BRIEF REPORT: Gender and Total Knee/Hip Arthroplasty Utilization Rate in the VA System

Sonya Borrero, MD,[1] C. Kent Kwoh, MD,[1,2] Jennifer Sartorius, MS,[2] Said A. Ibrahim, MD, MPH[1,2]

[1]School of Medicine, University of Pittsburgh, Pittsburgh, PA, USA; [2]Center for Health Equity Research and Promotion, VA Pittsburgh Health Care System, Pittsburgh, PA, USA.

OBJECTIVE: Osteoarthritis (OA) is a leading cause of disability and is more prevalent in women than men. Total joint arthroplasty is an effective treatment option for end-stage OA. We examined gender differences in utilization rates of total knee/hip arthroplasty in the Veterans Administration (VA) system.

METHODS: The sample consisted of all VA patients for fiscal year (FY) 1999, 50 years of age or older, with or without the diagnosis of OA in any joint. We calculated the odds of patients undergoing total knee/hip arthroplasty adjusting for age, comorbidities, and presence of OA. We included the hospital site as a random effects variable to adjust for clustering.

RESULTS: Of the 1,968,093 (2.3% women) VA patients in FY 1999 who were 50 years of age or older, 329,461 (2.9% women) patients carried a diagnosis of OA. For women, 2-year adjusted odds of undergoing total knee or hip arthroplasty were 0.97 (0.83 to 1.14) and 1.00 (0.79 to 1.27), respectively.

CONCLUSION: Among patients potentially at risk for the procedure, men and women in the VA system were equally likely to undergo knee/hip arthroplasty.

KEY WORDS: osteoarthritis; gender; arthroplasty; Veterans Administration.
DOI: 10.1111/j.1525-1497.2006.00375.x
J GEN INTERN MED 2006; 21:S54–57.

Osteoarthritis (OA) is a leading cause of physical disability in the elderly, and the prevalence of OA-related disability is greater for women than for men.[1,2] Total joint arthroplasty (TJA) is a cost-effective treatment option that has been found to reduce pain and improve functional status for patients with end-stage OA.[3] Numerous studies have reported that women are less likely than men to undergo certain medical procedures including cardiac catheterization, coronary revascularization, and renal transplant.[4–6] It remains unclear whether these gender differences are because of inequities in health care access, differences in patient preferences, or varying provider recommendations. Disparities in health care along gender lines may indicate gender-based barriers to the receipt of appropriate care and might lead to deleterious effects on health outcomes. Limited data also suggest that gender differences exist in the utilization rate of elective total knee and hip joint arthroplasty.[7–13]

There have been methodologic limitations in the studies demonstrating gender disparity in the rates of TJA utilization in the United States. Most of the data have been extracted from population-based or Medicare studies examining the number of arthroplasties performed during a given study period.[8–13] In all but 1 of these studies, the rates of arthroplasty were higher for women than men. However, because of data limitations, these studies were not able to consider the population at risk for the treatment, that is, those with OA, or the higher incidence of OA among women. Therefore, these studies cannot demonstrate whether a gender difference exists in terms of the proportion of patients in need of total joint replacement who actually undergo surgery. A population-based study in Ontario, Canada that had taken into account OA prevalence and indications for arthroplasty found women to be less likely to undergo the treatment compared with men.[7] A similar study has not yet been performed in the United States.

We used the VA national database to examine gender differences in the utilization of total knee and hip arthroplasty among patients potentially at risk for the procedure.

METHODS

Patient Population

This study was approved by the Institutional Review Board of the Pittsburgh Veterans Administration Health Care System. The databases that were utilized for this project are the VA patient treatment files (PTF) and the outpatient clinic (OPC) files. The PTF is the national VA database for inpatient care, and OPC is the national VA database for outpatient care. Together these databases make up the VA National Patient Care Database (NPCD), in which data are collected for health administration and utilization assessment purposes.

