

# Racial Differences in Health Care Utilization Among Patients with Osteoarthritis

KELLI L. DOMINICK, TARA K. DUDLEY, STEVEN C. GRAMBOW, EUGENE Z. ODDONE,  
and HAYDEN B. BOSWORTH

**ABSTRACT. Objective.** Research has identified racial variations in certain aspects of osteoarthritis (OA) related medical care. We compared health services utilization between African American and white veteran outpatients with OA.

**Methods.** Subjects were 1612 white and 861 African American patients receiving medical care for OA at the Durham VAMC, Durham, NC, USA. Two major components of OA related medical care were examined during a one-year period: physician visits and use of analgesic and antiinflammatory medications.

**Results.** There were no racial differences in overall frequency of OA related physician visits or visits to rheumatologists. About 86% of both African American and white patients were prescribed some analgesic or antiinflammatory medication. There were, however, racial differences in the use of specific drug classes. African Americans were more likely to be prescribed nonselective nonsteroidal antiinflammatory drugs (69% vs 60%), but less likely to be prescribed COX-2 inhibitors (4% vs 7%) and narcotic analgesics (33% vs 40%) than whites (all  $p < 0.05$ ). African Americans also had a shorter annual mean days' supply for several common medications, including acetaminophen, acetaminophen combined with codeine, and acetaminophen combined with oxycodone (all  $p < 0.05$ ).

**Conclusion.** African Americans and white veterans with OA did not differ substantially in their use of physician services. However, within this equal access health care system that requires minimal co-payments for medications, there were racial differences in prescription medication use. These differences may have implications for both quality of pain relief and risk of side effects. (J Rheumatol 2003;30:2201–6)

*Key Indexing Terms:*

OSTEOARTHRITIS                      ETHNIC GROUPS                      HEALTH SERVICES                      ANALGESICS  
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*From the Center for Health Services Research in Primary Care, Durham VAMC; and the Division of General Internal Medicine, Department of Psychiatry and Behavioral Sciences, Department of Biostatistics and Bioinformatics, and Center for Aging and Human Development of Duke University Medical Center, Durham, North Carolina, USA.*

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*K.L. Dominick, PhD, Health Research Scientist, Center for Health Services Research in Primary Care, Durham VAMC, Assistant Research Professor, Department of General Internal Medicine, Senior Fellow, Center for the Study of Aging and Human Development, Duke University; T.K. Dudley, MStat, Statistician, Center for Health Services Research in Primary Care, Durham VAMC; S.C. Grambow, PhD, Senior Statistician, Center for Health Services Research in Primary Care, Durham VAMC, Assistant Research Professor, Department of Biostatistics and Bioinformatics, Duke University; E.Z. Oddone, MD, MHSc, Director, Center for Health Services Research in Primary Care, Durham VAMC, Chief, Division of General Internal Medicine and Senior Fellow, Center for the Study of Aging and Human Development, Duke University; H.B. Bosworth, PhD, Associate Director, Center for Health Services Research in Primary Care, Durham VAMC, Associate Research Professor, Department of Medicine, Assistant Research Professor, Department of Psychiatry and Behavioral Sciences, Senior Fellow, Center for the Study of Aging and Human Development, Duke University.*

*Address reprint requests to Dr. K.L. Dominick, Veterans Affairs Medical Center (152), 508 Fulton Street, Durham, NC 27705. E-mail: domin004@mc.duke.edu*

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Osteoarthritis (OA) affects 21 million people in the United States<sup>1</sup>, and its prevalence is expected to increase dramatically as our population ages<sup>2</sup>. While there is no known cure for OA, pharmacological treatments, self-care practices, and surgical procedures can provide substantial reductions in pain and limit functional impairment<sup>3-6</sup>. Although the prevalence of OA is similar among African Americans and whites, there are documented racial disparities in some facets of OA related medical care. Within the Medicare population, African Americans undergo both hip and knee arthroplasty at about half the per-capita rate of whites<sup>7-9</sup>. With respect to outpatient care, some studies have shown that African Americans with OA are more likely than whites to report being under physician care<sup>10,11</sup>. Other studies suggest that African Americans may be less likely to report using over-the-counter analgesic medications<sup>10,12</sup> but more likely to report using prescription medications for OA<sup>13</sup>. However, it is unclear to what degree access to care and socioeconomic status may influence these results.

