8%), back pain (28.8%), pain in limb (24.4%), dental pain (9.3%), and chronic pain (7.6%).

Characteristics of patients who were hospitalized for pain-related diagnoses are shown in Table 2. Interestingly, female patients outnumbered male patients nearly 2 to 1. The largest numbers of inpatient hospitalizations related to chronic pain were for patients aged 45–64 years and those aged 65–84 years. The majority of patients were white and non-Hispanic; however, information about ethnicity was missing for a large number of patients. Most patients who were admitted to the hospital had some type of insurance: Medicare (55.2%), private insurance (20.7%), Medicaid (10.8%), or VA/CHAMPUS (1.4%); only 4.5% of patients paid for services out of pocket.

Figures 1 and 2 show the yearly rates of hip and knee replacement surgery, respectively, in North Carolina for 2006 through 2010, by age group. It is especially noteworthy that the rates of hip and knee replacement surgery among individuals 45–64 years of age increased by 24% and 17%, respectively, between 2006 and 2010. Overall rates of hip and knee replacement surgeries rose, as did rates in each age group—with the exception

**TABLE 1.**  
**Common Pain-Related Diagnoses for Inpatients and Emergency Department Patients in North Carolina in 2010**

| Diagnosis                                  | Treated as inpatient<br>Number of diagnoses (%) | Treated in ED<br>Number of diagnoses (%) |
|--------------------------------------------|-------------------------------------------------|------------------------------------------|
| Back pain                                  | 32,626 (12.8)                                   | 251,307 (28.8)                           |
| Chronic pain                               | 32,519 (12.8)                                   | 66,600 (7.6)                             |
| Dental pain                                | 1,301 (0.5)                                     | 81,464 (9.3)                             |
| Headaches                                  | 25,745 (10.1)                                   | 260,782 (29.8)                           |
| Pain in limb                               | 97,236 (38.3)                                   | 213,858 (24.4)                           |
| Joint replacement of the shoulder or elbow | 2,302 (0.9)                                     | NA                                       |
| Lower-extremity joint replacement          | 32,534 (12.8)                                   | NA                                       |
| Spinal fusion                              | 14,044 (5.5)                                    | NA                                       |
| Other spinal procedure                     | 14,290 (5.6)                                    | NA                                       |
| <b>Total unique patients</b>               | <b>178,662</b>                                  | <b>764,656</b>                           |
| <b>Total visits</b>                        | <b>254,060</b>                                  | <b>873,828</b>                           |

Note. ED, emergency department.

Some patients presented as inpatients or to the emergency department on more than 1 occasion; thus, the number of visits was higher than the number of unique patients. Also, the following diagnoses are not listed separately because they involved such small numbers of patients, but they were included in our search of the databases and are included in the total number of unique patients and total number of visits: arthroplasty and repair of hand, fingers, or wrist; arthrodesis of foot or ankle; arthrodesis of other joint; and refusion of spine.

**TABLE 2.**  
**Characteristics of Hospitalized Patients with Pain Complaints in North Carolina in 2010**

| Characteristic                 | Number of patients (%) |
|--------------------------------|------------------------|
| <b>Gender*</b>                 |                        |
| Male                           | 63,139 (35.34)         |
| Female                         | 115,522 (64.66)        |
| <b>Age (years)</b>             |                        |
| <1                             | 58 (0.03)              |
| 1-17                           | 2,031 (1.1)            |
| 18-44                          | 30,215 (16.9)          |
| 45-64                          | 67,151 (37.6)          |
| 65-84                          | 65,183 (36.5)          |
| ≥85                            | 14,024 (7.9)           |
| <b>Race</b>                    |                        |
| White                          | 116,287 (65.1)         |
| Black                          | 27,333 (15.3)          |
| Asian/Pacific Islander         | 943 (0.5)              |
| Native American/Alaskan Native | 3,024 (1.7)            |
| Other                          | 2,000 (1.12)           |
| Unknown/information missing    | 29,075 (16.3)          |
| <b>Ethnicity</b>               |                        |
| Hispanic                       | 1,523 (0.9)            |
| Non-Hispanic                   | 126,968 (71.1)         |
| Unknown/information missing    | 50,171 (28.1)          |
| <b>Insurance</b>               |                        |
| Medicare                       | 98,626 (55.2)          |
| VA/CHAMPUS                     | 2,469 (1.4)            |
| Medicaid                       | 19,238 (10.8)          |
| Private insurance              | 36,976 (20.7)          |
| No insurance (self-pay)        | 8,087 (4.5)            |

