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The Effects of Total Knee Arthroplasty on Physical Functioning and Health among the Under Age 65 Population

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ABSTRACT

Objectives: This study examined the effects of total knee arthroplasty on six measures of physical functioning, self-rated health, pain, earnings, and employment status among US adults aged 51 to 63 years at baseline. **Methods:** Data came from the Health and Retirement Study, a nationally representative longitudinal study conducted biannually. The analysis sample consisted of individuals aged 51 to 63 years at baseline with arthritis who were resurveyed at 2-year intervals from 1996 to 2010. Propensity score matching was used to compare outcomes of persons receiving total knee arthroplasty (TKA) with those of matched controls. Six measures of physical functioning were examined: lower-body mobility problems, instrumental activities of daily living limitations, activities of daily living limitations, and large muscle, fine motor, and gross motor limitations. Self-rated health and pain were also examined. The two employment-related outcomes were earnings and employment status. **Results:** Receipt of TKA was associated with better outcomes for several measures of physical functioning, especially mobility limitations, pain, and self-rated health. Receipt of TKA was not associated with increased earnings or employment. **Conclusions:** Receipt of TKA yields important improvements in physical function among persons with an arthritis diagnosis who received the procedure before reaching the age of 65 years. This study contributes to knowledge about the benefits of TKA in a community setting among nonelderly recipients of TKA.

Keywords: pain, physical functioning, quality of life, total knee arthroplasty.

Introduction

The benefits of total knee arthroplasty (TKA) for joint function, physical functioning, pain reduction, and health-related quality of life are well documented for elderly persons [1–3]. In contrast, little is known about TKA outcomes for persons younger than 65 years despite the fact that this age group has had the highest increases in rates of joint replacement during the past three decades [4,5].

Few studies have examined outcomes of TKA among persons younger than 65 years. Two studies examined implant failure of TKA in this age group. Both reported that implant failure was substantially higher among persons younger than 65 years than among persons 65 years and older [6,7]. Styron et al. [8] examined return to work after TKA among 162 persons aged 18 to 69 years who worked full time before TKA. At 3 months postsurgery, 71% had returned to full-time work. Returning to work or increasing work hours is a more likely outcome for persons younger than 65 years than for persons older than 65 years. Persons younger than 65 years also tend to have fewer other chronic illnesses, which have been shown to reduce benefits of TKA [9]. Nonetheless, the few studies that compared TKA outcomes for patients younger than 65 years and patients older than 65 years reported no differences in postoperative pain and function [10,11]. Given that TKA is among the most frequently performed procedures in the United States and the high expense per procedure, determining its benefits in this understudied population is important.

This study examined physical functioning, self-rated health, pain, and employment-related outcomes of TKA among persons from a nationally representative sample who were younger than 65 years at baseline. The data permitted the development of a control group based on many attributes of sample persons before TKA receipt and assessment of multiple outcomes. Although a substantial number of joint replacements occur before individuals reach the age of 65 years, rates of arthroplasty increase substantially after enrollment in Medicare, especially among the previously uninsured [12,13]. To our knowledge, this is the first study to examine the effects of knee replacement on physical functioning, pain, self-rated health, and employment-related outcomes in a nationally representative sample of individuals younger than 65 years at baseline.

Methods

Three forms of analysis were performed. First, logit analysis was used to predict the receipt of TKA. Second, propensity score matching (PSM) was used to create a control group that was

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compared with the recipients of TKA. Third, changes in the outcome variables for the treatment and control groups were compared.

Sample

Data came from the Health and Retirement Study (HRS), a longitudinal biennial study of a nationally representative sample of US adults aged 51+ years and their spouses or partners that began in 1992 [14]. Data for this study were from the HRS interviews conducted in the period 1996 to 2010. We began with 1996 because the HRS physical functioning measures were not standardized until 1996. Spouses and partners of index respondents also were interviewed regardless of age. Because the interview was identical for index respondents and their spouses/partners, we included the latter if they satisfied our sample inclusion criteria. Baseline interviews were in-person; subsequent interviews were conducted by telephone. The baseline response rate for the HRS sample was 81.6%; follow-up response rates ranged from 85.4% to 93.4%.

The initial analytic sample consisted of HRS respondents, including spouses/partners, who were aged 51 to 63 years at baseline, participated in two consecutive interviews (e.g., 1996–1998 through 2008–2010), self-reported that they had arthritis, and at baseline had never had TKA (N = 4616). Like all the study measures, a diagnosis of arthritis was obtained by respondent self-report; the HRS did not ask about the site(s) of the respondent's arthritis. The HRS did not ask specifically about *osteoarthritis* until its 2006 interviews. Cohorts were constructed for each 2-year interval (i.e., 1996–98 to 2008–2010); the earlier date was treated as the baseline, and the later date was treated as the outcome measurement.

