EXTENDED REPORTS

Associations of radiological osteoarthritis of the hip and knee with locomotor disability in the Rotterdam Study

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Abstract

***Objective*—To assess the contribution of radiological osteoarthritis of the hips and knees to disabilities in the activities of daily living related to lower limb function.**

***Methods*—During a home interview 1156 men and 1739 women, randomly chosen from the source population of all independently living residents aged 55 years and over living in a district of Rotterdam (the Rotterdam Study) were asked about locomotor disability by six questions of the Health Assessment Questionnaire (HAQ) and about pain in the hips and knees in the past month. Radiographs of hips and knees were scored according to the Kellgren grading system for osteoarthritis.**

***Results*—The prevalence of locomotor disability, defined as at least some difficulty with three or more out of six lower limb functions, was 20.2% for men and 31.9% for women; hip pain was present in 8.3% of the men and 16.6% of the women; knee pain in 12.6% of the men and 22.3% of the women. The prevalence of radiological osteoarthritis grade 2+ of the hip was 14.1% for men and 15.9% for women, and of the knee 16.3% and 29.1% respectively. The odds ratio (OR) (95% confidence intervals) of hip radiological osteoarthritis for locomotor disability adjusted for age and all other variables was for men: 1.4 (0.9, 2.1) and for women: 2.2 (1.6, 2.9). The ORs of knee radiological osteoarthritis adjusted for age and all other variables were 1.1 (0.9, 2.1) and 1.4 (1.1, 1.8) respectively. Severe radiological osteoarthritis (grade 3+) was stronger associated. The ORs of pain in the hips or knees and morning stiffness were much higher (between 2.7 and 5.5 for men and between 2.1 and 5.1 for women).**

***Conclusions*—Radiological osteoarthritis of the hip and knee are only weak independent predictors of locomotor disability in women, and not at all independently associated with locomotor disability in men. Age, pain of the hips and knees, and morning stiffness seem to be the most important independent determinants of locomotor disability.**

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Locomotor disability as defined by the difficulty people experience when carrying out basic activities of daily living related to the lower limbs can be caused by many diseases. In a recent paper we demonstrated the association between locomotor disability and joint pain and morning stiffness.[1] In the elderly radiological osteoarthritis of the hip and knee is often related to joint pain and morning stiffness. This paper analysed the effect of radiological osteoarthritis on the occurrence of locomotor disability. Data from the National Health and Nutrition Examination Survey-I Epidemiologic Follow-up Study (NHEFS) and the Framingham Study suggested a large impact of radiological osteoarthritis of the knee on disability in the activities of daily living related to lower limb function.[2–6] More recently a British study reported an increased risk of locomotor disability in people with pain and radiological osteoarthritis of the knees.[7 8] However, data on the influence of pain or radiological osteoarthritis of the hip are lacking. This study analysed in 2985 people of the Rotterdam Study cohort the association between radiological osteoarthritis and self reported pain in the hips and knees and locomotor disability.

Methods

POPULATION

The Rotterdam Study is a prospective follow up study of the frequency and risk factors of chronic disease and disability in persons aged 55 years and over in the general population.[9] The source population comprises all residents aged 55 years and over on 1 January 1989 living in the Ommoord district of Rotterdam.[10] Baseline data on all 10 275 eligible people, 9161 living independently and 1114 residing in the six homes for the elderly in the district, were collected from April 1990 to July 1993.

Between April 1990 and July 1992 2247 men and 3433 women, randomly chosen from the source population of independently living

people, were invited to participate in a home interview. These subjects constitute the study base of this study. Complete interview data were available for 1819 men (81.0%) and 2817 women (82.1%). In the second phase of the study, the participants were invited to visit the research centre for additional measurements. The average time lapse between the interview and the visit to the centre was two weeks. Of the interviewed subjects 1690 men (92.9%) and 2577 women (91.4%) participated in the centre examinations. Logistic reasons obliged us to start the study with a restricted number of measurements at the centre. For the study on the relation between disability and locomotor signs and symptoms complete data were available for 1156 men and 1739 women, 63.6% and 61.7%, respectively, of the originally interviewed 1819 men and 2817 women.

