Ambulatory Physical Activity, Disease Severity, and Employment Status in Adult Women with Osteoarthritis of the Hip

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ABSTRACT. ***Objective.*** To measure ambulatory physical activity and determine associations between physical inactivity and joint function, gait function, disease severity, and employment status in adult women with hip osteoarthritis (OA) living in the community.

Methods. Sixty-five adult women with hip OA were recruited from an outpatient clinic. Ambulatory physical activity was measured using an activity monitor based on an accelerometer over 7 days, which estimated step counts, net energy expenditure, and time spent in activity by acceleration intensity. The Harris hip score, walking speed, and radiographic stage were assessed for joint function, gait function, and disease severity, respectively. Employment status was classified into unemployed and employed (sitting occupations and standing/walking occupations).

Results. More than 40% of patients were classified as inactive, with less time spent in moderate-intensity activity (median 5.6 vs 22.9 min/day) compared with their counterparts. Employment status and the presence or absence of stage 4 (endstage) arthritis were independently associated with activity classification, and there was an interaction between these 2 variables; i.e., although stage 4 arthritis was associated with inactivity in patients who were unemployed, it bore no relationship in patients who were employed.

Conclusion. A significant proportion of adult women with hip OA were physically inactive, with a lack of moderate-intensity activity. The possible interaction between endstage OA and employment status requires further study to determine whether being at work negates the adverse effects of endstage OA or whether higher functioning due to physical activity enables patients with endstage OA to be employed. (J Rheumatol 2006;33:939–45)

Key Indexing Terms:
PHYSICAL ACTIVITY ACCELEROMETER HIP OSTEOARTHRITIS WOMEN

Osteoarthritis (OA) is a common, chronic arthritis that frequently affects the knee and hip and is a leading cause of mobility-related disability in older adults[1]. However, there is currently no medical treatment to cure OA, and the goals of management are to reduce pain and improve disability and quality of life.

There is much evidence of the benefits of moderate-intensity exercise for reducing pain, improving function and fitness, and preventing disability in patients with OA[2-4]. Apart from OA related benefits, regular physical activity improves a number of health outcomes in cardiovascular disease, diabetes, obesity, osteoporosis, and cancer[5]. The US public health organizations recommend at least 30 minutes of moderate-intensity activity on most, preferably all, days of the week[5,6]. Despite this, results from US and Canadian national surveys of physical activity suggest that the majority of adults with arthritis do not meet the minimum recommendation and the prevalence of physical inactivity is significant, although it varies with age, sex, body mass index (BMI), race, and education[7-9]. Another study suggests that functional limitations, severe pain, poor health status, and psychosocial factors are also associated with physical inactivity among older adults with arthritis[10]. Although large in scale, these telephone interview-based studies provide no details of clinical information on arthritis such as arthritis type or disease severity.

There have been few reports measuring physical activity objectively among patients with OA in relation to function and disease severity. Our study had 3 objectives: (1) to measure daily ambulatory physical activity using an activity monitor (AM) in adult women with hip OA living in the community; (2) to identify physically inactive patients from AM measurement; and (3) to determine associations of joint function, gait function, disease severity, and employment status with physical inactivity, given the association between the type of occu-

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pation and the number of steps taken in a large population survey[11]. Identifying inactive patients is important, as "sedentary individuals are expected to benefit most from increasing their activity to the recommended level"[6]. Our study will provide health professionals with useful information on ambulatory physical activity and determine whether function, disease severity, and employment status are associated with inactivity among adult women with hip OA.

MATERIALS AND METHODS

Patients. Seventy-one consecutive patients were recruited from an outpatient hip clinic at a large urban university hospital. The participants were all women because of their great predominance in the clinic. The inclusion criteria were adult women who had OA established on radiographs (described below), with or without past salvage surgery such as femoral osteotomy in one or both hips. All participants were able to walk at least 2 or 3 blocks as ascertained by part of the functional assessment of the Harris hip score (described below). They gave informed consent after understanding the purposes of the study. Patients were considered ineligible if they had pain in other weight-bearing joints or self-reported chronic diseases that possibly affect ambulation (e.g., heart or lung disease). Information about employment status (unemployed or employed) and, if employed, the type of employment with respect to physical activity (mostly sitting occupations, e.g., desk work, or mostly standing/walking occupations, e.g., sales) was obtained by interview.

