Utilization of Orthopaedic Services in a Capitated Population

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Background: The utilization rate for orthopaedic services (office visits and surgery) is not well known. The purpose of this study was to determine the utilization rates for orthopaedic office visits and surgical procedures in a large population of captured lives.

Methods: The study population comprised an average of 134,902 persons per month who were enrolled under a capitated insurance plan between January 1999 and December 1999. This plan was serviced by an independent physician association of sixty-two orthopaedic surgeons who were responsible for all orthopaedic care. Data were collected prospectively and stored in a centralized database. All analyses were conducted with use of monthly averages. Poisson regression was used to compare utilization rates and to calculate odds ratios in order to determine whether the utilization rates varied by age and gender.

Results: The highest proportions of office visits were due to fractures (21%), osteoarthritis (4%), meniscal tears (4%), and low-back pain or sciatica (4%). Knee arthroscopy (30%), foot and ankle procedures (10%), and spine procedures (9%) accounted for the highest proportions of surgical procedures. The overall utilization rates were 6.96 office visits and 1.99 surgical procedures per 1000 covered lives per month. Across all age groups, males and females did not differ with respect to the utilization rate for office visits ($p = 0.42$) or surgery ($p = 0.09$). Increased age was significantly related to increased utilization rates for office visits ($p \leq 0.0002$) and surgery ($p \leq 0.002$).

Conclusions: These data may be used to determine the size of a capitated population that an orthopaedic practice can accommodate, to determine the number of orthopaedic providers that is needed to provide services for a capitated population, and to estimate the expenses associated with providing orthopaedic services for a capitated population in an orthopaedic practice.

In the current medical environment of managed care and cost-containment strategies, third-party payers view surgical specialties such as orthopaedics as expensive services[1]. While previous investigators have used survey studies to estimate the number of office visits to orthopaedic surgeons per annum, the utilization rate for orthopaedic services in the United States remains obscure[2]. The utilization rate is an important factor in the determination of the economic value of orthopaedic services, particularly for capitated health-care plans. Capitation is a reimbursement mechanism in which a health care provider is paid a contracted fee before services are rendered. The provider assumes the financial risk of providing medical services for a particular group of persons. Typically, the specific services for which the provider is responsible are identified in the capitation agreement. If the demand for orthopaedic services can be determined, an orthopaedic practice can estimate how large a capitated population it can accommodate and the associated practice expenses. This information would aid fiscal and administrative management of an orthopaedic practice tremendously. Furthermore, the number of orthopaedic providers needed to serve a capitated population could be determined.

The purpose of the current study was to determine the utilization rates for orthopaedic services, including office visits and surgical procedures, in a large capitated population consisting of more than 120,000 covered lives. We also investigated how gender and age affected the rate of utilization for orthopaedic services.

Materials and Methods

The study population was a cohort enrolled under a capitated insurance contract for all orthopaedic clinical and

surgical services with a private, community-based independent physician association in Houston, Texas. The independent physician association consisted of sixty-two orthopaedic surgeons, including twenty-one whose practice was limited to a single subspecialty and forty-one who practiced general orthopaedics.

The capitated population consisted of employed adults and their dependents. The capitated agreement was offered through a commercial insurance company and did not cover Medicare enrollees. Plan members and their dependents were enrolled through their employers. Patients obtained access to orthopaedic services through a primary care physician when less emergent care was required and through an emergency room when the condition or injury was more serious. The data were prospectively collected from all persons in the cohort who sought orthopaedic treatment between January 1, 1999, and December 31, 1999. The number of patients; the number of office visits; the number of surgical procedures performed (trips to the operating room); gender; age; International Classification of Diseases Ninth Revision, Clinical Modification (ICD-9-CM) codes[3]; and American Medical Association's Current Procedural Terminology (CPT) codes[4] were recorded in a central computer database. Utilization of orthopaedic services was defined as (1) a person who attended one or more office visits (utilization of office visits), (2) a person who received orthopaedic surgery (utilization of surgery), or (3) a person who was the subject of a consultation while hospitalized as an inpatient. For the entire calendar year, only thirty-seven in-hospital consultations were performed. Of these thirty-seven consultations, twenty-one were followed by surgery on the day of the consultation; these twenty-one cases were counted only as persons who received orthopaedic surgery because the bylaws of the independent physician association dictated that the physician could not be compensated for an in-hospital consultation when surgery was performed on the same day. Since only sixteen of the in-hospital consultations performed in the calendar year were not followed by surgery on the same day, data on utilization of this service were excluded from additional study.