STUDY DESIGN

The analysis focused on the association of radiological osteoarthritis of the hips and knees with locomotor disability. Locomotor disability in the Rotterdam Study was defined as proposed by the International Classification of Impairments, Disabilities and Handicaps (ICIDH) and comprises the relevant items from the ambulation subcategory: walking, climbing stairs, getting in and out of bed and a car, bending, and rising from a chair.[11] The Stanford Health Assessment Questionnaire (HAQ) was used to assess disability.[12–15] A comprehensive description of the way the HAQ was assessed during the home interview carried out by one of our nine extensively trained interviewers, who were standardised on a regular basis, has been presented earlier.[1] Locomotor disability was defined as the mean of the scores on the six questions related to lower limb functions. The cut off for disability was 0.50, which means that the participants have at least some difficulty with three or more out of six functions.

Pain of the hips and knees was defined as pain during the past month in the left or right joint, or both. Pain was assessed by asking the participants if they suffered from pain or other complaints in their joints during the past month and if so which joints bothered them most. A manikin was used to check all joint sites. For the current analyses we used the data on pain in the hip and knee, irrespective of the fact that other joints might be more bothersome to the participant. Duration of generalised morning stiffness was assessed at three levels (that is, less than 0.5 hours, 0.5–1 hour, more than 1 hour) and subsequently dichotomised to no morning stiffness or 0.5 hours or more.[1]

At the research centre, which was located at the health centre of the study district, weight-bearing radiographs of the hips and knees were obtained. Radiological osteoarthritis was assessed by means of the grading system proposed by Kellgren *et al*.[16] The radiographs were scored by two independent readers (EO and HAV), who were blinded to all data of the participant. There was no written indication of sex or age on the film. Whenever the score of the two readers differed more than one grade or when one reader scored grade 1 and the other grade 2 or more a consensus reading was carried out. The consensus grade, or in case of a difference between grade 2 and 3 the highest grade, was entered as the final score. A subject was considered to have radiological osteoarthritis if the Kellgren score at the left or right side, or both, was greater or equal to two. In the Kellgren grading system mild radiological osteoarthritis (grade 2) of the hip is defined as: definite narrowing of joint space inferiorly, definite osteophytes and slight sclerosis, while mild radiological osteoarthritis of the knee is defined as: definite osteophytes and possible narrowing of joint space. Higher grades include cysts and deformity of the hips and sclerosis and deformity of the knees. Severe radiological osteoarthritis was defined as Kellgren score of 3 or over.

Body height was measured in cm, body weight in kg with the participant barefooted and wearing light indoor clothing. Body mass index (kg/m^2) was used as a measure of obesity.

DATA ANALYSIS

All analyses were done for men and women separately. We first estimated the age and sex specific prevalence (%) of locomotor disability, joint pain of the hips and knees and radiological osteoarthritis of the hips and knees. Secondly, the prevalence of disability in the six separate functions, which constitute the locomotor disability index, in strata of joint pain and radiological osteoarthritis was estimated.

The relation between joint pain and radiological osteoarthritis was established by calculating the sensitivity and specificity of joint pain and radiological osteoarthritis.

The separate associations between locomotor disability and radiological osteoarthritis, pain, morning stiffness, and body mass index (BMI) were estimated by means of age adjusted odds ratios using a multiple logistic regression model. BMI was analysed in quartiles with the second quartile (23.9–25.7 kg/m^2 for men and 23.9–26.3 kg/m^2 for women) being the reference category. Although overweight is commonly defined as a BMI of 26–29 kg/m^2, and obesity as 30 kg/m^2 or higher, we chose, in this elderly population, to analyse BMI in quartiles. People in the first quartile (< 23.9 kg/m^2 for men and women) were considered to

Table 1 Some characteristics of the subjects of this study compared with all participants of the Rotterdam Study