Measures. Overall function of the hip involved was assessed at study entry using the Harris hip score[12]. This score has been widely used as an outcome measure after hip surgery and is validated with OA-specific and quality of life scales[13]. It has 4 domains: function, pain, deformity, and range of motion, allowing a total score ranging from 0 to 100 points (low–high). Lower hip score was used for sample description, and analyses in patients with bilateral involvement after both hips were scored.

Walking speed was measured as an index of gait function[14] using a stopwatch on a 10 m straight walkway. The subjects were instructed to walk at a normal and comfortable speed. The use of walking aids (canes or crutches) was permitted if required. After one practice, the test was repeated twice. An average time of the 2 trials was converted to speed expressed as m/s.

A single experienced observer (ST) assessed radiographs using the Kellgren-Lawrence scale[15] with some modifications for each hip, where 0 = normal; 1 = the presence of either possible joint space narrowing or osteophytes, residua of hip dysplasia may be present, incipient OA; 2 = definite mild joint space narrowing (less than 50%) with or without osteophytes, mild subluxation or sclerosis may be present, mild OA; 3 = definite moderate joint space narrowing (at least 50%) with moderate or multiple osteophytes, some sclerosis, and possible bony attrition, advanced OA; and 4 = severe joint space narrowing with large osteophytes, severe sclerosis, and definite bony attrition, endstage OA. OA was classified as present if the stage was ≥ 1. A higher disease stage was used for sample description and analyses in patients with bilateral involvement after both hips were scored.

Ambulatory physical activity was measured using an AM, which has a uniaxial acceleration sensor (Lifecorder®, Suzuken Co. Ltd., Nagoya, Japan). The AM is 6.2 × 4.6 × 2.6 cm in size, 40 g weight, and is worn at the waist. This model AM has been validated for estimating the number of steps taken and time spent engaged in activity[16,17], and for estimating energy expenditure (EE) and activity intensity during nonstructured and structured activities such as treadmill walking in comparison with indirect calorimetry[18]. Basic features of this AM to estimate ambulatory physical activity have been described in detail[18,19]. Briefly, the AM categorizes the activity into one of 9 (1–9) levels of intensity based on the rate and magnitude of vertical acceleration pulses detected by the sensor over 4 s. After input of body mass, the activity level is subsequently converted by an algorithm to EE due to the activity, which is counted every 4 s. The device also determines steps taken from an acceleration versus time curve. Data of ambulation measurements for a maximum of 42 days can be stored in an internal memory chip and downloaded to a personal computer. Special software is available for daily continuous records of AM outputs.

Patients were instructed to wear the AM during waking hours except during bathing or swimming and to do ordinary daily activities without reading step counts for 7 days. They were also instructed to keep a simple log reporting the date when the pedometer was worn continuously from morning until night. After the measurement period, which started from the day following a visit, the AM and log were returned by mail.

For each participant, activity assessment was restricted to the data of the days when the AM was worn continuously from morning until night, as confirmed by the daily continuous AM records and log. AM outputs of the number of steps taken, EE, and activity intensity were used for sample description and analyses. EE was adjusted for body mass as raw data of EE proportional to body mass. The number of steps taken and unadjusted and adjusted EE were averaged per day and expressed as steps/day, kcal/day, and kcal/kg/day, respectively. Nine levels of activity intensity were grouped into light (levels 1–3), moderate (levels 4–6), and vigorous intensity (levels 7–9), as suggested previously in reference to estimated metabolic equivalents (MET)[18,19]. Time spent in activity by light, moderate, and vigorous intensity was averaged separately and expressed as min/day.