The capitated arrangement between the insurance company and the primary care physicians provided no incentive for the primary care physicians to either over-refer or under-refer patients to an orthopaedic specialist. Under the capitated arrangement, the individual orthopaedic surgeon was reimbursed from the pooled capitated income of the independent physician association for the services that he or she provided. The percentage of the monthly revenue that the physician received was calculated on the basis of the ratio of his or her total RBRVS (Resource Based Relative Value Scale) for office visits, surgery, and in-hospital consultations during the month divided by the total RBRVS (for the same services) of the entire group of sixty-two orthopaedic surgeons during the month. Nonemergent surgical services were subjected to a utilization review process by a group of three orthopaedic surgeons in the independent physician association.

During the twelve-month study period, an average of 134,902 persons per month were covered under this capitated contract. The data generated by the practices of all sixty-two orthopaedic surgeons were analyzed. The database was routinely monitored, and quality-control measures were undertaken to ensure data validity and accuracy.

Statistical Methods

All analyses were based on monthly averages and standard deviations. Degrees of freedom for all quarterly and annual analyses were based on average monthly enrollments. Descriptive statistics were used to compare the average utilization rates (per 1000 members per month) between genders, among age groups, and between genders within age groups. Z tests adjusted for multiple comparisons with use of the Bonferroni correction were used to determine whether there were significant differences between months with respect to cohort sizes and utilization rates for office visits and surgery. Seasons (winter, spring, summer, and fall) were defined by the respective celestial equinoxes and solstices in each year. Analyses of variance were used to determine if there were significant seasonal differences in cohort size and utilization rates for office visits and surgery.

Utilization rates can be described in terms of either the number of persons receiving specific services or the quantity of services provided (since a patient may receive several services). Poisson (log-linear) regression models were used to estimate the average monthly rates of four variables: (1) the number of patients attending office visits, (2) the total number of office visits, (3) the number of patients undergoing surgery, and (4) the total number of surgical procedures. The odds ratios produced by Poisson regression were used to examine the differences in the utilization rates between genders, among age groups, and between genders within age groups. For all of the utilization rates, 95% confidence intervals were calculated. For all analyses, a two-tailed p value of ≤ 0.05 was considered significant.

Results

The average size of the cohort during the study period was 134,902 ± 3734.1 members per month. The average number of patients attending office visits was 798 ± 59.0 per month, for an average rate of 5.91 (95% confidence interval, 5.50 to 6.32) per 1000 members per month. The average number of office visits was 939 ± 91.3 per month, for an average rate of 6.96 (95% confidence interval, 6.51 to 7.40) per 1000 members per month. Dividing the number of office visits per month by the number of patients attending office visits per month yielded an average of 1.2.

The most common diagnostic categories were fractures (accounting for 21% of the office visits), low-back pain or sciatica (4%), acute meniscal tears (4%), osteoarthritis of various joints (4%), chondromalacia patellae (3%), patellofemoral syndrome (3%), cruciate ligament injury (2%), carpal tunnel syndrome (2%), rotator cuff syndrome (2%), and lateral epicondylitis (2%).