Note. CHAMPUS, Civilian Health and Medical Program of the Uniformed Services; VA, Veterans Affairs.

Percentages may total more than 100% due to rounding.

\*One observation is not included due to gender being reported as unknown.

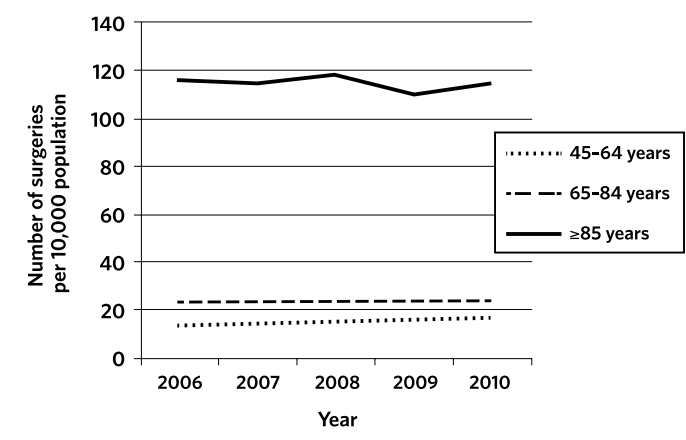
of hip replacement surgeries among those 85 years of age or older.

Table 3 compares the numbers and rates of hip and knee replacement surgeries in 2010 with the numbers and rates that we projected for 2030. Using age-specific population estimates and projected changes in the rates of hip and knee replacement surgeries, we found that the total number of hip replacement surgeries performed annually in North Carolina is likely to have increased by about 33% by 2030, and the number of knee replacement surgeries is likely to have increased by 52%.

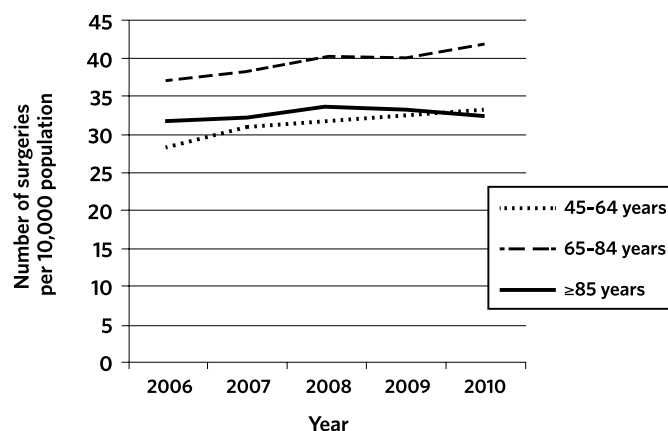
Our findings will not surprise physicians who treat or study adults with pain conditions. ED utilization for pain-related conditions is exceedingly common, with nearly 1 in 10 North Carolinians seeking such care in 2010. It is also not surprising that certain conditions are more common among hospital inpatients than among ED patients. Most hospitalizations for pain-related complaints are for conditions that require surgical treatment (such as spinal or joint surgery). The frequency of ED utilization for pain-related complaints suggests a need for alternative sources of care, extended physician office hours, primary care medical homes, and education of patients regarding self-management.