The AM was validated in a very controlled setting along a corridor as follows. Patients wore the AM and walked about 100 steps at their usual pace. The accuracy was estimated by the count increase while walking divided by the exact number of steps taken as measured using a hand-tally. The test confirmed the accuracy of the AM with a mean accuracy of 95.2% (± SD 4.9), although there was a possibility that this accuracy may have been lower when participants were engaged in less controlled "real" activities.

Analysis. The group mean comparison of AM measurements by employment status (unemployed, sitting occupations, and standing/walking occupations) was examined in a one-way analysis of variance (ANOVA). *Post hoc* analysis using Tukey's honest significant difference test was performed to determine which means differ.

To determine whether there was a group of inactive patients, hierarchical cluster analysis was performed on EE using Ward's method, since EE is an overall ambulation measure reflecting both time spent in physical activity and intensity of physical activity. Cluster analysis is commonly used for classification, which combines the closest pair of objects (clusters or patients) successively according to inter-object distance until all patients cluster together in one group.

AM measurements were compared between the inactive and not-inactive groups using the Mann-Whitney U test to examine the validity of classification and to identify which measurement differed most as a pronounced feature of physical inactivity.

To identify possible correlates of physical inactivity, demographics were compared between the inactive and not-inactive groups using the Mann-Whitney U test for continuous variables (age, BMI, hip score, and walking speed), chi-square test for employment status (unemployed, sitting occupations, and standing/walking occupations), and Fisher's exact test for categorical variables (hip involvement, past surgery, and each radiographic stage).

To examine associations between physical inactivity and variables of interest (joint function, gait function, disease severity, and employment status), logistic regression analysis was performed on activity classification (0 = inactive, 1 = not-inactive) as a dependent variable. The main effects of hip score, walking speed, and radiographic stage were examined separately in the analysis, with or without adjusting for age and employment status (0 = unemployed, 1 = employed). It has been shown that age and employment status are factors relating to physical activity among patients with arthritis[5,7-9,20,21].

To further examine the relationship between variables and inactivity, we tested whether the effects of hip score, walking speed, and disease severity on activity classification varied according to employment status. The effects of these variables were assessed separately for patients who were unemployed and those who were employed in logistic regression analysis, adjusting for age, hip score, walking speed, and disease severity.

Computer software (JMP 5.0J, SAS Institute Japan Inc., Tokyo, Japan) was used for all analyses. P values < 0.05 were considered statistically significant.

RESULTS

Activity monitor-wearing. As seen from daily continuous AM records over 7 days, one participant was considered to have worn the AM intermittently every day and was therefore excluded from analyses. Of the remaining 70 participants, 39 were considered to have worn the AM continuously from morning until night for 7 days, 17 for 6 days, 9 for 5 days, 1 for 4 days, and 4 for 3 days during the measurement period. Analyses were restricted to full-day data of the 65 participants who kept wearing the AM for 5 days or more.

Demographic characteristics. The 65 participants had a median age of 50 years (range 30–71) and a median BMI of 21.4 kg/m^2 (range 14.5–27.8), including 8 (12%) overweight (BMI ≥ 25 kg/m^2) participants. The median hip score was 78 points (range 46–100) and the median walking speed was 1.16 m/s (range 0.76–1.56). Of the 65 participants, 25 (38%) were unemployed and 40 (62%) were employed, including 18 (28%) engaged in sitting occupations and 22 (34%) engaged in standing/walking occupations. Thirty-nine (60%) had unilateral hip involvement, and 33 (51%) had undergone past hip surgery. Radiographic stage was 1 in 6 patients (9%), 2 in 16 (25%), 3 in 16 (25%), and 4 in 27 (42%), representing two-thirds with advanced or endstage arthritis.

Ambulatory physical activity. Table 1 shows the AM results of the 65 participants. There were 4.5–7.7-fold differences between minimum and maximum values of step counts and unadjusted and adjusted EE across the participants. Activity time by intensity declined sharply as it increased from light to moderate and from moderate to vigorous. Time spent in moderate-intensity ranged widely from 1.1 to 42.1 min/day (38.3-fold difference) and accumulated > 30 min/day in 9 (14%) participants, ≥ 20 but < 30 min/day in 13 (20%), ≥ 10 but < 20 min/day in 15 (23%), and < 10 min/day in 28 (43%).