The average number of patients receiving surgery was 243 ± 29.7 per month, for an average rate of 1.80 (95% confi-

TABLE I Utilization Rates for Orthopaedic Services per One Thousand Members per Month by Age

Age *(yr)*	Mean No. of Persons Attending Office Visits (95% Confidence Interval)	Mean No. of Office Visits (95% Confidence Interval)	Mean No. of Persons Receiving Surgery (95% Confidence Interval)	Mean No. of Surgical Procedures (95% Confidence Interval)
0-4	1.56 (0.84 to 2.27)	1.93 (1.13 to 2.72)	0.72 (0.23 to 1.20)	0.85 (0.32 to 1.38)
5-9	2.33 (1.48 to 3.18)	2.81 (1.88 to 3.74)	1.23 (0.61 to 1.85)	1.41 (0.75 to 2.07)
10-14	5.79 (4.45 to 7.13)	6.90 (5.45 to 8.36)	1.83 (1.08 to 2.58)	2.14 (1.33 to 2.95)
15-19	6.43 (4.94 to 7.91)	7.58 (5.98 to 9.19)	1.43 (0.73 to 2.13)	1.60 (0.86 to 2.34)
20-24	2.92 (1.76 to 4.08)	3.35 (2.11 to 4.60)	0.86 (0.23 to 1.50)	0.99 (0.32 to 1.67)
25-29	3.75 (2.56 to 4.94)	4.30 (3.03 to 5.57)	0.99 (0.38 to 1.61)	1.06 (0.43 to 1.69)
30-34	4.83 (3.58 to 6.09)	5.81 (4.44 to 7.18)	1.19 (0.57 to 1.82)	1.28 (0.64 to 1.92)
35-39	6.32 (4.99 to 7.65)	7.60 (6.15 to 9.06)	1.86 (1.14 to 2.58)	2.09 (1.32 to 2.85)
40-44	7.45 (6.00 to 8.91)	9.02 (7.43 to 10.61)	2.15 (1.37 to 2.93)	2.33 (1.52 to 3.14)
45-49	9.06 (7.30 to 10.82)	10.49 (8.61 to 12.38)	2.83 (1.84 to 3.81)	3.04 (2.02 to 4.06)
50-54	9.97 (7.87 to 12.07)	11.50 (9.25 to 13.74)	3.18 (1.99 to 4.36)	3.52 (2.28 to 4.77)
55-59	11.09 (8.40 to 13.79)	12.53 (9.68 to 15.38)	3.29 (1.82 to 4.76)	3.53 (2.01 to 5.05)
60-64	12.11 (8.21 to 16.00)	13.84 (9.71 to 17.98)	3.96 (1.74 to 6.19)	4.21 (1.92 to 6.50)
≥65	11.63 (4.00 to 19.26)	13.15 (5.09 to 21.22)	4.35 (0.00 to 9.02)	5.22 (0.12 to 10.32)
All groups	5.91 (5.50 to 6.32)	6.96 (6.51 to 7.40)	1.80 (1.57 to 2.02)	1.99 (1.75 to 2.23)

dence interval, 1.57 to 2.02) per 1000 members per month. The average number of surgical procedures was 269 ± 35.2 per month, for an average rate of 1.99 (95% confidence interval, 1.75 to 2.23) per 1000 members per month. Dividing the number of surgical procedures per month by the total number of patients receiving surgery per month yielded an average of 1.1.

The most common types of orthopaedic surgical procedures, as a proportion of the total number of surgical procedures performed, were arthroscopy of the knee (30%), foot and ankle procedures (10%), spine procedures (9%), wrist and hand procedures (8%), operative treatment of fractures (8%), and shoulder procedures not including arthroplasty (5%). Total knee arthroplasty and total hip arthroplasty together accounted for <3% of all surgical procedures performed.

Utilization of Orthopaedic Services by Month and Season

Neither the number of members in the cohort nor the gender distribution of the members differed significantly between months ($p > 0.05$) or between seasons ($p > 0.05$). There was an average of 67,535 ± 1990.5 females and 67,367 males ± 1745.5 per month within the cohort. (The male-to-female ratio remained very close to 1.00 throughout the year.) There was also no significant difference between months with respect to the rate of patients attending office visits, the rate of office visits, the rate of patients receiving surgery, or the rate of surgical procedures ($p > 0.05$). In addition, there were no significant seasonal variations in the rates of patients attending office visits or receiving surgery ($p > 0.05$).