The study sample included all VA patients (total cohort) in the NPCD during fiscal year (FY) 1999 (October 1998 to September 1999) who were 50 years of age or older. To focus the analysis on elective TJA, we excluded patients with hip fracture in FY 1999 and those who had undergone hemi-arthroplasty (a procedure that is performed to repair hip fractures). Patients younger than 50 years were excluded because of low prevalence of advanced hip and knee OA.[1] To narrow the sample to those at risk for the procedure, we identified a subsample (OA subcohort) consisting of patients with a diagnosis of OA using the International Classification of Diseases, Ninth Edition (ICD)-9-CM code 715. Because additional comorbidities might have influenced the decision for surgery, we collected data on comorbidities using the components of

The authors have no conflicts of interest to declare.

Address correspondence and requests for reprints to Dr. S. A. Ibrahim: Center for Health Equity Research and Promotion (151-C), VA Pittsburgh Health Care System, Pittsburgh, PA 15240 (e-mail: said.ibrahim2@med.va.gov).

the Deyo-Modified Charlson Index (a marker of burden of comorbidity). Although the Charlson index is validated as an inpatient measurement of comorbidities and, therefore, is not a perfect measure of out-patient comorbidities, it has been used extensively in studies examining health care utilization and outcomes.[14] To identify specific diseases, ICD-9-CM codes were used for the following: congestive heart failure, AIDS/HIV, rheumatoid arthritis, liver disease, myocardial infarction, chronic lung disease, diabetes, stroke, dementia, renal disease, peptic ulcer disease, cancer, peripheral vascular disease, metastatic solid tumor, and hemiplegia/paraplegia.

Study Outcome

The primary outcome of the study was undergoing knee or hip TJA within 2 years (FY 2000 and 2001). For knee arthroplasty, we used ICD-9-CM code 81.54 and for hip arthroplasty we used ICD-9-CM code 81.51.

Statistical Analysis

Baseline comparisons were performed using χ^2 tests for categorical variables and *t*-tests for normally distributed continuous variables. For multivariable modeling, we used random effects logistic regression with hospital site as the random effect to account for clustering effects. The final model outcomes were adjusted for age dichotomized as 50 to 64 and 65 and over. The relationship between age and the outcome is nonlinear in part because of the significant jump in joint replacement utilization among Medicare age groups. Additionally, analyses on the total cohort were adjusted for the number of comorbidites and for OA (to consider gender differences in OA prevalence). To minimize the effect of missing racial data, race was eliminated from the final models, as was region, after finding they did not change the outcome. The χ^2 and *t*-tests were performed using SAS v8.02 for Windows and the random effects models were fit using STATA 8.0.

RESULTS

The demographic and clinical characteristics of the total cohort and the OA subcohort are presented in Table 1. Briefly, a total of 1,968,093 patients were identified in the total cohort, and 329,461 patients in the OA subcohort. In the total cohort, 1,923,524 (97.7%) were male and 44,569 (2.3%) were female. In the OA subcohort, 319,924 (97.1%) were male and 9,537 (2.9%) were female. The mean age was 65 years in the total cohort and 66 years in the OA subcohort. Women had a significantly higher rate of rheumatologic disease than men and lower rates of myocardial infection, congestive heart failure, peripheral vascular disease, stroke, chronic lung disease, peptic ulcer disease, diabetes with complications, and cancer. In the total cohort, men also had significantly higher rates of liver disease, hemiplegia, and renal disease. Among patients with racial data available, 202,252 (15.4%) men were African American in the total cohort and 36,453 (14.4%) were African American in the OA subcohort. Among women, 3,732 (11.5%) were African American in the total cohort and 799 (10.0%) were African American in the OA subcohort.

In the total cohort, 5,370 (0.3%) had total knee arthroplasty (TKA), and 2,709 (0.1%) had total hip arthroplasty (THA) within the 2-year follow-up period. By gender, 172 (0.4%) women and 5,198 (0.3%) men had TKA ($P<.001$), and 91 (0.2%) women and 2,618 (0.1%) men had THA ($P=.001$). In the OA subcohort, 4,791 (1.5%) had TKA and 2,220 (0.7%) had THA. There were no differences by gender as 153 (1.6%) women and 4,638 (1.5%) men had TKA and 73 (.8%) women and 2147 (.7%) men had THA.

