

# Preoperative Health Status of Patients With Four Knee Conditions Treated With Arthroscopy

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Normative preoperative Short Form-12 Health Survey components summary scores have not been reported for patients who have knee conditions treated with arthroscopy. During one calendar year, 269 consecutive patients with a knee injury (119 meniscus lesions, 73 anterior cruciate ligament ruptures, 54 articular cartilage lesions, and 23 with patellar instability) completed the Short Form-12 Health Survey before medical evaluation. Mental Component Scale and Physical Component Scale scores were computed. Scores were compared with previously published normative and age-specific data for several medical conditions and the United States general population. With the number of patients available, no significant differences were detected between knee conditions for the Mental Component Scale and Physical Component Scale scores. In general, Physical Component

Scale scores among patients with knee conditions were similar to previously reported Physical Component Scale scores for patients with orthopaedic shoulder conditions and significantly lower than the United States population norms. These data can be used as historic control groups to represent patients with knee conditions requiring arthroscopy. Age-specific Mental Component Scale and Physical Component Scale scores are indicated when comparing groups with a limited age range.

General measures of health status, such as the 36-item and 12-item Short Form Health Surveys, allow comparisons among patient groups with different medical conditions.<sup>5,7,8,12,13</sup> However, there are no published studies comparing the health status of groups of patients with operable knee conditions with patients with other medical conditions or with the general population. Therefore, it is unknown how knee conditions affect patients' perceived health relative to other medical conditions.

The Short Form-12 Health Survey yields a Mental Component Scale and Physical Component Scale scores that are indicators of mental and physical health status, respectively.<sup>15,16</sup> Normative scores for the Short Form-36 Health Survey's Mental Component Scale and Physical Component Scale have been reported

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for many patient groups and healthy populations.<sup>6,15,16</sup> The Short Form-12 Health Survey's Mental Component Scale and Physical Component Scale scores are very highly correlated ( $r^2 \geq 0.90$ ) with the Short Form-36 Health Survey's Mental Component Scale and Physical Component Scale scores. This allows comparisons among groups for whom normative scores for the Short Form-36 Health Survey's Mental Component Scale and Physical Component Scale have been published.<sup>6,11,15,16</sup> The reduced patient response burden of the Short Form-12 Health Survey is an attractive alternative for orthopaedic clinics. The shorter form allows diagnosis-specific or body-region-specific outcome surveys to be administered concurrently.

This retrospective study reports self-rated preoperative health status among four groups of patients with knee conditions treated with arthroscopic surgery. Normative and age-specific Short Form-12 Health Survey Mental Component Scale and Physical Component Scale scores for each knee group were compared with previously published Mental Component Scale and Physical Component Scale scores for patients with other medical conditions and the general United States population.

## MATERIALS AND METHODS

Between January and December 1999, one orthopaedic surgeon evaluated 272 patients with knee disorders who each eventually had arthroscopic knee surgery. Indications for surgery were pain, swelling, or instability of the knee that interfered with daily activities and a surgically repairable lesion in the knee. As part of an ongoing outcomes data collection project, all patients completed the Short Form-12 Health Survey using a touch-screen computer system immediately before their initial office evaluation.

Three patients (all women; ages 49, 57, and 76 years) did not complete the Short Form-12 Health Survey and could not have scores computed. Excluding these three patients, 269 patients were included in the study. These data were retrieved from a coded archival database. This protocol was exempt from institutional review.

Patients were classified into one of four diagnostic groups. Diagnosis was determined by history and clinical examination, and was confirmed at arthroscopy. The Meniscus Group included 119 patients with lesions of the medial or lateral meniscus, including longitudinal, horizontal, flap, or radial tears. Patients who had a cruciate ligament injury were excluded from this group. Sixty-nine patients (58%) in the Meniscus Group had concomitant articular cartilage lesions of the patella or femur.

The Anterior Cruciate Ligament Group included 73 patients with traumatic anterior cruciate ligament rupture. More than 95% of these injuries had occurred within the previous 4 months. Patients were included in the Anterior Cruciate Ligament Group regardless of coexisting meniscus ( $n = 28$ ; 38%) or articular cartilage ( $n = 2$ ; 3%) lesions.