Utilization of Orthopaedic Services by Gender and Age

Across all age groups, the rates of patients attending office visits, the rates of office visits, the rates of patients receiving surgery, and the rates of surgical procedures did not differ significantly by gender ($p > 0.05$).

Age significantly affected the rate of patients attending office visits ($p \leq 0.0002$) and the rate of patients receiving surgery ($p \leq 0.002$) (Table I and Fig. 1). Between the ages of twenty and sixty-four years, the rate of patients attending office visits and the rate of patients receiving surgery both increased approximately linearly with age (Table I and Fig. 1).

The rate of patients attending office visits increased significantly ($p < 0.000001$) from birth to the age of nineteen years and then declined significantly ($p = 0.00002$) in the age group of twenty to twenty-four years (Table I and Fig. 1). The rate at which patients between the ages of ten and nineteen years attended office visits was higher than the rates for persons between birth and the age of nine years (odds ratio for age of ten to nineteen years, 3.12; 95% confidence interval, 2.21 to 4.41) and for persons between the ages of twenty and twenty-nine years (odds ratio for age of ten to nineteen years, 1.80; 95% confidence interval, 1.31 to 2.45). Between the ages of five and thirty-nine years, the rate of males attending office

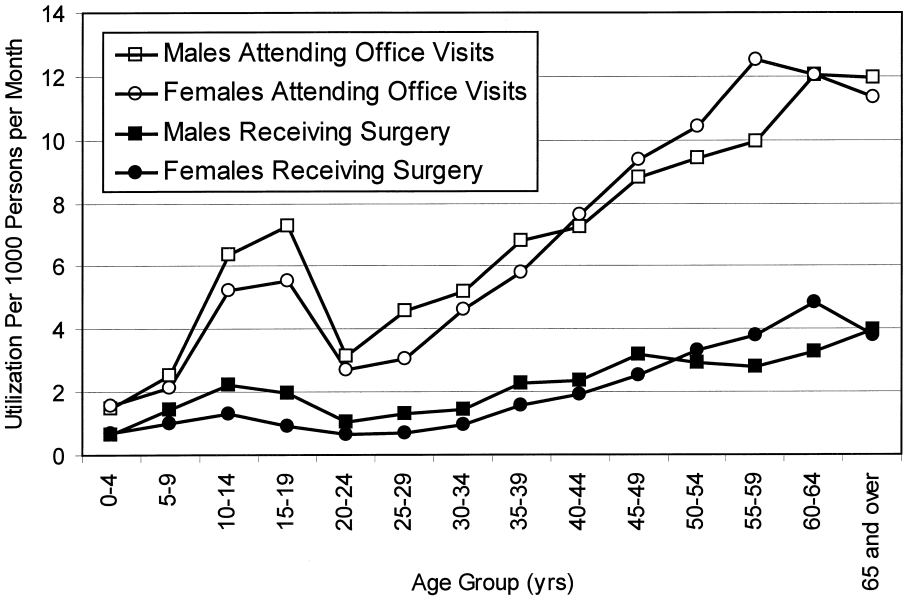

Fig. 1

The rates of persons attending office visits and of those receiving orthopaedic surgery per 1000 covered lives per month by gender and age.

visits was significantly higher ($p < 0.000001$) than the rate of females attending office visits (odds ratio for males, 1.10; 95% confidence interval, 1.07 to 1.13). For the ages of forty years and older, the rate of males attending office visits was significantly lower ($p < 0.000001$) than the corresponding rate for females (odds ratio for males, 0.79; 95% confidence interval, 0.77 to 0.82).

The rate at which persons between the ages of ten and nineteen years received surgery was higher than that for persons between the ages of birth and nine years (odds ratio for the age of ten to nineteen years, 1.75; 95% confidence interval, 1.03 to 3.00) but did not differ from the rate for persons between the ages of twenty and twenty-nine years old (odds ratio for the age of ten to nineteen years, 1.73; 95% confidence interval, 0.97 to 3.09). Between the ages of five and forty-nine years, the rate of males receiving surgery was significantly higher ($p = 0.000004$) than the rate of females receiving surgery (odds ratio for males, 1.13; 95% confidence interval, 1.08 to 1.18). For the ages of fifty years and over, the rate of males receiving surgery was significantly lower ($p < 0.000001$) than the rate of females receiving surgery (odds ratio for males, 0.69; 95% confidence interval, 0.61 to 0.78).