In the final models, patients aged 65 and greater had higher odds for TKA and slightly higher odds for THA before OA adjustment compared with patients aged 50 to 64. After OA adjustment, there was no significant difference between the 2 age groups with regard to THA. In addition, as the number of comorbidites increased, the odds for TJA significantly decreased. Without adjustment for OA status, the odds ratios (ORs) for both TKA and THA was 1.4, indicating that

Table 1. Baseline Demographic and Clinical Characteristics by Gender

	Total Cohort			Osteoarthritis Subcohort		
	Male *n*=1,923,524	Female *n*=44,569	*P* Value	Male *n*=319,924	Female *n*=9,537	*P* Value
Age (mean in years)	65.4	65.3	NS	66.6	67	<.001
Race (% African American)*	15.4	11.5	<.001	14.4	10	<.001
Comorbid illness (% present)						
Myocardial infarction	3.5	1.7	<.001	6.9	3.7	<.001
Congestive heart failure	0.7	0.5	<.001	1.2	0.9	.008
Peripheral vascular disease	0.7	0.3	<.001	1.4	0.6	<.001
Stroke	0.5	0.3	<.001	0.9	0.5	<.001
Chronic lung disease	2.5	2.2	<.001	5.7	4.6	<.001
Peptic ulcer disease	0.5	0.3	<.001	1.5	0.9	<.001
Rheumatologic disease	0.1	0.3	<.001	0.3	0.7	<.001
Liver disease	0.1	0.1	.029	0.1	0.1	NS
Diabetes with complications	3.2	2.1	<.001	5.5	3.7	<.001
Dementia	0.1	0.1	NS	0.1	0.1	NS
Cancer	0.9	0.5	<.001	1.8	1	<.001
Hemiplegia or paraplegia	0.1	0	.008	0	0	NS
Renal disease	0.2	0.1	<.001	0.3	0.2	NS
Metastatic solid tumor	0	0	NS	0.1	0.1	NS
AIDS/HIV	0	0	NS	0	0	NS

NS =P *value*> *.05.*

**In the total cohort, 31% of the racial data was missing.*

Table 2. Odds of Undergoing Hip or Knee Arthroplasty within 2 years from Multivariable Models

	Total Cohort (unadjusted for OA) (n=1,968,093)		Total Cohort (adjusted for OA) (n=1,968,093)		OA Subcohort (n=329,461)	
	OR	95% CI	OR	95% CI	OR	95% CI
Knee arthroplasty within 2 years						
Female versus male	1.35	1.16 to 1.58	1.01	0.86 to 1.18	0.96	0.82 to 1.13
Age group 65+ versus age group 50 to 64	1.31	1.24 to 1.39	1.13	1.07 to 1.20	1.13	1.06 to 1.20
Number of comorbidities	0.67	0.62 to 0.73	0.40	0.37 to 0.44	0.38	0.34 to 0.41
OA diagnosis versus no OA diagnosis	—	—	48.10	43.99 to 52.59	—	—
Hip arthroplasty within 2 years						
Female versus male	1.41	1.14 to 1.74	1.08	0.88 to 1.34	0.99	0.79 to 1.26
Age group 65+ versus age group 50 to 64	1.12	1.04 to 1.21	0.97	0.90 to 1.05	0.97	0.89 to 1.06
Number of comorbidities	0.70	0.62 to 0.79	0.44	0.39 to 0.50	0.40	0.35 to 0.46
OA diagnosis versus no OA diagnosis	—	—	27.82	25.18 to 30.72	—	—

CI, confidence interval; OR, odds ratio; OA, osteoarthritis.

significantly more joint arthroplasties were performed in women. After adjustment for OA, these estimates were no longer significant and were similar to the estimates from the OA subcohort (Table 2).

DISCUSSION

In a sample consisting of all patients in the FY 1999 who were 50 years of age or older and carried the diagnosis of OA, there were no statistically significant gender differences in the odds of undergoing TKA or THA within the 2-year study period.