The Patellar Group consisted of 23 patients with chronic or acute patellar instability. These patients had a history of knee instability (giving way) or frank patellar dislocation, but no ligament or meniscus injuries. Clinical signs included a lateral-riding patella, abnormal lateral patellar glide, and a lateral patella or a dystrophic lateral femoral condyle on Merchant-view radiographs. Twelve patients (52%) in the Patellar Group had concomitant articular cartilage lesions of the patella or femur.

The Articular Group included 54 patients with symptomatic articular cartilage lesions of the femoral condyles or patella that were confirmed at arthroscopy. History included pain and swelling with prolonged weightbearing activity. Clinical signs included joint inflammation, normal clinical instability tests, and patellar pain or crepitus during manual patellar compression. Some patients had degenerative changes visible on posteroanterior radiographs. Patients with anterior cruciate ligament rupture, a meniscus lesion described above, or patellar instability were excluded from the Articular Group. Patients with articular cartilage lesions requiring arthroscopy who had concomitant degenerative meniscus lesions that did not require surgical intervention were included in the Articular Group.

The scoring algorithms derived by Ware et al<sup>15</sup> were used to obtain the Short Form-12 Health Survey's Mental Component Scale and Physical Component Scale scores. The Mental Component Scale and Physical Component Scale scores are standardized with a mean of 50 points and a standard deviation of 10 points among the general United States population.<sup>15</sup> Mean and standard deviation were computed for the Mental Component Scale and

Physical Component Scale scores within each group. Separate two-way analyses of variance (ANOVA) were used to determine if age, Mental Component Scale Scores, or Physical Component Scale scores varied as a function of gender or knee condition.

Previously published 36-Item or 12-Item Short Form Health Survey mental scores for patients with orthopaedic shoulder conditions,<sup>5</sup> chronic medical conditions,<sup>14,15</sup> and the general United States population<sup>15</sup> were used as historic control groups.<sup>11</sup> To evaluate differences among groups, mean difference scores for the Mental Component Scale and Physical Component Scale were calculated for each possible pair of diagnoses. Mean difference scores that exceeded two times the standard error of measurement for the respective score ( $\pm 6.3$  for Mental Component Scale,  $\pm 5.4$  for Physical Component Scale<sup>14,17</sup>) were considered significant (greater than chance at the 0.05 level). Previous investigators, including the publishers of the Short Form-12 Health Survey, recommend this method to identify significant and meaningful differences between groups.<sup>3,14,17</sup>

Pearson product moment correlation coefficients were computed between age and each component score. These coefficients represent the degree to which two variables are related. Percentiles relative to the age-matched United States popula-

tion norms<sup>15</sup> were computed for the Mental Component Scale and Physical Component Scale scores for each knee diagnosis group to evaluate the deviation of patients with knee conditions from the population norms. The United States population has been recommended as the standard group for interpretation.<sup>7,15</sup> Mental Component Scale and Physical Component Scale scores equivalent to the United States population's twenty-fifth percentile, which is the score that less than 25% of the population will receive, have been suggested as the criterion defining impairment.<sup>11</sup> Mental Component Scale and Physical Component Scale scores lower than the twenty-fifth percentile were used to identify mental or physical impairment in the knee groups relative to the United States population.

## RESULTS

Table 1 shows the mean ages and gender of patients within and across the four knee conditions. Age did not differ significantly by gender within the knee condition groups ( $p = .247$ ) or across the entire sample ( $p = .149$ ). Age did differ significantly, however, between knee conditions ( $p < .0005$ ). Tukey's post hoc pairwise tests indicated that the patients in the Patella Group (28.3 years) and the Anterior

**TABLE 1. Age at Initial Evaluation for Knee Diagnosis Groups**

| Group                      | Gender       | n   | Average Age (years) | Age Range (years) |
|----------------------------|--------------|-----|---------------------|-------------------|
| Meniscus                   | Male         | 76  | 46.1                | 16-68             |
|                            | Female       | 43  | 52.6                | 14-81             |
|                            | Total        | 119 | 48.4*               | 14-81             |
| Anterior cruciate ligament | Male         | 52  | 33.8                | 14-63             |
|                            | Female       | 21  | 31.1                | 14-70             |
|                            | Total        | 73  | 33.0*               | 14-70             |
| Patellar                   | Male         | 8   | 25.8                | 14-40             |
|                            | Female       | 15  | 29.7                | 13-62             |
|                            | Total        | 23  | 28.3*               | 13-62             |
| Articular                  | Male         | 31  | 42.5                | 18-62             |
|                            | Female       | 23  | 47.2                | 21-73             |
|                            | Total        | 54  | 44.5*               | 18-73             |
| Total                      | Male         | 167 | 40.6                | 14-68             |
|                            | Female       | 102 | 43.6                | 13-81             |
|                            | Total sample | 269 | 41.8                | 13-81             |

\*The Patellar Group and Anterior Cruciate Ligament Group were significantly ( $p < .0005$ ) younger than the Meniscus Group and Articular Group.