Understanding racial variations in OA related health service utilization is critical, as these differences may have implications for quality of care, symptom reduction, and disability. Studies have focused primarily on comparing

proportions of African American and white patients who use joint replacement. While these studies are important, they only highlight care at a relatively late stage in the natural history of OA. Other important aspects of OA related medical care have received relatively little attention. For example, racial differences in frequency of physician visits and referrals to specialists (i.e., rheumatologists) have not been examined. Racial variations in pharmacological management, including use of specific medication classes and duration of medication use, have also not been well studied. More detailed investigation of racial differences in medication use is especially important, given the centrality of pharmacological treatment for the management of OA symptoms<sup>3</sup>.

For several reasons, the Veterans Administration (VA) health care system represents a valuable source of information regarding racial variations in medical care for OA. First, the VA health care system is a relatively equal-access system, in which patients receive services at low or no cost. The use of VA data therefore provides an excellent opportunity to assess racial differences in medical care in an environment that minimizes economic and access-to-care issues. Second, the VA administrative databases allow the simultaneous examination of detailed information regarding OA related physician service and medication use. Third, the VA pharmaceutical data include not only prescription medications such as nonsteroidal antiinflammatory medications (NSAID) and narcotic analgesics, but also information on the use of aspirin and acetaminophen, which are typically not included in pharmacy databases. We examined racial differences in 2 major components of OA related medical care among a group of veterans with documented OA. Our specific objectives were to compare physician visits (including specialty services) and prescription medication use between African American and white VA Medical Center patients.

## MATERIALS AND METHODS

The study protocol was reviewed and approved by the Institutional Review Board of the Durham VA Medical Center.

**Subjects.** Subjects included African American and white patients who had a physician visit involving OA at the Durham VAMC between October 1998 and September 1999 (n = 2473). These individuals were identified via a primary or secondary ICD-9 diagnosis code of 715, using the hospital's electronic medical record system. Because this study focused on racial differences, patients whose race was missing from medical records were excluded (19%). In addition, 17 patients of Asian, American Indian, or Hispanic origin were excluded from study. Compared to subjects with complete racial status information, subjects excluded because of missing race data were somewhat younger [mean ages = 57.3 (SD 14.9) vs 61.3 (SD 13.9) years;  $p < 0.001$ ] and had a lower proportion of females (1.9% vs 4.9%;  $p = 0.002$ ). Subjects with missing race data were also less likely to be disabled due to service-connected illnesses or conditions than included subjects (63.5% vs 70.8%;  $p < 0.001$ ), were less likely to have any OA related visit during the followup period (53.4% vs 63.1%;  $p < 0.001$ ), and had a lower mean number of OA related visits (1.1 vs 1.8;  $p < 0.001$ ).

**Health service utilization data.** For each patient, health service utilization was assessed for one year following the first OA related physician visit

occurring within the study period. Two components of health service utilization were examined: OA related physician visits and prescriptions for analgesic and antiinflammatory medications. Physician visit and prescription use data were acquired from Durham VA electronic medical records. OA related physician visits were defined as visits involving a primary or secondary ICD-9 diagnosis code of 715. Patients' OA related visits specifically to rheumatology and orthopedic clinics were also examined. With respect to prescription analgesic and antiinflammatory use, we examined use of the following major drugs and drug classes: aspirin (> 325 mg/day), acetaminophen, nonacetylated salicylates, nonselective NSAID, COX-2 inhibitors, and narcotic analgesics (specifically, oxycodone, codeine, and propoxyphene because these were the oral narcotic medications available on the formulary). Three additional medication related variables were assessed: the total number of analgesic/antiinflammatory prescriptions provided during the year, number of different analgesic/antiinflammatory drugs prescribed, and total days' supply (i.e., number of days during the year for which a patient filled a prescription). Total days' supply was calculated for the 5 most commonly prescribed medications: acetaminophen, acetaminophen combined with codeine, acetaminophen combined with oxycodone, ibuprofen, and naproxen.