Our finding is in contrast to previous population analyses that did not consider the gender differences in OA prevalence or the population at risk for the treatment when examining gender variations in TJA utilization rates.[8–13] Our results also differ from those by the Canadian investigators,[7] who found gender differences in TJA utilization rates. The Canadian study, however, was a population-based study in a different country with a different health care system. For example, long waiting times for elective TJA are common in publicly funded universal health care systems such as Canada's,[15] and it is not clear how such access issues impact gender utilization of the treatment. Furthermore, the Canadian study evaluated socioeconomically diverse, community-dwelling patients whose preferences and access to care may differ. In fact, baseline income comparisons between men and women in that study showed women to have significantly lower yearly income than men. This is particularly important in light of the evidence that lower income, regardless of insurance status, is associated with lower THA utilization rates.[16] Compared with the sample in the Canadian study, our study sample of VA patients appears to be of a more socio-economically similar background.[17]

Understanding the existence of gender differences in the utilization of TJA is important. Because of its high prevalence and associated functional disability, knee/hip OA is a major health burden in the elderly, and women may bear this burden more so than men.[1] There is currently no cure for OA, but TJA provides an effective treatment option for those patients who have exhausted medical management of their disease. Although our study did not demonstrate gender differences in the rates of TJA utilization, underutilization by both genders has been reported.[7]

Additionally, there is evidence that women may delay accessing this treatment even when it is needed. For example, women have worse pain and functional status than men at the time of THA.[18] Patients with worse functional status prior to TJA do not achieve as good a functional result postoperatively as those with a better preoperative functional status.[19] Therefore, on top of overall underutilization of THA, women's health status may be additionally compromised because of a delay in timing of the procedure. Women may be under a different set of social pressures, such as care-giving roles, that could influence their access and treatment decisions regarding elective procedures such as joint arthroplasty.[20]

Our study has several limitations. First, the study examined a VA sample, a patient population that is predominately male and, commonly, of low socioeconomic status. Therefore, our results may not be generalizable to the larger U.S. population. Second, we had no information on disease severity. While TJA rates between the genders were similar in this study, it is possible that more women may have severe disease compared with men and that a higher TJA utilization rate in women compared with men would be more clinically appropriate. Third, although our denominator for rate calculations is more specific with regard to OA diagnosis compared with other similar studies, it included patients with OA in any joint. The lack of information of disease severity and of the specific joint involved limited our ability to evaluate the appropriateness of hip/knee joint arthroplasty utilization in the sample. Fourth, we did not fully examine VA outsourcing. Veterans 65 years of age or older who have access to non-VA care through Medicare may have accessed non-VA hospitals for TJA. If one gender preferentially accessed non-VA hospitals, this could have potentially influenced our ORs comparing TJA utilization rates between the genders.

In summary, we examined a sample of VA patients, 50 years of age or older with or without the diagnosis of OA regarding total knee/hip arthroplasty utilization. We found that when disease prevalence is considered, there are no statistically significant gender differences. However, given previous studies that have shown significant gender differences in the use of medical procedures, further investigation using more clinically informative data is warranted.

This study was funded by grants from the VA Center for Health Equity Research and Promotion of the VA Services Research and Development Office. Dr Ibrahim is a recipient of a career development award from the VA Health Services Research

and Development Office and the Robert Wood Johnson Foundation's Harold Amos Faculty Development Award. The views expressed in this paper are those of the authors and do not represent those of the Department of Veterans Affairs. The authors would also like to thank Kim Hansen for editorial input.