Cruciate Ligament Group (33.0 years) each were significantly ( $p < .0005$ ) younger than the patients in the Meniscus Group (48.4 years) and the Articular Group (44.5 years).

Mental Component Scale scores did not differ significantly by gender ( $p = .536$ ), by knee condition ( $p = .660$ ), or by gender within knee condition ( $p = .299$ ). Physical Component Scale scores, however, did differ significantly by knee condition ( $p = .012$ ), but not by gender ( $p = .330$ ) or by gender within knee condition ( $p = .345$ ). In post hoc pairwise comparisons, mean Physical Component Scale scores for the Anterior Cruciate Ligament Group (41.2) and Articular Group (36.2) were significantly different ( $p = .033$ ). The magnitude of this difference (5.1 points), however, was less than measurement error (5.4 points). Other post hoc pairwise tests of Physical Component Scale score differences between knee conditions were not significant ( $p > .05$ ). Because no significant differences by gender were detected, subsequent analyses were conducted using the combined data of both genders to increase statistical power.

Table 2 shows the normative (means and standard deviations) Mental Component Scale

and Physical Component Scale scores for each knee group, including subgroups with multiple conditions, such as anterior cruciate ligament rupture with meniscus tear. Table 2 also shows the percentile of each group and subgroup relative to age-specific United States population norms. The subgroup scores did not differ significantly from the respective group scores.

Across the entire sample, 42.9% of the patients scored at or below the United States general population's twenty-fifth percentile for the Mental Component Scale. In addition, 69.3% scored at or below the twenty-fifth percentile for the Physical Component Scale. The mean Mental Component Scale scores for each knee group were above the age-matched population twenty-fifth percentile criterion. Each knee group and subgroup, however, had Physical Component Scale scores well below the age-matched population twenty-fifth percentile, suggesting substantial perceived physical impairment for patients in those groups.

Table 3 shows the comparison among the mean Mental Component Scale scores for patients with knee conditions with patients with

**TABLE 2. Mean Scores and Age-Specific Percentiles for the Short Form-12 Health Survey Mental Component Scale and Physical Component Scale Scores Among Patients With Knee Disorders**

| Group   | n   | Mental Component Scale |            | Physical Component Scale |            |
|---|-----|------------------------|------------|--------------------------|------------|
|   |     | Mean (SD)              | Percentile | Mean (SD)                | Percentile |
| Meniscus group                                    | 119 | 44.7 (6.2)             | 27.4%      | 37.9 (9.7)               | 10.8%      |
| Meniscus and Articular subgroup                   | 69  | 44.8 (6.4)             | 27.8%      | 36.8 (8.7)               | 8.7%       |
| Anterior Cruciate Ligament group                  | 73  | 44.6 (6.2)             | 31.9%      | 41.2 (10.7)              | 3.6%       |
| Anterior Cruciate Ligament and Meniscus subgroup  | 28  | 44.0 (7.2)             | 29.8%      | 40.3 (9.8)               | 2.6%       |
| Anterior Cruciate Ligament and Articular subgroup | 2   | 48.6 (3.7)             | 43.3%      | 31.0 (10.1)              | 0.2%       |
| Patellar group                                    | 23  | 43.4 (6.4)             | 27.8%      | 40.4 (10.2)              | 2.7%       |
| Patellar and Articular subgroup                   | 12  | 46.7 (6.6)             | 40.1%      | 36.6 (10.1)              | 0.6%       |
| Articular group                                   | 54  | 45.3 (7.0)             | 28.8%      | 36.2 (9.9)               | 1.4%       |

SD = standard deviation; Percentile = percent of age-matched United States population scoring at or below the respective score; A rating of  $\leq 25\%$  indicates substantial impairment.