**Statistical analyses.** Chi-square tests were used to examine the bivariate relationship of race with the following variables: having one or more physician visits, having one or more rheumatology clinic visits, having one or more orthopedic clinic visits, use of any analgesic/antiinflammatory medication, and use of specific analgesic/antiinflammatory classes. Multivariable logistic regression models were then used to test the relationship of race to each of the above health service utilization variables after controlling for relevant covariates: age, sex, service connection, and having arthroplasty within 5 years prior to the study. The number of annual physician visits was also of interest. We first compared the median number of physician visits and the interquartile range for African American and white patients. Because of the highly skewed nature of physician visit counts, negative binomial regression analyses were used to statistically test the bivariate and multivariable relationships of race to this variable<sup>14</sup>.

Additional analyses were conducted to examine more specific aspects of medication use. We examined racial differences in the number of annual analgesic/antiinflammatory prescriptions, number of different analgesic/antiinflammatory drugs, and the annual days' supply of selected medications. T tests were used to examine the bivariate relationship of race to these variables, and multivariable regression models examined the relationship of race to each variable after controlling for age, sex, service connection, and previous arthroplasty. These analyses included only individuals who were prescribed the medication(s) of interest at some point during the followup period.

Because some race variables were missing from VA administrative databases, we performed sensitivity analyses using multiple imputation methodology to assess potential bias due to missingness<sup>15</sup>. Ten datasets were multiply imputed using the SAS procedure PROC MI. Regression models were run for each of these 10 datasets, and the parameter estimates from these regressions were combined using the SAS procedure PROC MIANALYZE. All statistical analyses were performed using SAS PC, Version 8 (SAS Inc., Cary, NC, USA).

## RESULTS

The final study sample included 1612 white patients (65%) and 861 African American patients (35%). Subjects were predominantly male (95%), the mean age was 61.1 years (SD 14.0), 71% were service-connected, and 5% had undergone arthroplasty within 5 years prior to the study. African American and white patients were similar with respect to sex, service connection, and previous arthroplasty. However, African Americans were younger than whites (mean ages 57.2 vs 63.2 yrs;  $p < 0.001$ ).

*OA related physician visits.* Roughly 64% of African American patients and 63% of white patients had at least one OA related physician visit during the one-year followup period (Table 1). African Americans and whites were also similar in their use of orthopedic and rheumatology services. About 4% of both African American and white patients visited a rheumatology clinic, while 13% of African American patients and 15% of white patients visited an orthopedic clinic. When controlling for age, sex, service connection, and prior arthroplasty, odds of having any physician visit or a rheumatology clinic visit did not vary according to race. However, the odds of visiting an orthopedic clinic were significantly lower for African Americans in the adjusted model (OR 0.72, 95% CI 0.56–0.94). The median number of OA related physician visits for both African American and white patients was one (interquartile range = 2). Both bivariate and multivariable negative binomial regression models revealed no racial differences in the number of annual OA related physician visits (data not shown).

*Prescription medication use.* About 86% of both African American and white patients were prescribed some type of analgesic or antiinflammatory medication during the followup period (Table 2). There were, however, significant racial differences in the use of particular medication classes. A significantly greater proportion of African American patients were prescribed nonselective NSAID in comparison

to white patients (69% vs 60%;  $p < 0.001$ ). Both COX-2 inhibitors and narcotic analgesics were prescribed to smaller proportions of African Americans than whites (COX-2: 4% of African Americans vs 7% of whites,  $p < 0.001$ ; narcotics: 33% of African Americans vs 40% of whites,  $p < 0.001$ ). In the adjusted analyses, African American patients had significantly greater odds of acetaminophen use and nonselective NSAID use but significantly lower odds of COX-2 inhibitor use and narcotic analgesic use (Table 2).

There was also a racial difference in the total number of annual analgesic/antiinflammatory prescriptions. Among patients who were prescribed at least one analgesic/antiinflammatory medication during followup, African Americans filled a significantly lower mean number of prescriptions than whites [African American 3.1 (SD 3.7) vs white 3.7 (SD 4.1);  $p < 0.001$ ]. This racial difference persisted in an analysis that controlled for age, race, service connection, and prior arthroplasty ( $\beta$  for African American race =  $-0.09$ ,  $p = 0.001$ ). The racial difference in number of prescriptions could not be attributed to white patients being prescribed a greater number of different analgesic/antiinflammatory drugs during the year, as white patients were prescribed a mean of 1.8 (SD 1.3) different drugs, and African Americans were prescribed a mean of 1.7 (SD 1.2;  $p = 0.66$ ). A multivariable regression model also showed no racial difference in number of different drugs prescribed.