Discussion

Several reports published by the Centers for Disease Control and Prevention (CDC) have analyzed the National Ambulatory Medical Care Survey (NAMCS) data in order to estimate the rate of office visits to orthopaedic surgeons in the United States[5,6]. The NAMCS is a national multistage probability sampling survey. According to these reports, the estimated utilization rate for office visits to orthopaedic surgeons is between 14.5 and 14.9 office visits per 100 persons per year[5,6]. These rates are equivalent to approximately twelve office visits per 1000 persons per month, which is considerably higher than the rate of approximately seven office visits per 1000 members per month in our study. Several differences between the populations under study and the methodologies may explain these differences.

The population studied in the current investigation comprised employed adults (and their dependents) who were insured through a capitated commercial insurance plan. Thus, uninsured or elderly (retired) persons were underrepresented in our cohort. The NAMCS population consisted of the entire noninstitutionalized population of the United States. The data derived from our cohort represents the utilization rates in a known population of captured lives; no sampling or estimation was required. In contrast, the NAMCS utilized survey information from sampled representative practices, and therefore the data are an estimation of orthopaedic utilization rates.

Under the capitated arrangement that we investigated, all patients with nonemergent conditions had to be referred by a primary care physician. The arrangement between the insurance company and the primary care physicians did not involve any financial incentives to either over-refer or under-refer patients to an orthopaedic specialist. Therefore, we do not believe that this particular capitated arrangement introduced bias into the referral behavior of the primary care physicians. However, it is possible that other capitation plans could influence the referral behavior of primary care physicians, which would directly affect the utilization rate for orthopaedic office visits.

Under the capitated arrangement investigated in the present study, the orthopaedic surgeon was reimbursed from the pooled capitated income of the independent physician association on the basis of the services (RBRVS) that he or she provided. Because of this arrangement, the orthopaedic surgeons' behavior should not have been influenced by the capitated insurance structure as the incentives were no different from a fee-for-service reimbursement. However, it is possible that, under other capitated agreements, the behavior of ortho-

paedic surgeons could be influenced by certain aspects of the capitation agreement.

The use of capitation as a reimbursement strategy has been declining in recent years[7-9]. Because the effects of capitation and other managed care strategies on physician behavior are unknown, our data should not be used to predict utilization of orthopaedic services by persons enrolled in insurance plans that employ reimbursement strategies other than capitation or for persons with other types of health care coverage. Utilization of health care services has been shown to vary according to payer type[5,6,10]. In addition, the utilization of orthopaedic services in capitated plans with a smaller number of covered lives may be greatly affected by the age distribution and health status of its enrollees. Thus, extrapolation of our results to different types of capitated populations should be done cautiously and with careful attention to the demographics of the specific capitated population.

Figure 2 shows that the utilization rate among persons who were sixty-five years of age or older in our study (13.0 office visits per 1000 members per month) was lower than that in the NAMCS data[6] (19.5 office visits per 1000 persons per month). In comparison with the 1999 United States census data used by the CDC[5], we had proportionately fewer persons in the age group of sixty-five years or older (0.6% of our population) than would be expected in a random sample of the United States population (12.6%). The persons who were sixty-five or older in our cohort were not retired and were using the capitated insurance plan as their primary health care coverage. Thus, the socioeconomic and general health characteristics of those persons may not be representative of the characteristics of persons sixty-five or older who are retired and use Medicare as a primary health care coverage in the general United States population. Consequently, our results are probably not representative of the true general utilization rates for orthopaedic services among persons sixty-five or older in the United States. We therefore cannot recommend using the results of the present investigation to predict utilization of orthopaedic services by persons sixty-five or older.