	This study	*Research centre*	*Interview*
Men (n)	1156	1690	1819
Age range (y)	55.0–93.2	55.0–94.3	55.0–94.3
mean age (SD)	68.6 (7.5)	68.5 (7.7)	68.9 (8.0)
	% (95% CI)	*% (95% CI)*	*% (95% CI)*
Locomotor disability	20.2 (17.9, 22.5)	19.9 (18.0, 21.8)	21.9 (20.0, 23.8)
Hip pain	8.3 (6.7, 9.9)	8.3 (7.0, 9.6)	8.5 (7.2, 9.8)
Knee pain	12.6 (10.7, 14.5)	12.2 (10.6, 13.8)	12.5 (11.0, 14.0)
Morning stiffness	4.6 (3.4, 5.8)	4.6 (3.6, 5.6)	4.6 (3.6, 5.6)
Women (n)	1739	2577	2817
Age range (y)	55.0–94.0	55.0–95.6	55.0–95.6
mean age (SD)	69.4 (8.1)	69.2 (8.3)	69.7 (8.8)
	% (95% CI)	*% (95% CI)*	*% (95% CI)*
Locomotor disability	31.9 (29.7, 34.1)	32.5 (30.7, 34.3)	34.8 (33.0, 36.6)
Hip pain	16.6 (14.9, 18.3)	16.3 (14.9, 17.7)	16.4 (15.0, 17.8)
Knee pain	22.3 (20.3, 24.3)	22.9 (21.3, 24.5)	22.6 (21.1, 24.1)
Morning stiffness	8.6 (7.3, 9.9)	9.2 (8.1, 10.3)	9.2 (8.1, 10.3)

Table 2 Prevalence (%) of locomotor disability, joint pain, and radiological osteoarthritis of the hip and knee of men and women by age

	Age group (y)				
	55–64 %	*65–74 %*	*75–84 %*	*85+ %*	*Total % (95% CI)*
Men (n)	404	501	234	17	1156
Locomotor disability	11.1	19.8	34.2	58.8	20.2 (17.9, 22.5)
Joint pain					
Hip	8.4	7.6	8.5	23.5	8.3 (6.7, 9.9)
Knee	13.4	10.4	16.2	11.8	12.6 (10.7, 14.5)
Radiological osteoarthritis					
Hip ⩾2	11.4	14.2	17.1	35.3	14.1 (21.1, 16.1)
Hip ⩾3					2.5 (1.6, 3.4)
Knee ⩾2	10.1	16.8	24.8	35.3	16.3 (14.2, 18.4)
Knee ⩾3					2.6 (1.7, 3.5)
ROA + pain					
Hip ⩾2	2.2	2.2	1.7	11.8	2.2 (1.4, 3.1)
Hip ⩾3					0.8 (0.3, 1.3)
Knee ⩾2	2.0	4.6	6.4	11.8	4.2 (3.0, 5.4)
Knee ⩾3					1.6 (0.9, 2.3)
Women (n)	589	684	416	50	1739
Locomotor disability	15.8	30.4	51.0	82.0	31.9 (29.7, 34.1)
Joint pain					
Hip	14.6	17.4	18.0	18.0	16.6 (14.9, 18.3)
Knee	21.4	24.4	20.4	18.0	22.3 (20.3, 24.3)
Radiological osteoarthritis					
Hip ⩾2	5.9	18.4	23.3	38.0	15.9 (14.2, 17.6)
Hip ⩾3					6.1 (5.0, 7.2)
Knee ⩾2	19.0	29.4	38.2	68.0	29.1 (27.0, 31.2)
Knee ⩾3					4.7 (3.7, 5.7)
ROA + pain					
Hip ⩾2	2.5	5.7	8.7	4.0	5.3 (4.2, 6.4)
Hip ⩾3					3.0 (2.2, 3.8)
Knee ⩾2	7.1	11.3	11.3	14.0	9.9 (8.5, 11.3)
Knee ⩾3					2.5 (1.8, 3.2)

As the number of people with ROA grade ⩾3 is small only total prevalences are given. ROA + pain = radiological osteoarthritis and pain in the same joint.