Table 1. OA related physician visits according to race.

	Bivariate Relationship			Adjusted Model	
	Whites (n = 1612), %	African Americans (n = 861), %	p	Adjusted* Odds for African Americans	95% CI
Any physician visit	62.5	63.9	0.49	1.11	0.93–1.32
Rheumatology visit	4.2	4.1	0.86	0.97	0.64–1.49
Orthopedic visit	14.6	13.4	0.41	0.72	0.56–0.94

\* Results of logistic regression models controlling for age, sex, service connection, and having arthroplasty within the prior 5 years. Referent race is white.

Table 2. Analgesic/antiinflammatory use according to race.

	Bivariate Relationship			Adjusted Model	
	Whites Using Drug (n = 1612), %	African Americans Using Drug(n = 861), %	p	Adjusted* Odds of Use for African Americans	95% CI
Any analgesic/ antiinflammatory	85.6	86.2	0.70	1.04	0.81–1.32
Acetaminophen	29.2	31.9	0.16	1.45	1.20–1.76
Aspirin (> 325 mg)	2.5	3.1	0.34	1.14	0.94–1.39
Nonselective NSAID	60.3	69.1	< 0.001	1.26	1.04–1.53
COX-2 inhibitors	7.4	4.1	< 0.001	0.56	0.38–0.83
Nonacetylated salicylates	6.5	5.5	0.30	0.76	0.52–1.10
Narcotic analgesics	40.1	32.6	< 0.001	0.67	0.56–0.80

\* Results of logistic regression models controlling for age, sex, service connection, and having arthroplasty within the previous 5 years. Referent race is white.

The largest relative racial difference in health service use occurred in the annual days' supply of medications (Table 3). In bivariate analyses, African Americans had a lower annual mean days' supply of acetaminophen, acetaminophen combined with codeine, acetaminophen combined with oxycodone, and ibuprofen (all  $p < 0.05$ ). In multivariable regression analyses, African Americans had a significantly lower days' supply of acetaminophen, acetaminophen combined with codeine, and acetaminophen combined with oxycodone (all  $p < 0.05$ ), and tended to have a lower days' supply of ibuprofen ( $p = 0.067$ ).

*Results of multiple imputation analyses.* We repeated all study analyses with multiply imputed race data. Results of these analyses did not differ significantly or meaningfully from analyses that excluded individuals with missing race data.

## DISCUSSION

This study examined racial differences in 2 primary components of medical care for OA: physician visits and prescription medication use. In contrast to results of other studies, African American and white subjects in this sample did not differ in their use of physician services. Previous studies have shown that among community samples of individuals with OA, African Americans are more likely than whites to report currently being under physician care for arthritis<sup>10,11</sup>. One possible explanation of prior findings is that African Americans are generally more likely than whites to visit a physician when experiencing pain<sup>16</sup>. This study sample differs from earlier studies because we included only individuals currently under physician care for arthritis. Our results revealed that among a group of OA patients enrolled in VA care, African Americans and whites did not differ in either annual number of physician visits or the proportion of patients who visited rheumatology and orthopedic clinics. It is important to consider that since the VA health system is a relatively equal-access system with minimal or no co-payments, financial constraints should have minimal influence on patients' frequency of physician visits or referrals to specialists. Well designed studies are still needed to examine racial differences in physician visits for OA in health care settings where access to care issues are more pronounced.

While there were no significant racial variations in physician services in this sample, there were some differences in patterns of prescription medication use. First, African Americans and whites differed in their frequency of use of several medication classes. African Americans were more likely to be prescribed acetaminophen and nonselective NSAID than white patients, but were less likely to be prescribed COX-2 inhibitors and narcotic analgesics. While some of these significant differences were qualitatively fairly similar between racial groups (i.e., 4% vs 7% for COX-2 inhibitor use), it is notable that such differences persist at all in the VA health care system where co-payments are minimal and equal for all drugs. These differences may be even more pronounced in other health care systems. Further, in the context of a highly prevalent condition such as OA, even small racial differences may signify an important public health problem if they indicate disparities in quality of care<sup>17</sup>.