Activity monitor results by employment status. Table 2 shows the ANOVA results for group mean differences in AM measurements by employment status. Patients with sitting occupations had significantly higher mean unadjusted and adjusted EE and time spent in moderate-intensity activity than patients who were unemployed. Further, compared to patients with sitting occupations, those with standing/walking occupations had significantly higher mean step counts, adjusted EE, time spent in light and vigorous-intensity activity, and total activity time.

Table 1. Ambulation measurements in 65 adult women with hip OA.

Ambulation Measures	Patients, n = 65 Median (range)	Mean (SD)
General ambulation measures		
Step counts, steps/day	6681 (2836–12847)	6646 (2420)
Unadjusted EE, kcal/day	129.0 (43.7–336.8)	142.2 (66.1)
Adjusted EE, kcal/kg/day	2.7 (1.0–5.9)	2.8 (1.2)
Time by intensity of exercise		
Light, min/day	50.1 (22.3–103.4)	53.2 (17.6)
Moderate, min/day	13.6 (1.1–42.1)	15.9 (11.5)
Vigorous, min/day	0.5 (0–8.0)	1.2 (1.5)
Total, min/day	68.1 (29.7–121.9)	70.3 (24.6)

EE: energy expenditure.

Activity monitor results by activity classification. Three clusters of patients were identified in the later stage of cluster analysis performed on EE. The cluster with the lowest EE remained unjoined until the final step and was therefore classified as inactive, comprising 28 patients (43%). The other 2 clusters of patients, which had higher EE, were combined and classified as not-inactive (n = 37, 57%). Compared to not-inactive patients, inactive patients had significantly lower values of all AM measures (medians, step counts 4538 vs 7984 steps/day; unadjusted EE 84.9 vs 178.4 kcal/day; adjusted EE 1.7 vs 3.3 kcal/kg/day; light activity 40.9 vs 63.8 min/day; moderate activity 5.6 vs 22.9 min/day; vigorous activity 0.2 vs 1.2 min/day; total activity time 50.0 vs 86.1 min/day; all p < 0.001). Among AM measurements, time spent in moderate-intensity activity differentiated most clearly between inactive and not-inactive patients.

Group comparisons of demographic characteristics. Table 3 shows demographic characteristics by activity classification. Inactive patients were significantly older and had lower medians of BMI, hip score, and walking speed and a higher prevalence of stage 4 arthritis than not-inactive patients. There was also a significant difference in employment status between inactive and not-inactive groups (p < 0.001, chi-square test). Demographic characteristics that did not differ significantly between inactive and not-inactive patients included hip involvement, past surgery, and arthritis in stages 1 to 3.

Logistic regression analysis. In the logistic regression analysis for inactivity, stage 4 was used for disease severity (0 = presence of stage 4, 1 = absence of stage 4 arthritis), because of a significant group-difference in its prevalence. Table 4 shows the main effects of hip score, walking speed, and stage 4 with their estimated coefficients for inactivity, with and without adjusting for age or employment status. Adjustment significantly decreased the magnitude of the coefficients except for that of hip score with employment status. In contrast, the coefficient of employment status remained substantially unchanged and significant after adjusting for age, hip score, and walking speed, and decreased to a certain extent after adjusting for stage 4.

We further tested a hypothesis that the effects of variables of interest varied according to employment status. Figure 1 shows the unadjusted interaction between stage 4 and employment status to determine inactivity. In patients who were unemployed, stage 4 was significantly associated with inactivity (p = 0.01, Fisher's exact test). Logistic regression was performed on inactivity separately for patients who were unemployed and those who were employed, with or without adjusting for confounding variables (Table 5). In patients who

Table 2. Ambulation measurements of 65 adult women with hip OA by employment status*.