Table 3 Prevalence (%) of disability in the six separate functions, which constitute the locomotor disability index, in men and women according to joint status

	Rising from chair	*In/out bed*	*Walking*	*Climbing stairs*	*Bending*	*In/out car*
Men						
No pain						
No ROA	12.7	12.3	13.3	15.5	27.3	12.4
Knee ROA	12.7	12.7	21.8	24.5	14.5	14.5
Hip ROA	16.9	20.5	22.9	19.3	15.7	19.3
Knee and hip ROA	18.2	31.8	27.3	36.4	13.6	18.2
Knee pain						
No ROA	23.7	28.8	23.7	27.1	22.0	20.3
Knee ROA	20.0	23.3	43.3	40.0	10.0	30.0
Hip pain						
No ROA	28.2	41.0	33.3	30.8	28.2	30.8
Hip ROA	16.7	38.9	44.4	38.9	22.2	50.0
Women						
No pain						
No ROA	13.0	14.4	14.1	24.5	16.7	16.8
Knee ROA	19.5	21.7	24.4	38.9	17.2	28.1
Hip ROA	30.1	26.5	34.9	48.2	31.3	39.8
Knee and hip ROA	40.0	27.7	40.0	55.4	36.9	58.5
Knee pain						
No ROA	25.4	27.9	24.6	35.2	17.2	25.4
Knee ROA	34.3	32.4	50.5	62.9	34.3	45.7
Hip pain						
No ROA	32.6	33.7	40.7	46.5	31.4	44.2
Hip ROA	58.8	64.7	55.9	73.5	64.7	67.6

No pain = no pain in any joint. No ROA = no radiological osteoarthritis in any joint. Knee ROA = radiological osteoarthritis in knees only. Hip ROA = radiological osteoarthritis in hips only. Knee and hip ROA = radiological osteoarthritis in knees and hips simultaneously. Knee pain = pain in knees only. Hip pain = pain in hips only.

be underweight, while those in the fourth quartile (> 27.8 kg/m^2 for men and > 29.2 kg/m^2 for women) were classified as obese.

Age, joint pain, morning stiffness, radiological osteoarthritis, and BMI were entered jointly in a multiple logistic regression model of locomotor disability to estimate adjusted odds ratios and aetiologic fractions for all independent variables. The aetiologic fraction (EF) is defined as the proportion of disabled persons, which is attributable to the determinant of interest.[17] The EF was calculated using the formula:

$$EF = p(aOR-1)/\{p(aOR-1) + 1\}$$

where p is the prevalence of the determinant in the population and aOR is the odds ratio adjusted for all variables in the model. In this analysis locomotor disability, joint pain, morning stiffness, and radiological osteoarthritis were entered as dichotomous variables. All analyses were done for radiological osteoarthritis and severe radiological osteoarthritis separately.

Results

In table 1 the prevalence of locomotor disability, pain in hips and knees, and morning stiffness of the participants of this study are compared with those of all interviewed subjects and with those of all participants who visited the research centre. Restriction of the originally interviewed cohort by non-response and missing data on physical examination had no effect on the age distribution of the study group. People visiting the research centre were somewhat less disabled than those interviewed, but the differences were very small. The occurrence of pain and morning stiffness did not differ between the three groups, taking the 95% confidence intervals into account.

Table 2 presents the prevalence figures of locomotor disability, joint pain, and radiological osteoarthritis in the study group. Locomotor disability and radiological osteoarthritis of the hips and knees increased significantly with age, but pain in the hips or knees did not (possibly with the exception of hip pain in very old men).

Table 3 shows the prevalence of disability in the separate functions that constitute the locomotor disability index according to joint status in men and women respectively. In men pain and radiological osteoarthritis of the hip have a major impact on walking and getting in and out of a car and pain and radiological osteoarthritis of the knee on walking and climbing stairs. Isolated knee pain and hip pain in men have their strongest effect on getting in or out of bed. In women both pain in the knees and hips and radiological osteoarthritis of the knees and hips have a major effect on climbing stairs, followed by getting in and out of a car for pain and radiological osteoarthritis of the hips.