The age distribution of the persons who were sixty-four years of age or younger in our cohort was within 3% of the age distribution in the noninstitutionalized United States population[5]. We found the rate of office visits by persons sixty-four or younger to be seven visits per 1000 members per month. The 1995 and 1996 NAMCS data estimated a comparable, although slightly higher, rate of office visits (equivalent to eleven office visits per 1000 persons per month) for the same age range[6].

There was a correlation between age and the rate of office visits. We identified a curvilinear pattern of utilization of office visits by persons younger than twenty-nine years. More persons between the ages of ten and nineteen years utilized office visits than did persons between the ages of birth and nine years or between the ages of twenty and twenty-nine years. The rate of orthopaedic office visits increased approximately linearly between the ages of twenty and sixty-four years. This trend is similar to that reported in the 1995 and 1996 NAMCS data, in which the rate of orthopaedic office visits was estimated to gradually increase from a low of 6.0 visits per 100 persons per year for ages under fifteen years to a high of 24.6 visits per 100 persons per year for ages of sixty-five years and older[6].

The CDC report of the 1995 and 1996 NACMS data did not provide the utilization rates for surgical services for orthopaedic conditions[6]. To the best of our knowledge, we are the first to report the rate of orthopaedic surgery among a large cohort of captured lives.

We observed a correlation between age and the rate of surgery. We identified a curvilinear pattern for the rate of surgery among persons younger than twenty years. The rate of orthopaedic surgery for persons between the ages of ten and nineteen years was higher than that for persons nine years of age and younger but did not differ from the rate for persons

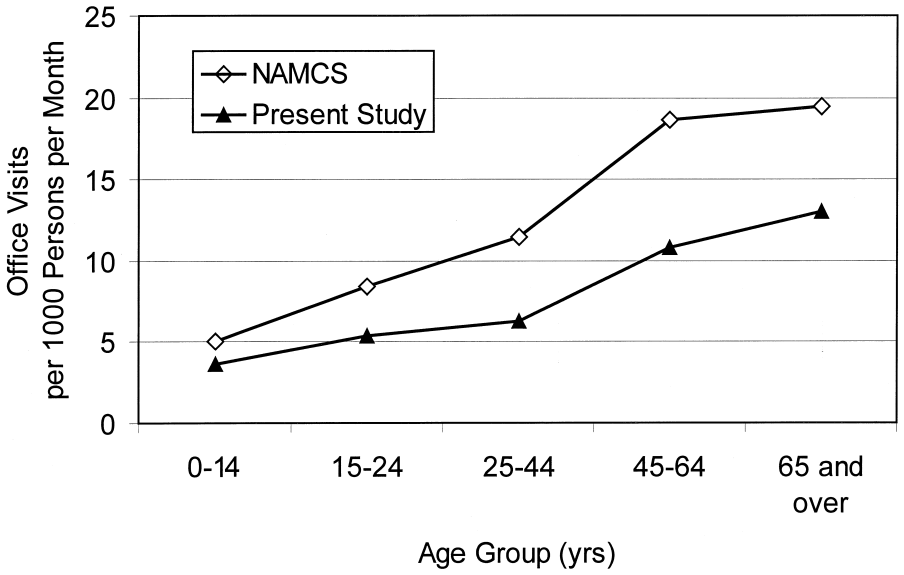

Fig. 2
Comparison of rates of office visits from the 1996 National Ambulatory Medical Care Survey (NAMCS) with those of the present study.