**TABLE 3. Rank-Ordered (Most to Least Impaired) Mean Short Form-12 Health Survey Mental Component Scale Scores by Diagnosis**

| Diagnosis Group                                      | n    | Mean Mental Component Scale Score |
|--|------|-----------------------------------|
| Clinical depression                                  | 502  | 34.8 <sup>††§</sup>               |
| Tenth percentile for United States population        |      | 37.8                              |
| Patellar Group                                       | 23   | 43.4 <sup>†</sup>                 |
| Anterior Cruciate Ligament Group                     | 73   | 44.6 <sup>†</sup>                 |
| Meniscus Group                                       | 119  | 44.7 <sup>*</sup>                 |
| Twenty-fifty percentile for United States population |      | 45.1                              |
| Articular Group                                      | 54   | 45.3 <sup>§</sup>                 |
| Back pain  | 519  | 46.9                              |
| Rotator cuff tear                                    | 111  | 47.2                              |
| Glenohumeral instability                             | 149  | 48.1                              |
| Impingement  | 117  | 49.1                              |
| United States population                             | 2329 | 50.0 <sup>†</sup>                 |
| Congestive heart failure                             | 216  | 50.4 <sup>†</sup>                 |
| Adhesive capsulitis                                  | 100  | 51.0 <sup>††</sup>                |
| Myocardial infarction                                | 107  | 51.7 <sup>††§</sup>               |
| Diabetes mellitus Type II                            | 541  | 51.9 <sup>††§</sup>               |
| Glenohumeral osteoarthritis                          | 67   | 52.2 <sup>††§</sup>               |
| Hypertension   | 2089 | 52.2 <sup>††§</sup>               |

<sup>††§</sup>Significant ( $\geq 6.3$  points) difference from respective knee diagnosis ( $p < .05$ ).

other medical conditions and the United States general population. Patients with clinical depression had a significantly ( $p = .003$ ) lower mean Mental Component Scale score than the patients with knee conditions. All four knee groups had mean Mental Component Scale scores significantly ( $p \leq .027$ ) lower than patients with myocardial infarction, diabetes mellitus Type II, glenohumeral arthritis, and hypertension. None of the knee groups' mean Mental Component Scale scores differed significantly from scores of groups of patients with back pain ( $p \geq .134$ ), rotator cuff tear ( $p \geq .115$ ), glenohumeral instability ( $p \geq .070$ ), or subacromial impingement ( $p \geq .051$ ). Only the Patellar Group had Mental Component Scale scores significantly ( $p = .018$ ) lower than the United States general population.

Table 4 shows the comparison among the knee groups' mean Physical Component Scale scores with patients with other medical conditions and the United States general population. In contrast to the Mental Component Scale, every knee group had a mean Physical Component Scale score significantly ( $p \leq .0005$ )

lower than the United States general population norm. The Anterior Cruciate Ligament Group and Patellar Group each had significantly ( $p \leq .018$ ) better Physical Component Scale scores than did groups of patients with rotator cuff tear and congestive heart failure. Mean Physical Component Scale scores in the Articular Group and Meniscus Group were significantly ( $p \leq .009$ ) lower than patients with clinical depression or hypertension. The Articular Group's mean Physical Component Scale score also was significantly ( $p \leq .009$ ) lower than the mean Physical Component Scale scores for groups of patients with myocardial infarction and back pain. No group of patients with any medical condition had a mean Physical Component Scale score significantly worse than the Articular Group and Meniscus Group. Mean Physical Component Scale scores for the patients with knee conditions did not differ significantly from patients with glenohumeral instability, glenohumeral osteoarthritis, subacromial impingement, adhesive capsulitis, or Type II diabetes mellitus.

Using the data of all four knee groups, the

**TABLE 4. Rank-Ordered (From Most to Least Impaired) Mean Short Form-12 Health Survey Physical Component Summary Scores by Diagnosis**