Ambulation Measures	Employment Status Unemployed, n = 25, Mean (SD)	Sitting Occupation, n = 18, mean (SD)	Standing/Walking Occupation, n = 22, mean (SD)	ANOVA F	p	Mean Difference Sitting–Unemployed (95% CI)	p**	Mean Difference Standing/Walking–Sitting (95% CI)	p**
General									
Step counts, steps/day	5105 (1438)	6499 (2199)	8518 (2250)	17.81	0.000	1394 (–61, 2848)	0.063	2018 (523, 3514)	0.005
Unadjusted EE, kcal/day	101.1 (37.8)	144.9 (63.9)	186.6 (65.4)	13.71	0.000	43.8 (2.3, 85.3)	0.036	41.7 (–0.9, 84.4)	0.057
Adjusted EE, kcal/kg/day	2.0 (0.7)	2.8 (1.1)	3.7 (1.1)	18.26	0.000	0.8 (0.1, 1.5)	0.026	0.9 (0.2, 1.7)	0.012
Time by intensity of exercise									
Light, min/day	46.0 (13.2)	48.5 (15.4)	65.3 (17.9)	10.19	0.000	2.5 (–9.0, 14.0)	0.861	16.8 (5.0, 28.7)	0.003
Moderate, min/day	8.8 (6.6)	18.1 (11.8)	22.2 (11.5)	11.14	0.000	9.3 (1.8, 16.7)	0.011	4.2 (–3.5, 11.8)	0.393
Vigorous, min/day	0.4 (0.5)	0.8 (0.9)	2.4 (1.9)	16.45	0.000	0.4 (–0.5, 1.3)	0.504	1.6 (0.6, 2.5)	< 0.001
Total, min/day	55.1 (15.5)	67.3 (21.1)	90.0 (22.7)	18.52	0.000	12.2 (–2.5, 26.9)	0.121	22.7 (7.6, 37.7)	0.002

* Values compare the mean ambulation measurements between unemployed patients, patients with sitting occupations, and those with standing/walking occupations using analysis of variance (ANOVA). ** Tukey's *post hoc* test p value. EE: energy expenditure.

Table 3. Demographic characteristics by activity classification*.

Demographics	Activity Classification Inactive, n = 28	Not-Inactive, n = 37	Inactive vs Not-Inactive p
Basic characteristics			
Age, median (range), yrs	55 (30–71)	48 (30–66)	0.005
Body mass index, median (range), kg/m^2	21.9 (14.5–27.8)	20.1 (15.6–27.4)	0.041
Employment status			
Unemployed, no. (%)	19 (68)	6 (16)	
Sitting occupations, no. (%)	7 (25)	11 (30)	
Standing/walking occupations, no. (%)	2 (7)	20 (54)	< 0.001
Joint function			
Hip score, median (range), points	73 (46–100)	84 (49–100)	0.012
Gait function			
Walking speed, median (range), m/s	1.11 (0.76–1.36)	1.21 (0.86–1.56)	0.022
Disease status			
Hip involvement, unilateral, no. (%)	17 (61)	22 (59)	0.991
Past surgery, yes, no. (%)	15 (54)	18 (49)	0.804
Radiographic stage, no. (%)**			
1	1 (4)	5 (14)	0.225
2	5 (18)	11 (30)	0.385
3	4 (14)	12 (32)	0.146
4	18 (64)	9 (24)	0.002

* Values compare demographics between inactive and not-inactive patients using Mann-Whitney U test for continuous variables (age, BMI, hip score, and walking speed), chi-square test for employment status, and Fisher's exact test for categorical variables (hip involvement, past surgery, and each radiographic stage). ** Modified Kellgren-Lawrence grade (see text for details).

were unemployed, the estimated coefficient of stage 4 remained substantially unchanged and significant, even after adjusting for confounders. However, in patients who were employed, no variables were associated with physical inactivity.