Perhaps the most noteworthy finding from this analysis is the rate of joint replacement surgeries, particularly the increase in that rate between 2006 and 2010. Nationally, the volume of knee replacement surgeries among Medicare beneficiaries increased 161.5% between 2001 and 2010, and per-capita utilization increased 99.2% [5]. In 2010 the median cost of hip replacement surgery in the

**FIGURE 1.**  
**Yearly Rates of Hip Replacement Surgery in North Carolina by Age Group, 2006-2010**



**FIGURE 2.**  
Yearly Rates of Knee Replacement Surgery in North Carolina by Age Group, 2006–2010



Southern United States, using hospital discharge data on charges and a standardized ratio of cost to charges, was \$16,458; for knee replacement surgery it was \$15,822 [6]. We estimate that the total cost of knee and hip replacement surgeries in North Carolina in 2010 was \$500 million, and we project that this cost will increase to \$700 million in 2030 (assuming no increase in the costs per procedure). This represents a major future health care cost. It should be noted that these figures do not include

the cost of treatment prior to surgery, which can include outpatient visits, radiology services, procedures (eg, joint injections), consultations, and prescription medications. Rehabilitation costs and losses in productivity are also not included.

The prevention and treatment of obesity will be an important factor in mitigating this trend [7]. In addition, there is regional variability in rates of joint replacement among Medicare patients [8], which points to another source of consideration for con-

**TABLE 3.**  
Numbers and Rates of Hip and Knee Replacement Surgeries in North Carolina in 2010, with Projections for 2030, by Age Group

| Age group (years)                        | Hip replacement     |                                           | Knee replacement    |                                           |
|------------------------------------------|---------------------|-------------------------------------------|---------------------|-------------------------------------------|
|                                          | Number of surgeries | Number of surgeries per 10,000 population | Number of surgeries | Number of surgeries per 10,000 population |
| <b>2010</b>                              |                     |                                           |                     |                                           |
| 45-64                                    | 4,172               | 16.7                                      | 8,332               | 33.2                                      |
| 65-84                                    | 5,972               | 23.7                                      | 10,576              | 41.9                                      |
| ≥85                                      | 1,692               | 114.7                                     | 477                 | 32.3                                      |
| <b>Projection 1 for 2030<sup>a</sup></b> |                     |                                           |                     |                                           |
| 45-64                                    | 4,532               | 16.7                                      | 9,064               | 33.2                                      |
| 65-84                                    | 4,776               | 23.7                                      | 8,444               | 41.9                                      |
| ≥85                                      | 2,941               | 114.7                                     | 828                 | 32.3                                      |
| <b>Projection 2 for 2030<sup>b</sup></b> |                     |                                           |                     |                                           |
| 45-64                                    | 8,218               | 30.1                                      | 15,343              | 56.2                                      |
| 65-84                                    | 5,481               | 27.2                                      | 13,059              | 64.8                                      |
| ≥85                                      | 2,567               | 100.1                                     | 969                 | 37.8                                      |

<sup>a</sup>Projection 1 for 2030 assumes that the rates of joint replacement surgery will remain constant from 2010 to 2030 and applies those rates to population estimates for 2030.

<sup>b</sup>Projection 2 for 2030 calculates new rates for 2030 based on linear trends and applies those rates to population estimates for 2030.

trolling costs. Some of this variability may be driven by provider preference and community norms. However, another major factor is patient preference and the degree of patient engagement in decision making related to arthritis treatment and joint replacement surgery. One study of a shared decision-making model for hip and knee replacement showed that use of decision aids was associated with drastically lower numbers of hip and knee replacement surgeries (decreases of 26% and 38%, respectively) [9].

Chronic pain is a common and costly problem resulting in frequent and expensive ED visits and hospitalizations. Optimal treatment, delivery of care in the most appropriate locations, prevention, and cost containment will require broad stakeholder engagement and investment on the part of consumers, providers, payers, and public health professionals. NCMJ

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