| Diagnosis                                      | n    | Mean Physical Component Scale Score |
|--|------|-------------------------------------|
| Congestive heart failure                       | 216  | 34.5 <sup>†‡</sup>                  |
| Rotator cuff tear                              | 111  | 34.7 <sup>†‡</sup>                  |
| Articular Group                                | 54   | 36.2 <sup>§</sup>                   |
| Glenohumeral osteoarthritis                    | 67   | 36.4                                |
| Impingement                                    | 117  | 36.6                                |
| Adhesive capsulitis                            | 100  | 37.6                                |
| Meniscus Group                                 | 119  | 37.9 <sup>*</sup>                   |
| Tenth percentile for general population        |      | 38.0                                |
| Glenohumeral instability                       | 149  | 38.2                                |
| Patellar Group                                 | 23   | 40.4 <sup>†</sup>                   |
| Anterior Cruciate Ligament Group               | 73   | 41.2 <sup>†</sup>                   |
| Diabetes mellitus Type II                      | 541  | 41.5                                |
| Myocardial infarction                          | 107  | 42.6 <sup>§</sup>                   |
| Back pain and sciatica                         | 519  | 43.1 <sup>§</sup>                   |
| Hypertension                                   | 2089 | 44.3 <sup>*§</sup>                  |
| Clinical depression                            | 502  | 45.0 <sup>*§</sup>                  |
| Twenty-Fifty percentile for general population |      | 46.5 <sup>**§</sup>                 |
| United States population                       | 2329 | 50.1 <sup>**†§</sup>                |

\*†‡§Significant (≥5.4 points) difference from respective knee diagnosis (p < .05).

Pearson product moment correlation coefficient (r) between age and Mental Component Scale scores (r = 0.14, p = 0.02), and between age and Physical Component Scale scores (r = 0.25, p = 0.0004), indicated significant but modest age effects for both scales. Table 5 shows the age-specific Mental Component Scale and Physical Component Scale standard scores for each knee condition. Table 5 also shows percentiles relative to age-specific United States general population norms. Most of the Mental Component Scale scores were above the respective age-specific twenty-fifth percentile. The most notable exceptions (in age groups containing more than 10 patients) were between the patients in the Meniscus and Articular Groups 35 to 44 years of age, both of whom scored below the twenty-fifth percentile. For mean Physical Component Scale scores, however, every age category within every knee condition, except the Anterior Cruciate Ligament Group among patients 65 to 74 years of age (n = 2) scored below the respective age-specific twenty-fifth percentile. These results suggest that substantial perceived

physical health impairment existed among this sample of patients with knee conditions.

## DISCUSSION

Only a few published articles include 12-item or 36-item Short Form Health Survey scores for groups of patients with knee conditions.<sup>1,2,9,10,12</sup> No reports of 12-item or 36-item Short Form Health Survey component scores for knee conditions similar to those of the current study were found. Studies of efficacy, efficiency, and economy of medical treatment, particularly across medical diagnoses, should consider initial health status of the patients because different conditions produce different mental and physical health effects. Without an indication of how groups differ at baseline, comparing the relative effects of medical treatment for those groups is difficult.

Davies et al<sup>1</sup> and Kosinski et al<sup>7</sup> reported Mental Component Scale and Physical Component Scale scores for patients with osteoarthritis<sup>1</sup> or osteoarthritis and rheumatoid arthritis<sup>7</sup> of the knee. The Articular Group's

**TABLE 5. Standard Scores (z-scores) of Knee Groups' Mean Short Form-12 Health Survey Mental Component Scale Score and Physical Component Scale Score Results to Age-Specific United States Population Normative Scores**