DISCUSSION

Our study provides objective data for ambulatory physical activity measured using an activity monitor among Japanese adult women with hip OA living in the community. We found large inter-subject differences in ambulation measures, particularly in time spent engaged in moderate-intensity activity. The results of this measure suggested that most subjects (> 85%) did not meet the current physical activity recommendations[5,6]. This rate is similar to those from US and Canadian national surveys among adults with arthritis, despite differences in samples and methods of measuring physical activity (AM vs telephone interview)[7-9]. Such a high rate in our sample also supports the need for interventions to promote physical activity among adult women with hip OA.

Identifying inactive individuals is important because they are at risk for disability[22] and are expected to benefit most

Table 4. The main effects of hip score, walking speed, disease stage, and employment status on activity classification. Estimated coefficients are presented for physical inactivity, with or without adjusting for confounding variables.

Independent Variables	Unadjusted Coefficient for Physical Inactivity (95% CI)	Adjusted Coefficient for Physical Inactivity (95% CI)
Joint function		
Hip score, points	–0.05 (–0.09, –0.01)	–0.03 (–0.08, 0.01)†
		–0.05 (–0.10, 0)††
Gait function		
Walking speed, m/s	–3.95 (–7.72, –0.62)	–2.60 (–6.56, 1.05)†
		–3.28 (–7.55, 0.60)††
Disease severity		
Stage 4 (endstage)*	0.86 (0.34, 1.42)	0.70 (0.14, 1.29)†
		0.64 (0.04, 1.27)††
Characteristic		
Employment status**	1.19 (0.63, 1.80)	1.16 (0.56, 1.83)†
		1.18 (0.60, 1.80)§
		1.14 (0.60, 1.78)#
		1.05 (0.46, 1.70)¶

* 0 = presence of stage 4, 1 = absence of stage 4. ** 0 = unemployed, 1 = employed. † Adjusted for age. †† Adjusted for employment status. § adjusted for hip score. # Adjusted for walking speed. ¶ Adjusted for stage 4.

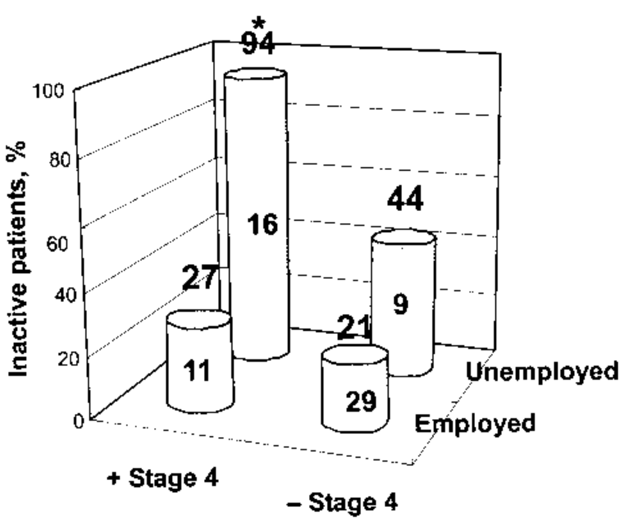

Figure 1. Unadjusted association between stage 4 arthritis and physical inactivity, according to employment status. Values at the top of columns are the percentage of inactive patients within each cell, and values in the middle of columns are number of patients within each cell. *p = 0.01 versus – stage 4 and unemployed (Fisher's exact test).

from increasing their physical activity[6]. Indeed, a clinical trial of sedentary adults substantiates the effectiveness of a lifestyle physical activity intervention in improving physical activity, cardiorespiratory fitness, and blood pressure[23]. Given there is no general agreement on a standard definition of inactivity, our cluster analysis performed on energy expenditure identified a large cluster of inactive patients, accounting for more than 40% of the patients. Their inactivity was evident in all ambulation measures, particularly in moderate-intensity activity, compared with their counterparts. This observation is not specific for inactive patients with hip OA. Meijer, *et al* also observed a significant decline in time spent in moderate-intensity activity among older adults, compared with young adults[24]. Thus, a lack of moderate-intensity activity may be a common and important component of physical inactivity regardless of origin.