Measures

Three types of variables were used in analysis. Baseline measures were used in the PSM to identify the treatment (i.e., TKA recipients) and nontreatment groups. The outcomes on which the two groups were compared were measured at follow-up (i.e., 2 years after baseline). Receipt of TKA was reported as occurring during the interval between baseline and follow-up.

Key independent variable

The key independent variable was receipt of TKA. At each follow-up interview, participants were asked if they had knee replacement in the previous 2 years. Receipt of TKA was measured dichotomously (1 = receipt of TKA between consecutive interviews; 0 = no receipt).

Outcome variables

We examined 11 outcome variables, all measured at follow-up (i.e., 2 years after baseline): 6 physical functioning measures likely to be affected directly or indirectly by osteoarthritis of the knee, 2 measures of self-reported pain, self-rated health, and respondents' earnings and employment status. *Activities of daily living (ADL) or basic self-care tasks* were walking across a room, dressing, bathing, getting in and out of bed, and using the toilet. *Instrumental activities of daily living (IADL) tasks*, which require a higher level of functioning than do ADLs, were using the telephone, managing money, taking medications, shopping, and preparing meals. The *mobility limitations index* included walking several blocks, walking one block, walking across a room, climbing several flights of stairs, and climbing one flight of stairs. The *large muscle index* included sitting for 2 hours; getting up from a chair; stooping, kneeling, or crouching; and pushing/pulling a large object. The *fine motor index* included picking up a dime from the floor, eating, and dressing. The *gross motor skill index* included walking one block, walking across a room, climbing one flight of stairs, getting out of bed, and bathing/showering. There was some overlap across physical functioning measures; nonetheless, the indexes measured different aspects of physical functioning that may be affected by TKA. Scale items were coded 1 if the respondent reported difficulty performing or could not perform the task (0 = no difficulty). Scale items were summed to yield scale scores. Baseline scale scores, constructed identically to the outcome measures, were used in the PSM.

Four items measuring self-reported pain were used in the PSM, all measured at baseline. The first item asked respondents if they usually experienced pain and was coded 1 for the presence of pain (0 otherwise). Two dichotomous variables measured the amount of pain: moderate pain and severe pain (1 = yes; 0 = no). The reference category was mild pain. The fourth item assessed whether pain interfered with the respondent's usual activities (1 = yes; 0 = no). Only any pain ("pain") and pain that interferes with usual activities ("pain restrict") were included as outcomes and were measured at follow-up.

Self-rated health was measured on a five-point scale—that is, excellent, very good, good, fair, and poor. For the PSM, a dichotomous measure of self-rated fair/poor health (excellent, very good, or good health = 0; fair or poor health = 1) at baseline was used for matching TKA and control samples. The original five-point scale ("self-rated health") was used as an outcome variable at follow-up; higher scores represent poorer health.

At both baseline and follow-up, earnings were measured as a continuous variable in thousands of dollars. For the PSM analysis, we also included a variable for other household income, defined as the difference between total household income and the respondent's earnings in the year before the baseline interview. At both baseline and follow-up, employment status was measured by a dichotomous variable set to 1 if the respondent reported any hours of work during the past month and to 0 otherwise.

Matching variables

Treatment and control groups for the PSM were matched on variables that previous research suggested relate to receipt or outcomes of TKA among persons aged 65+ years [16–21]. All the matching variables were measured at baseline. Baseline measures of the 11 outcomes were included in the PSM, as described above. We also included covariates for three racial/ethnic groups: blacks, Hispanics, and persons of other race. Each was coded dichotomously, with whites as the reference group. Educational attainment was represented by four binary variables to permit measurement of nonlinear relationships between TKA receipt and educational attainment: less than high school (0–11 years) (reference group), high school (12 years), some college (13–15 years), and college degree or higher (16+ years). Gender was coded 1 for women and 0 for men. Marital status was coded 1 if currently married and 0 otherwise. Obesity was measured using the standard body mass index cutoff point of 30 (1 = obese; 0 = nonobese). Health insurance coverage was measured dichotomously (1 = private or public health insurance; 0 = no health insurance). Dichotomous variables for survey year also were included to ensure that the treatment and control groups were temporally equivalent.

Analytic Methods

Propensity score matching

PSM was used to identify an appropriate comparison group for the TKA recipients. The goal of PSM is to make the treatment and control groups as similar as possible and thereby reduce selection bias [22,23]. Matching required two steps. First, logit regression was used to predict the log odds that respondents with arthritis