| Group                            | Age (years)          | Mental Component Scale |         | Physical Component Scale |         |
|----------------------------------|----------------------|------------------------|---------|--------------------------|---------|
|                                  |                      | Score                  | z-Score | Score                    | z-Score |
| Meniscus Group                   | 18–34 years (n = 16) | 43.2                   | –0.61   | 39.0                     | –2.13*  |
|                                  | 35–44 years (n = 22) | 41.8                   | –0.96*  | 40.1                     | –1.66*  |
|                                  | 45–54 years (n = 30) | 47.1                   | –0.35   | 36.9                     | –1.35*  |
|                                  | 55–64 years (n = 31) | 44.6                   | –0.61   | 38.0                     | –0.80*  |
|                                  | 65–74 years (n = 11) | 46.1                   | –0.63   | 34.9                     | –0.80*  |
|                                  | ≥75 years (n = 4)    | 44.0                   | –0.56   | 28.0                     | –0.97*  |
| Anterior Cruciate Ligament Group | 18–34 years (n = 32) | 44.9                   | –0.44   | 40.9                     | –1.84*  |
|                                  | 35–44 years (n = 16) | 45.8                   | –0.49   | 40.4                     | –1.61*  |
|                                  | 45–54 years (n = 10) | 44.3                   | –0.64   | 42.3                     | –0.78*  |
|                                  | 55–64 years (n = 3)  | 41.2                   | –0.95*  | 35.0                     | –1.08*  |
|                                  | 65–74 years (n = 2)  | 44.6                   | –0.79*  | 45.9                     | 0.20    |
| Patellar Group                   | 18–34 years (n = 11) | 44.2                   | –0.52   | 42.5                     | –1.61*  |
|                                  | 35–44 years (n = 2)  | 46.0                   | –0.48   | 46.8                     | –0.73   |
|                                  | 45–54 years (n = 3)  | 41.9                   | –0.98*  | 29.3                     | –2.15*  |
|                                  | 55–64 years (n = 1)  | 52.3                   | 0.18    | 29.3                     | –1.63*  |
| Articular Group                  | 18–34 years (n = 12) | 43.8                   | –0.56   | 40.9                     | –1.85*  |
|                                  | 35–44 years (n = 15) | 43.0                   | –0.82*  | 37.7                     | –1.98*  |
|                                  | 45–54 years (n = 15) | 44.7                   | –0.60   | 35.3                     | –1.51*  |
|                                  | 55–64 years (n = 7)  | 48.8                   | –0.18   | 30.7                     | –1.49*  |
|                                  | 65–74 years (n = 5)  | 52.3                   | 0.02    | 30.2                     | –1.22*  |

\*A z-score  $\leq -0.68$  is below the population's twenty-fifth percentile and indicates substantial impairment. Computation of z-scores:  $z = (\text{group mean} - \text{population mean}) / \text{population standard deviation}$ . A negative z-score indicates a score below the United States population mean. Data of 21 subjects younger than 18 years were excluded from this table.

mean Physical Component Scale score (36.2 points) in the current study approximated the scores of the arthritis groups (36 to 39 points<sup>1</sup>). Patients in the current Articular Group (mean, 44.5 years), however, were younger than the patients in the arthritis groups (mean ages, 61.5 years<sup>1</sup> and 60 years<sup>7</sup>). In addition, most (n = 45; 83.3%) of the patients in the Articular Group had traumatic articular cartilage lesions rather than degenerative arthritis.<sup>1,7</sup>

Shapiro et al<sup>12</sup> reported only change scores (posttreatment scores subtracted from pretreatment scores) for patients having anterior cruciate ligament reconstruction. Di Fabio and Boissonnault<sup>2</sup> reported Short Form-36 Health Survey scores that showed patients with various knee disorders scored one to two standard deviations below the United States population

average. Similarly, Roos et al<sup>10</sup> reported that patients having arthroscopic meniscus repair had preoperative scores at least one standard deviation below the United States population mean. As stated, none of these previous reports compare patients with knee disorders with patients with nonorthopaedic diagnoses.

In the current study, mean Mental Component Scale scores for patients with knee disorders were below the United States population average, with all four groups scoring near the twenty-fifth percentile (Table 2). Mean Mental Component Scale scores for the knee groups were closer to the United States population norms after adjusting for age (Table 5). Mean Physical Component Scale scores for patients with knee conditions, however, were substantially lower than the United States general pop-

ulation norms within and across age groups. This large effect on self-rated physical health has been reported for patients with various orthopaedic and medical conditions.<sup>5-7,14,15</sup> This also was consistent with previous studies of patients with various knee disorders.<sup>1,2,9,10,12</sup>

As an indicator of general physical health, low Physical Component Scale scores ( $\leq 40$  points) indicate limitations in self-care and physical activities and self-rated poor general health.<sup>14-16</sup> The mean Physical Component Scale scores were below 40 for the Articular Group (36.2) and Meniscus Group (37.9), and near 40 for the Patellar Group (40.4) and Anterior Cruciate Ligament Group (41.2), suggesting a substantial effect of knee disorders on physical health. In particular, the effect of articular cartilage lesions on physical health (as indicated by Physical Component Scale score) was comparable with that of congestive heart failure and various orthopaedic shoulder disorders. Articular cartilage lesions were significantly more physically disabling than myocardial infarction, back pain, sciatica, and hypertension. Meniscus lesions, patellar instability, and anterior cruciate ligament rupture also negatively affected Physical Component Scale scores.