Physical activity is a behavior related to lifestyle, and a number of factors have been shown to correlate with and/or influence physical activity, including personal, social, and environmental factors[6-11,25,26]. In our study, employment status and disease severity had an interrelationship, and were independently associated with physical inactivity. Moreover, we first found an interaction between these 2 variables to determine activity classification, i.e., although endstage OA was significantly associated with inactivity in patients who were unemployed, it was not in those who were employed. There are 2 possible explanations for this finding. First, being employed may be a strong enough influence to negate an adverse effect of endstage OA on ambulation, a hypothesis supported by several epidemiologic studies[25,26]. White women who were employed were found to be more likely to meet physical activity recommendations than those who were not[25]. Conversely, the highest prevalence of inactivity according to occupation was observed for women who were homemakers[26]. The other explanation is that higher levels of physical activity may slow the decline in functioning associated with OA[27,28], thus permitting functioning at a level whereby a person can be employed.

Theoretically, we expected that poor functional status was associated with inactivity, as suggested previously in older adults with arthritis[10]. In that study, respondents who reported functional limitations were more likely to be inactive than those who did not. However, our regression analysis for inactivity revealed that hip score and walking speed were not statis-

Table 5. The effect of hip score, walking speed, and stage 4 (endstage) arthritis on physical inactivity, according to employment status. Estimated coefficients are presented for physical inactivity, with or without adjusting for confounding variables, in patients who were unemployed and those who were employed.

Employment Status	Independent Variables	Unadjusted Coefficient for Physical Inactivity (95% CI)	Adjusted Coefficient for Physical Inactivity (95% CI)
Unemployed	Hip score, points	–0.08 (–0.18, 0.00)	0.04 (–0.12, 0.21)**
	Walking speed, m/s	–6.56 (–16.09, 0.22)	–5.31 (–20.43, 6.51)†
	Stage 4 (endstage)*	1.47 (0.40, 3.02)	1.49 (0.09, 3.44)††
Employed	Hip score, points	–0.03 (–0.09, 0.03)	–0.03 (–0.12, 0.05)**
	Walking speed, m/s	–1.57 (–6.75, 3.30)	1.45 (–5.53, 8.71)†
	Stage 4 (endstage)*	0.18 (–0.68, 0.97)	–0.08 (–1.02, 0.78)††

* 0 = presence of stage 4, 1 = absence of stage 4. ** Adjusted for age, walking speed, and stage 4. † Adjusted for age, hip score, and stage 4. †† Adjusted for age, hip score, and walking speed.

tically significant, after adjusting for strong confounding effects of age and employment status. The reason for this discrepancy in the function-inactivity relationship may be due to differences in samples and methods in measuring physical activity and functions (direct measurements vs telephone interview).

Our study has several limitations. Because of the small sample size, the study provided large confidence intervals, particularly in the interaction model, which may affect the interpretation of the results, and did not generate enough numbers to allow for definitive conclusions in some of the comparisons between employment status and between inactive and not-inactive participants. Although the validity and reliability of the AM for assessing ambulatory physical activity has been established[18,19,29], it is not sensitive for some physical activities such as cycling and activities involving arm motion. We obtained a good mean accuracy of 95.2% in step counting along a corridor, but the sensitivity to other activities of daily living including household activities is unclear. The study was primarily restricted to patients from an outpatient clinic who had mild to moderate loss of joint function and gait function, as indicated by hip score and walking speed, and participants were all Japanese. Therefore, interpreting and generalizing our findings should be done with caution. It is likely that inactive patients who have severe pain and disability require surgical treatment such as total hip arthroplasty to improve their ambulation. Japanese may differ from people from other cultures in terms of activity[30].

Health professionals should note that the majority of adult women with hip OA are not likely able to meet physical activity recommendations, and that a significant proportion of those are physically inactive, with a lack of moderate-intensity activity. The effect of stage 4 arthritis on physical activity may vary according to employment status. Further studies are needed to determine whether being in work negates the adverse effects of endstage OA or whether higher functioning due to physical activity enables patients who have endstage OA to be employed.

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