Greater use of nonselective NSAID may place African American patients at increased risk for gastrointestinal (GI) side effects<sup>18-20</sup>. Although COX-2 inhibitors are more expensive than the nonselective NSAID, it is unlikely that medication cost underlies the current racial difference in COX-2 use, since co-payments are equal for all drugs. Within the VA system, COX-2 inhibitors require subspecialist approval. Therefore physicians must spend additional effort to attain COX-2 inhibitors for patients. Physicians may be more likely to prescribe COX-2 inhibitors if patients specifically request these medications. Thus, differences in patients' knowledge of or requests for these medications may explain some of the observed racial differences. This issue may be particularly relevant to this study, given the widespread direct-to-consumer advertising of COX-2 inhibitors<sup>21,22</sup>.

The lower rate of narcotic analgesic use among African Americans in this study is consistent with other studies that have documented less frequent use and lower doses of narcotics among racial minorities with other pain related conditions<sup>23-26</sup>. While reasons for these racial differences are still unclear, possible explanations include differences in patient-physician communication about pain and physicians' perceptions about risk for addiction<sup>23,27</sup>. Although

Table 3. Annual days' supply of analgesic/antiinflammatory drugs according to race.

	Bivariate Relationship			Adjusted Model	
	Mean Days' Supply for Whites (± SD)	Mean Days' Supply for African Americans (± SD)	p	Regression Coefficient (SE) for African American Race	p
Acetaminophen (n = 746)	93.0 (71.8)	78.5 (57.3)	0.004	-11.4 (5.1)	0.026
Acetaminophen + Codeine (n = 310)	56.1 (39.2)	46.4 (26.7)	0.029	-9.9 (4.5)	0.030
Acetaminophen + oxycodone (n = 665)	116.0 (129.7)	89.6 (116.5)	0.013	-26.0 (10.5)	0.011
Ibuprofen (n = 787)	97.2 (70.8)	85.9 (61.8)	0.022	-9.2 (5.0)	0.067
Naproxen (n = 378)	99.8 (74.4)	94.3 (60.5)	0.447	-2.1 (7.3)	0.776

\* Results of linear regression models controlling for age, sex, service connection, and having arthroplasty within the prior 5 years.



narcotic analgesics have potential for becoming addictive, this risk seems to be minimal among patients with arthritis<sup>28</sup>. Further, narcotics are particularly useful when pain is refractory to treatment with other medications, and they are not associated with GI side effects common to nonselective NSAID<sup>3</sup>. Additional research is clearly needed to explain racial differences in narcotic analgesic use in general, and among patients with OA in particular.

A second important racial difference in analgesic/anti-inflammatory use patterns was that for several of the most commonly prescribed medications (especially acetaminophen, acetaminophen combined with codeine, and acetaminophen combined with oxycodone), African American patients had a significantly lower mean days' supply during the followup year. Thus African Americans were either prescribed fewer days of medication than whites, or obtained refills less regularly, or discontinued medication use earlier. Given the low cost of medications to patients within the VA health system, it is unlikely that the financial burden of co-payments underlies these racial differences. Because medication refills are mailed to patients, transportation availability is also an unlikely cause. Some patients who have alternative health care resources utilize VA services primarily for obtaining prescription medications at low cost, and these patients may be given longer supplies of drugs than patients who are followed more frequently within the VA system. However, it is unlikely that this entirely explains the racial variations in days' supply in this study, since the number of annual physician visits was similar for white and African American patients. African Americans may have experienced less symptom reduction, encountered more side effects, or had a stronger preference for utilizing nonpharmacological treatments. Further research is necessary to explore reasons for these racial differences in the duration of medication use and to examine whether they are even more pronounced in other health care systems.

There are limitations to this study. First, because this study sample included only patients treated within one VAMC, it cannot be assumed that the observed patterns of health care utilization translate to other patient populations. Second, this predominantly male sample limits the generalizability to women with OA. A third limitation was the lack of patient-level data concerning OA symptoms. Thus we could not assess the adequacy of patients' pain control or their functional capacity. Future studies that include this important clinical data will allow examination of racial differences in health care utilization after controlling for severity of OA related pain and other symptoms.