Radiological osteoarthritis and joint pain were poorly associated, be it somewhat better in women than in men. Table 4 shows the sensitivity and specificity of joint pain and radiological osteoarthritis. In summary: 16.0% of the men and 33.2% of the women with radiological osteoarthritis of the hips had hip pain and 27.1% of the men and 31.8% of the women with hip pain had radiological osteoarthritis. Of the participants with radiological osteoarthritis of the knees 25.4% of the men and 34.2% of the women had knee pain and 32.9% of the men and 44.7% or the women with knee pain had radiological osteoarthritis. The association between pain and severe radiological osteoarthritis was substantially greater: 31.0% of the men and 49.1% of the

*Table 4 Sensitivity (%) and specificity (%) of joint pain for radiological status and of radiological osteoarthritis for joint pain status***

		Men		Women	
		Of pain	*Of ROA*	*Of pain*	*Of ROA*
Hip					
Sensitivity	ROA ⩾2	27.1	16.0	31.8	33.2
	ROA ⩾3	9.4	31.0	18.0	49.1
Specificity	ROA ⩾2	87.1	93.0	87.2	86.5
	ROA ⩾3	98.1	92.3	96.3	85.5
Knee					
Sensitivity	ROA ⩾2	32.9	25.4	44.7	34.2
	ROA ⩾3	13.0	63.3	11.4	53.7
Specificity	ROA ⩾2	86.0	89.9	75.4	82.6
	ROA ⩾3	98.9	88.7	97.2	79.3

*Sensitivity of joint pain = proportion of people with ROA and joint pain in all people with joint pain. Specificity of joint pain = proportion of people with no ROA or joint pain in all people without joint pain. Sensitivity of ROA = proportion of people with joint pain and ROA in all people with ROA. Specificity of ROA = proportion of people with no joint pain or ROA in all people without ROA.

Table 5 Age adjusted odds ratios (95% confidence intervals) of joint pain, morning stiffness, obesity, and radiological osteoarthritis (ROA) for locomotor disability

	Men		*Women*	
Pain				
Hip	3.6 (2.3, 5.7)		5.3 (4.0, 7.0)	
Knee	3.4 (2.3, 5.0)		3.0 (2.3, 3.9)	
Morning stiffness	6.5 (3.6, 11.8)		6.5 (4.4, 9.6)	
Obesity*	1.7 (1.1, 2.6)		1.7 (1.3, 2.3)	
	Grade ⩾2	*Grade ⩾3*	*Grade ⩾2*	*Grade ⩾3*
ROA				
Hip	1.7 (1.2, 2.6)	3.1 (1.4, 6.9)	2.9 (2.2, 3.9)	7.4 (4.4, 12.5)
Knee	1.4 (0.9, 2.0)	4.5 (2.1, 9.7)	1.7 (1.4, 2.2)	3.5 (2.1, 5.8)
ROA + pain				
Hip	3.1 (1.4, 7.2)	4.0 (1.0, 15.8)	7.4 (4.4, 12.3)	15.5 (6.4, 37.5)
Knee	3.3 (1.8, 6.1)	11.5 (3.7, 36.0)	3.1 (2.2, 4.4)	6.6 (3.1, 14.3)

ROA = radiological osteoarthritis. *Obesity, body mass index fourth quartile versus second quartile (men: >27.8 versus 23.9–25.7, women: >29.2 versus 23.9–26.3).

Table 6 Adjusted odds ratios and aetiological fractions (EF) of joint complaints, radiological osteoarthritis (ROA), and obesity for locomotor disability

	Men		*Women*	
	aOR (95% CI)	*EF*	*aOR (95% CI)*	*EF*
Model with ROA ⩾2				
Hip pain	2.7 (1.7, 4.4)	12.6	3.6 (2.6, 4.9)	30.0
Knee pain	2.9 (1.9, 4.4)	19.5	2.1 (1.6, 2.8)	20.5
Morning stiffness	5.5 (3.0, 10.2)	17.0	5.1 (3.4, 7.7)	26.1
Hip ROA	1.4 (0.9, 2.1)	(5.0)*	2.2 (1.6, 2.9)	15.7
Knee ROA	1.1 (0.9, 2.1)	(1.6)*	1.4 (1.1, 1.8)	10.0
Obesity	1.5 (1.0, 2.3)	10.9	1.4 (1.1, 1.8)	10.0
Model with ROA ⩾3				
Hip pain	2.7 (1.7, 4.4)	12.4	3.4 (2.5, 4.7)	28.7
Knee pain	2.7 (1.8, 4.1)	17.9	2.1 (1.6, 2.8)	16.9
Morning stiffness	5.5 (3.0, 10.3)	17.1	5.0 (3.3, 7.6)	25.6
Hip ROA	2.1 (0.9, 4.9)	(2.8)*	4.4 (2.6, 7.4)	16.9
Knee ROA	2.7 (1.2, 5.9)	4.5	2.4 (1.4, 4.1)	6.0
Obesity	1.5 (1.0, 2.3)	10.3	1.7 (1.2, 2.3)	14.4