Comparisons with age-matched population norms also supported this finding. The squared correlation coefficient ( $r^2$ ) is an indicator of effect size. In the current study, the  $r^2$  between age and Physical Component Scale scores was .061, meaning that age explained 6.1% of the variance observed in Physical Component Scale scores. A lack of large effect size, however, does not necessarily imply the age effect is completely negligible.<sup>3,17</sup> Studies conducted among the United States general population report that Physical Component Scale scores vary slightly, but consistently, with age.<sup>14,15</sup> Using simple regression to examine this effect, the Physical Component Scale scores decreased in the current data approximately 1 point for every 6 years of age. Simply as an effect of age, one can expect a 5-point difference in mean Physical Component Scale scores when comparing groups that differ by 30 years or more.

The group mean Physical Component Scale scores shown in Table 2, which are not adjusted for age, would be appropriate when describing the health status of patients as actually seen in clinical practice. Gartsman et al<sup>5</sup> reported a mean Physical Component Scale score for patients with rotator cuff tear (34.7) that suggests they have more physical disability than patients with articular cartilage lesions in the current study (Physical Component Scale score = 36.2). Therefore, the typical patient with a rotator cuff tear would be expected to have slightly more perceived physical disability than the typical patient with an articular cartilage lesion.

Age-specific scores, however, allow comparisons of the relative impact of these medical conditions on physical health status within a particular age range, especially if the mean group ages are disparate. The average age of the patients with rotator cuff tear reported by Gartsman et al<sup>5</sup> was 56.3 years, whereas the average age of the current patients with articular cartilage lesions was 44.5 years. The typical patients are therefore in different age categories. The mean Physical Component Scale scores for patients in the Articular Group who were 55 to 64 years of age decreased substantially from 36.2 points to 30.7 points. Among patients in the 55- to 64-year age group, an articular cartilage lesion of the knee is significantly more physically disabling than a rotator cuff tear. The age-specific scores (Table 5) would be appropriate when describing health status of patients within a specific age range or comparing groups with mean age differences greater than 10 years. This is important if allocation of resources is based on the relative severity of a disease's effect on health.

This study has several limitations. First, because of database limitations, the current results were not adjusted for comorbidity. Comorbid conditions, particularly chronic medical conditions, decrease Physical Component Scale scores.<sup>4</sup> If a substantial proportion of the current patients did have comorbid conditions, the Physical Component Scale scores reported here may be negatively biased. In the practice from which the data were drawn, approximately 20%



of the patients reported having a chronic medical condition (diabetes mellitus, hypertension, cardiovascular disease). A substantially higher or lower rate of concomitant chronic medical conditions may yield slightly different Mental Component Scale and Physical Component Scale scores for patients with knee disorders than reported here.

Second, the Mental Component Scale and Physical Component Scale scores within age categories (Table 5) were estimated using very few patients in some instances. Small group size produces unstable statistical estimates. Therefore, caution is warranted when interpreting or referencing the values in Table 5 that were estimated with fewer than 10 patients. The estimates based on the full knee groups (Table 2), however, should be stable.

Finally, although cross-sectional comparisons of initial health status are appropriate with these data, longitudinal changes in health status with time or treatment cannot be determined. Study of longitudinal changes requires two or more scores collected with time. Several reports show that the Short Form-36 is sensitive and responsive to treatment effects and recovery for patients with knee conditions.<sup>2,9,12</sup> Postoperative Short Form-36 Health Survey scores for patients with surgical knee disorders have been shown to gradually recover toward the United States population mean.<sup>9</sup> No such reports using the Short Form-12 Health Survey data have been published.

Group and age-specific Short Form-12 component summary score norms were estimated for patients with various knees conditions that commonly are treated with arthroscopy. Patients with knee disorders had Physical Component Scale scores significantly worse than the general United States population. Age had a small, but significantly negative effect on Mental Component Scale and Physical Component Scale scores. Certain medical conditions have larger (rotator cuff tear, heart failure) or smaller (hypertension, clinical depression) effects on physical health than disorders of the knee, but these effects are moderated by age. Reporting and comparing group (Table 2) and age-spe-

cific (Table 5) Mental Component Scale and Physical Component Scale scores in additional studies are recommended. The Mental Component Scale and Physical Component Scale scores reported for patients with knee conditions in this study can be used as historic control group data for comparison with other diagnostic groups.

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