There are also limitations associated with the use of administrative databases for data acquisition. First, 19% of potentially eligible patients were missing race data and could not be included in these analyses. This proportion is similar to other reports from VA administrative data<sup>29</sup>. A

greater number of African Americans may have been excluded from analyses, since non-white individuals are somewhat more likely to have missing race data in VA administrative medical records<sup>29</sup>. However, our comparisons of subjects with missing and non-missing race data indicate that the primary factor leading to missing race data is frequency of use of VA services. In other words, less frequent visits to the VA led to fewer opportunities for race to be coded in the medical record. Further, when we repeated all analyses using imputed race data, results were not significantly different from those that excluded individuals with missing race data. Second, there are concerns regarding the accuracy of ICD-9 codes for OA. Studies have reported the sensitivity of ICD-9 codes for OA to be between 0.32 and 1.0<sup>30,31</sup> and the positive predictive value to be between 0.67 and 0.83<sup>31</sup>. This is a limitation of all administrative medical database studies involving OA, and it is not known whether the accuracy of coding for OA varies by race. Because of these possible coding inaccuracies, some individuals included in this sample may have been experiencing pain due to other joint problems, or nonspecific joint pain/symptoms, without definite radiographic evidence of OA. Third, it is possible that some OA related physician visits within the study period were missed because the diagnosis was not coded by the physician. While this would lead to an underestimation of the number of physician visits, we have no reason to suspect that this phenomenon would differ substantially by race. Use of VA medical records also did not allow examination of potential non-VA sources of physician care. However, there is a strong financial incentive for veterans to use VA services, observed OA related visits in this study were high, and we do not suspect that use of non-VA sources differs by race. Fourth, with regard to medication use, the VA pharmaceutical claims database does not allow an accurate assessment of the indication for a given drug. Thus, we cannot assume that all analgesic/anti-inflammatory medications were prescribed specifically for arthritis. We attempted to control for this factor as much as possible by including only medications that are routinely prescribed for OA and including only patients who were currently under care for OA at the Durham VAMC.

We concluded that among a sample of veterans who were currently enrolled in the VA for OA related care, African American and white patients utilized physician visits similarly, but had some differences in prescription medication use. While the clinical implications of these differences are not certain, African Americans' greater use of nonselective NSAID and shorter duration of use for some medications suggest that this racial group may be at increased risk for both adverse GI side effects and inadequate pain relief. These results, coupled with the expected increase in the prevalence of OA, signify a need to further explore both the underlying reasons for these racial variations and the clinical outcomes that result.