aOR = Odds ratio adjusted for all variables in the model and age. 95% CI = 95% confidence intervals of aOR. *= aOR not significantly higher than 1. EF = p(aOR−1)/(p(aOR−1) + 1).

women with severe radiological osteoarthritis had pain in the hips, while 63.3% of the men and 53.7% of the women with severe radiological osteoarthritis of the knee had pain in the corresponding joints.

Table 5 shows the univariate association of joint pain, morning stiffness, obesity, radiological osteoarthritis (grade ⩾ 2 and 3+), and the combination of radiological osteoarthritis and pain with locomotor disability measured by the age adjusted odds ratio. Taking the 95% confidence intervals into consideration the association between radiological osteoarthritis (grade ⩾ 2) and locomotor disability was significantly weaker than between joint pain and locomotor disability, the latter being of the same magnitude as between "radiological osteoarthritis + pain" and locomotor disability. The odds ratios of severe radiological osteoarthritis (grade 3 or 4) with pain were higher, but not significantly different from the odds ratios of pain. This suggests that joint pain is a stronger determinant of locomotor disability than radiological osteoarthritis alone.

In the multiple logistic regression analysis, in which all variables were entered jointly, morning stiffness and pain in the hips and knee were the most prominent independent predictors of locomotor disability. In women mild and severe radiological osteoarthritis and obesity were also significantly associated with locomotor disability, but in men the independent association was restricted to obesity and severe knee radiological osteoarthritis (table 6). The last column for each sex shows the proportion of disability in the total population that was attributable to the determinants of interest. For example, among men aged 55 years and over, it can be estimated that about 12% of all locomotor disability in the general population is attributable to hip pain.

Discussion

Before discussing the results of our study some methodological issues should be mentioned. The main source of potential bias in our study is selection bias. The reduction of the study group had two origins: refusal to visit the research centre and exclusion because of missing data. The Rotterdam Study invited each month 300 to 500 subjects, randomly chosen from the population of 10 275 eligible people. Because the radiographic equipment was not available during the first months of the study there are no radiographs of the participants who visited the research centre in this period. Among the participants who visited the research centre the prevalence of locomotor disability was lower than among all interviewed subjects, but the prevalence of joint pain was of the same magnitude in these two groups. Comparison of the odds ratios of hip and knee pain for locomotor disability in the three study groups showed no significant differences. We therefore conclude that with regard to the relevant parameters non-response occurred more or less random. Information bias defined as inaccuracy of data because the participants misinterpreted the questions is possible but not likely to have occurred very frequently: all data were assembled by means of a home interview and our interviewers were trained extensively and standardised on a regular basis. The other source of information bias is the interviewers themselves. Despite our efforts to ensure standardised data collection by instructing the interviewers to explain questions only and avoid recording their own judgements, it is still possible that especially in the questions on disability the assessments were influenced by the interviewers. As to the questions on joint pain the interviewers were trained to distinguish between muscle pain and joint pain; the participant had to point out the painful site and the interviewer was instructed to ask

specifically if it was indeed the joint that was painful and not the surrounding muscles, but especially whenever complaints of the hips were presented misclassification could have occurred (that is, it is not always possible for non-medical interviewers to make the right decision whether indeed the hip joint is the origin of complaints). The fact however that the specificity of hip pain was high (table 4) suggests that there was not much misclassification.