REFERENCES

1. **Peyron JG, Altman RD.** The epidemiology of osteoarthritis. In: Moskowitz RW, Howell DS, Goldberg VM, Mankin HJ, eds. Osteoarthritis: diagnosis and medical/surgical management. 2nd edn. Philadelphia: W.B. Saunders; 1992:15–37.
2. **Lawrence RC, Helmick CG, Arnett FC, et al.** Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis Rheum. 1998;41:778–99.
3. **Jones CA, Voaklander DC, Johnston DW, Suarez-Almazor ME.** Health-related quality of life outcomes after total hip and knee arthroplasties in a community-based population. J Rheumatol. 2000;27:1745–52.
4. **Ayanian JZ, Epstein AM.** Differences in the use of procedures between women and men hospitalized for coronary heart disease. N Engl J Med. 1991;325:221–5.
5. **Tobin JN, Wassertheil-Smolter S, Wexler JD, et al.** Sex bias in considering coronary bypass surgery. Ann Intern Med. 1997;107:19–25.
6. **Bloembergen WE, Mauger EA, Wolfe RA, Port FK.** Association of gender and access to cadaveric renal transplantation. Am J Kidney Dis. 1997;30:733–8.
7. **Hawker GA, Wright JG, Coyte PC, et al.** Differences between men and women in the rate of use of hip and knee arthroplasty. N Engl J Med. 2000;342:1016–22.
8. **Katz BP, Freund DA, Heck DA, et al.** Demographic variation in the rate of knee replacement: a multi-year analysis. Health Services Res. 1996; 31:125–40.
9. **Baron BJ, 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.
10. **Giacomini M.** Gender and ethnic differences in hospital based procedure utilization in California. Arch Intern Med. 1996;156: 1217–24.
11. **Quam JP, Michet CJ, Wilson MG, et al.** Total knee arthroplasty: a population based study. Mayo Clin Proc. 1991;156:589–95.
12. **Madhok R, Lewallen DG, Wallrichs SL, Ilstrup DM, Kurland RL, Melton L Jr.** Trends in the utilization of primary total hip arthroplasty 1969–90: a population-based study in Olmstead County, Minnesota. Mayo Clin Proc. 1993;68:11–8.
13. **Melton L Jr., Stauffer RN, Chao EY, Ilstrup DM.** Rates of total hip arthroplasty: a population based study. N Engl J Med. 1982;307:1242–5.
14. **Mahomed N, Barrett J, Katz JN, Baron JA, Wright J, Losina E.** Epidemiology of total knee replacement in the United States Medicare population. J Bone Joint Surg Am. 2005;87:1222–8.
15. **Kelly KD, Voaklander DC, Johnston WC, Suarez-Almazor ME.** Equity in waiting times for major joint arthroplasty. Can J Surg. 2002;45:269–76.
16. **Escalante A, Barrett J, del Rincon I, Cornell JE, Phillips CB, Katz JN.** Disparity in total hip replacement affecting Hispanic Medicare beneficiaries. Med Care. 2002;40:451–60.
17. **Wilson NJ, Kizer KW.** The VA health care system: an unrecognized national safety net. Health Aff. 1997;16:200–4.
18. **Holtzman J, Saleh K, Kane R.** Gender differences in functional status and pain in a Medicare population undergoing elective total hip arthroplasty. Med Care. 2002;40:461–70.
19. **Fortin PR, Penrod JR, Clarke AE, et al.** Timing of total joint replacement affects clinical outcomes among patients with osteoarthritis of the hip or knee. Arthritis Rheum. 2002;46:3327–30.
20. **Karlson EW, Dultroy LH, Liang MH, Eaton HE, Katz JN.** Gender differences in patient preferences may underlie differential utilization of elective surgery. Am J Med. 1997;102:524–30.

Voices of Women Veterans (continued)

HARASSMENT AND ABUSE

``It was mostly good, but a lot of sexual harassment. Very few people know about it. It has affected my job off and on throughout my life, and it has affected my relationships with most men.``

``I was raped by my chief within 2 weeks of being at my duty station, which led to many years of drinking and drugs to bury my feelings. I also broke my back in the service, walked around 11 days before x-rays and never had rest, so it never healed right. I try not to think about my time in the service. It affected my jobs, due to drinking and drugs, and it affected my relationships as I don't let people get close to me.''

``When I served, it was quite common for women to enlist. We were treated close to the way men were. The main difference was that we were closely monitored in how we interacted with the men in our company. I often felt like I was walking on eggshells, never knowing if a comment or even an action was going to be viewed as crossing the line of professionalism. My life has been forever changed by my experience in the military and as a veteran. Not a day goes by that I do not think about who I am and why. The only time I tell anyone that I am a veteran is when I am asked directly what I do for work. Then I explain that I am receiving 100% disability through the military. The next question is always 'Why, what's wrong with you?' On this point, I am not totally truthful. How do you tell someone you were raped by your drill sergeant? I just tell them I received a medical discharge. I don't think at this point in my life I am on the same level with my peers. I feel like I am on the outside looking in.''