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## REFERENCES

1. Lawrence RC, Helmick CG, Arnette FC, et al. Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. *Arthritis Rheum* 1998;41:778-99.
2. Helmick CG, Lawrence RC, Pollard RA, Lloyd E, Heyse SP. Arthritis and other rheumatic conditions: Who is affected now, Who will be affected later? *Arthritis Care Res* 1995;8:203-11.
3. Altman RD, Hochberg MC, Moskowitz RW, Schnitzer TJ. Recommendations for the medical management of osteoarthritis of the hip and knee. *Arthritis Rheum* 2000;43:1905-15.
4. Lorig KR, Sobel DS, Stewart A, et al. Evidence suggesting that a chronic disease self-management program can improve health status while reducing hospitalization. *Med Care* 1999;37:5-14.
5. Callahan CM, Drake BG, Heck DA, Dittus RS. Patient outcomes following tricompartmental total knee replacement: A meta-analysis. *JAMA* 1994;271:1349-57.
6. Shields RK, Enloe LJ, Leo KC. Health related quality of life in patients with total hip and knee replacement. *Arch Phys Med Rehabil* 1999;80:572-9.
7. Katz JN. Preferences, quality, and the (under)utilization of total joint arthroplasty. *Med Care* 2001;39:203-5.
8. Baron JA, Barrett J, Katz JN, Liang MH. Total hip arthroplasty: Use and select complications in the U.S. Medicare population. *Am J Public Health* 1996;86:70-2.
9. Katz BP, Freund DA, Heck DA, et al. Demographic variation in the rate of knee replacement: A multi-year analysis. *Health Serv Res* 1996;31:126-40.
10. Coulton CJ, Milligan S, Chow J, Haug M. Ethnicity, self-care, and use of medical care among elderly with joint symptoms. *Arthritis Care Res* 1990;3:19-28.
11. Dexter P, Brandt KD. Relationships between social background and medical care in osteoarthritis. *J Rheumatol* 1993;20:698-703.
12. Arcury TA, Bernard SL, Jordan JM, Cook HL. Gender and ethnic differences in alternative and conventional arthritis remedy use among community-dwelling rural adults with arthritis. *Arthritis Care Res* 1996;9:384-90.
13. Ibrahim SA, Siminoff LA, Burant CJ, Kwok CK. Variation in perceptions of treatment and self-care practices in elderly with osteoarthritis: A comparison between African American and white patients. *Arthritis Care Res* 2001;45:340-5.
14. Gardner W, Mulvey EP, Shaw EC. Regression analyses of counts and rates: Poisson, overdispersed poisson, and negative binomial models. *Psychol Bull* 1995;118:392-404.
15. Shafer JL. Analysis of incomplete multivariate data. London: Chapman & Hall; 1997.
16. Sharp K, Ross CE, Cockerham WC. Symptoms, beliefs, and the use of physician services among the disadvantaged. *J Health Soc Behav* 1983;24:255-63.
17. Prevalence of self-reported arthritis or chronic joint symptoms among adults — United States, 2001. *MMWR Morb Mortal Wkly Rep* 2002;51:948-50.
18. Griffin MR, Piper JM, Daugherty JR, Snowden M, Ray WA. Nonsteroidal anti-inflammatory drug use and increased risk for peptic ulcer disease among elderly persons. *Ann Intern Med* 1991;114:257-63.
19. Henry D, Lim L, Garcia Rodriguez L, et al. Variability in risk of gastrointestinal complications with individual non-steroidal anti-inflammatory drugs: results of a collaborative meta-analysis. *BMJ* 1996;312:1563-6.
20. Goldstein JL. Significant upper gastrointestinal events associated with conventional NSAID versus celecoxib. *J Rheumatol* 2000;27 Suppl 60:25-8.
21. Hollon MF. Direct-to-consumer marketing of prescription drugs: Creating consumer demand. *JAMA* 1999;281:382-4.
22. Kravitz RL. Direct-to-consumer advertising of prescription drugs: Implications for the patient-physician relationship. *JAMA* 2000;284:2244.
23. Ng B, Dimsdale JE, Shragg P, Deutz R. Ethnic differences in analgesic consumption for postoperative pain. *Psychosom Med* 1996;58:125-9.
24. Bernabei R, Gambassi G, Lapane K, et al. Management of pain in elderly patients with cancer. SAGE Study Group. *JAMA* 1998;279:1877-82.
25. Todd KH, Deaton C, D'Adamo AP, Goe L. Ethnicity and analgesic practice. *Ann Emerg Med* 2000;35:11-6.
26. Todd KH, Samaroo N, Hoffman J. Ethnicity as a risk factor for inadequate emergency department analgesia. *JAMA* 1993;269:1357-9.
27. Bonham VL. Race, ethnicity, and pain treatment: Striving to understand the causes and solutions to the disparities in pain treatment. *J Law Med Ethics* 2001;29:52-68.
28. Peloso PM. Opioid therapy for osteoarthritis of the hip and knee: Use it or lose it? [editorial]. *J Rheumatol* 2001;28:6-11.
29. Boehmer U, Kressin NR, Berlowitz DR, Christiansen CL, Kazis LE, Jones JA. Self-reported vs administrative race/ethnicity data and study results. *Am J Public Health* 2002;92:1471-3.
30. Fowles JB, Lawthers AG, Weiner JP, Garnick DW, Petrie DS, Palmer RH. Agreement between physicians' office records and Medicare Part B claims data. *Health Care Financ Rev* 1995;16:189-99.
31. Katz JN, Barrett J, Liang MH, et al. Sensitivity and positive predictive value of Medicare Part B physician claims for rheumatologic diagnoses and procedures. *Arthritis Rheum* 1997;40:1594-600.