This study among independently living people aged 55 years and over is the first to report on the influence of pain and radiological osteoarthritis of the hips and knees on disability in the activities of daily living related to lower limb function. Disability as evaluated by the Stanford Health Assessment Questionnaire was present in one fifth of the men and one third of the women. Suffering from pain in the hips and knees and from morning stiffness with a duration of more than half an hour were strongly associated with locomotor disability.[1] Although radiological osteoarthritis and joint pain are associated (table 4), the association between joint pain and locomotor disability was much stronger than between radiological osteoarthritis and locomotor disability (table 5). Most of the association between radiological osteoarthritis and locomotor disability could however be explained by the existence of musculoskeletal complaints and obesity as was shown in the multiple regression analysis (table 6). This analysis showed also that pain and morning stiffness had a much greater independent impact (greater aetiologic fractions) on the activities of daily living related to lower limb function in women than in men. The explanation could be that in men other disabling conditions such as intermittent claudication, heart failure, angina, and chronic respiratory disease as well as weakness of the lower limb muscles, especially the quadriceps, play a dominant part.[8 18] Psychosocial status could play a part in the explanation of disability as well. A substudy among the participants of this study showed high correlations between physical and psychosocial disability, assessed with the Sickness Impact Profile. The most important predictors of psychosocial disability in this study were chronicity of pain, male sex, current other mobility problems, and radiological osteoarthritis.[19]

In the presence of joint pain or radiological osteoarthritis both in men and women difficulties in walking, climbing stairs and getting in or out of a car or bed were the most prevalent disabilities of the lower limb functions. This could correspond with weakness of the quadriceps muscles. In women difficulties in climbing stairs and getting in and out of a car were the most prevalent disabilities irrespective of them having pain or radiological osteoarthritis.

The classification of radiological osteoarthritis according to the criteria of Kellgren is a widely used method in epidemiological studies on osteoarthritis, but their usefulness in clinical practice has been questioned. The American College of Rheumatology published criteria for osteoarthritis of the knee in 1986 and of the hip in 1991, often referred to as the Altman criteria.[20 21] These clinical criteria all start with the presence of pain and require the equivalent of grade 2 in the Kellgren grading system and for the knee one of three additional criteria: age over 50 years, stiffness less than 30 minutes, or crepitus. The age criterion is fulfilled by all our respondents. A recent population based study on the validity of several sets of classification criteria of osteoarthritis of the knee showed high percentages of agreement between the Altman clinical and radiographic criteria and Kellgren grade 2+ radiological osteoarthritis with pain.[22] The combination of joint specific pain and radiological osteoarthritis in our study can therefore be considered to represent symptomatic or clinical osteoarthritis. Although the odds ratios for locomotor disability of clinical osteoarthritis vary between 3 and 7 (table 5), they are essentially not different from the odds ratios of pain only or of severe radiological osteoarthritis only. Except for the higher prevalence rates of signs and symptoms it is not clear why these variables associate stronger with locomotor disability in women than in men. Neither can the better overlap between joint pain and radiological osteoarthritis in women be explained. The apparent lack of an independent association between radiological osteoarthritis and locomotor disability could in part be explained by the presence of radiological osteoarthritis of the patellofemoral joint, which was not studied by us. However, this would not explain the lack of association between radiological osteoarthritis of the hip and locomotor disability and can hardly be expected to change the non-significant adjusted odds ratio of radiological osteoarthritis of the knee (table 6) to substantially significant ones, as it only constitutes a minor portion of total radiological osteoarthritis of the knee

With regard to the knee our data are similar to those from the Framingham Study, the National Health and Nutrition Examination Survey-I Epidemiologic Follow-up Study (NHEFS), and a British study among community dwelling elders in Bristol.[2–8] For signs and symptoms of the hip no comparison data are available.

The findings of the Rotterdam Study suggest that although locomotor disability is a prevailing problem in an aging population, signs and symptoms of the musculoskeletal system can only partly explain its presence. Of the people with locomotor disability only a third or less have joint pain or radiological osteoarthritis of the hips or knees. On the other hand people who do suffer from pain whether or not combined with radiological osteoarthritis are threefold to sevenfold as often disabled. Obesity in women increases this risk even more.

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