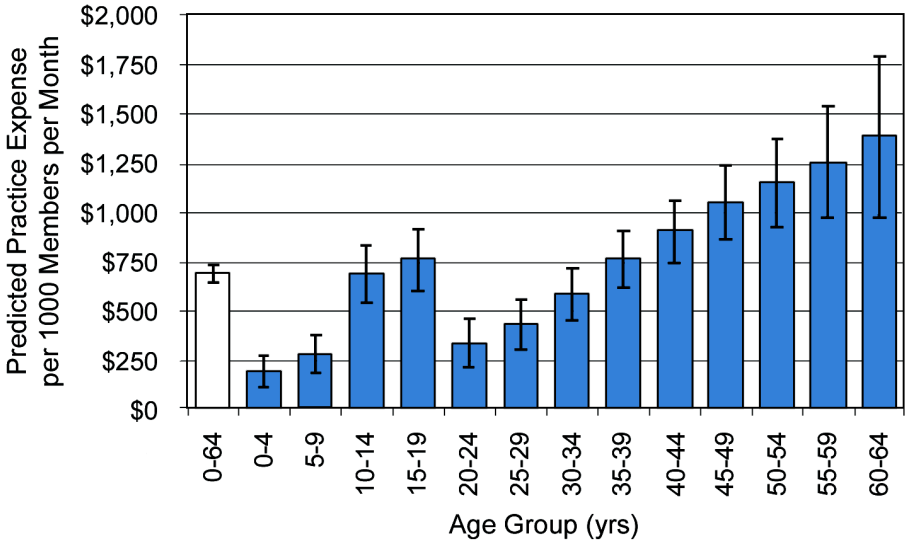

Fig. 3

Predicted practice expense of providing orthopaedic services per 1000 members per month for selected patient ages.

between the ages of twenty and twenty-nine years. The rate of orthopaedic surgery increased approximately linearly between the ages of twenty and sixty-four years. For every fifteen-year increase in age, the rate of patients receiving surgery increased by slightly more than one patient per month for every 1000 members.

The data from our cohort can be used for a variety of purposes. The number of covered lives for whom an orthopaedic group practice can provide care under a capitated contract can be estimated, and practice administrators can estimate how many orthopaedic providers will be required for a given number of covered lives (if each provider accepts a standard number of patients per month). Furthermore, the rates of orthopaedic office visits and surgery vary by gender within certain age groups, but unless the gender distribution of a capitated population is skewed, the age distribution of the population will have a more noticeable effect on utilization than will gender. Specifically, orthopaedic surgeons whose practice consists primarily of children (younger than eighteen years of age) can expect a much lower average utilization rate for office visits (4.10 patients per 1000 members per month) than can orthopaedic surgeons whose patients are primarily fifty years of age and older (11.36 patients per 1000 members per month). Thus, the age distribution of covered lives in a capitated insurance plan is important when establishing capitation contracts and when anticipating the capitation disbursements among the orthopaedic service providers.

Another important way in which the data from the present study can be utilized is to estimate the anticipated practice expenses associated with providing orthopaedic care to a population of lives. Using activity-based cost information collected in 1997, we previously estimated the average practice expense of a large orthopaedic group to be $99.09 per office visit[11]. The average rate of office visits can be multiplied by the average practice expense per office visit to show the expected monthly practice expenses for providing orthopaedic services per 1000 covered lives (Fig. 3). The estimates shown in Figure 3 are the expected monthly practice expenses per 1000 persons enrolled in the capitated health care plan, not the expenses per 1000 persons receiving service. The estimates shown in Figure 3 are equivalent to the practice expense per office visit in 1997; adjusted for inflation to the year 2002, the estimated practice expense would be $101.91 per office visit. These estimates are a simplified demonstration of a meaningful application of these data. Actual practice expenses undoubtedly vary by orthopaedic subspecialty, practice pattern, geographic location of the practice, and various other economic factors such as rent, wages, and practice size. Other orthopaedic practices can calculate their anticipated practice expenses for providing capitated services by using both the method introduced by us previously[11] for estimating per office visit practice expenses and the utilization data of the current investigation.

In conclusion, the utilization of orthopaedic services by a population of persons sixty-four years of age or younger enrolled under a commercial capitated contract depends on the age and gender of the population. Generally, the rates of orthopaedic office visits and orthopaedic surgery increase with age. Males have higher utilization rates in early adulthood, and females have higher utilization rates in later adulthood. These data can be used to estimate the number of covered lives that can be accommodated by an orthopaedic practice and to estimate the anticipated practice expenses for a given population enrolled under a capitated insurance contract. ■

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