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HIP OSTEOARTHRITIS AND WORK

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Abstract

Epidemiological evidence points strongly to a hazard of hip osteoarthritis from heavy manual work. Harmful exposures may be reduced by elimination or redesign of processes and use of mechanical aids. Reducing obesity might help to protect workers whose need to perform heavy lifting cannot be eliminated. Particularly high relative risks have been reported in farmers, and hip osteoarthritis is a prescribed occupational disease in the UK for long-term employees in agriculture. Even where it is not attributable to employment, hip osteoarthritis impacts importantly on capacity to work. Factors that may influence work participation include the severity of disease, the physical demands of the job, age, and the size of the employer. Published research does not provide a strong guide to the timing of return to work following hip arthroplasty for osteoarthritis, and it is unclear whether patients should avoid heavy manual tasks in their future employment.

Keywords

Hip; osteoarthritis; arthroplasty; occupation; lifting; manual handling; compensation

Osteoarthritis of the hip is a major cause of pain and disability in western populations. Although it is most frequent at older ages, many cases occur before retirement, when it can impact seriously on capacity to work. As longevity increases and changes to pensions require people to remain in employment to older ages, the scale of this problem is set to grow. Furthermore, it is now well established that certain occupational activities contribute importantly to development of the disease.

This chapter reviews the inter-relationship of hip osteoarthritis with employment. We begin with a brief summary of its descriptive epidemiology and major non-occupational risk factors. We then review the evidence for occupation as a cause of the disease, and the implications for prevention and compensation. Next we consider the impact of hip osteoarthritis on capacity to work, including after its surgical treatment. Finally we summarise the main conclusions that can be drawn from current evidence, and identify priorities for further research to address important unanswered questions.

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Descriptive epidemiology

The descriptive epidemiology of hip osteoarthritis has implications for the scale of its impact on employment, both currently and in the future. Evidence comes mainly from population-based surveys of symptoms and radiographic abnormalities. In addition, statistics on hospital admissions provide information about the frequency of surgical treatment for the disease (in particular by total hip replacement), although it must be recognised that rates of surgery are determined not only by the occurrence of the disorder, but also by the availability of arthroplasty and criteria for performing the operation, which may differ between populations and vary over time.

Case definition

Meaningful and unambiguous case definition for hip osteoarthritis is a challenge because it occurs in a spectrum of severity with no clear dichotomy between normality and abnormality. Moreover, the dominant symptoms of pain and stiffness correlate imperfectly with more objective radiographic evidence of the underlying pathology [1-3]. As with osteoarthritis in other joints, the disorder is characterised radiologically by reduction in joint space (reflecting a loss of articular cartilage), osteophytosis, and increased subchondral bone density with formation of cysts. In the most severe cases there can also be deformity of the femoral head. Many studies have graded the severity of radiographic abnormalities according to a scheme devised by Kellgren and Lawrence, using either standardised radiographs [4] or standardised verbal descriptors [5] as a reference. Others have used measures of joint space, such as the minimal distance between the articular surfaces [1,3]. An assessment of the validity and reliability of alternative case definitions when applied in a sample of 3,585 men and women aged ≥55 years, indicated higher inter-rater agreement and stronger association with symptoms for those based on minimal joint space and on comparison with standard radiographs, than for diagnosis based on verbal descriptors [2].

Frequency by sex, age, place and time

The prevalence and distribution of hip osteoarthritis internationally was estimated as part of the Global Burden of Disease 2010 study [6]. In a systematic review and meta-analysis, which adjusted for differences between studies in case definition, the global age-standardised prevalence of symptomatic, radiographically confirmed (Kellgren-Lawrence grades 2-4) disease in 2010 was estimated to be 0.85% (95% uncertainty interval 0.74% to 1.02%), with no evidence of a change since 1990. Rates were higher in women (0.98%) than men (0.70%), and increased progressively with age from close to zero at 30 years to 10% and higher above 80 years. They were highest in North America (1.6% in men, 2.1% in women) and lowest in East Asia (0.2% in men, 0.3% in women).

In Britain, a report published by Arthritis Research UK [7] used data from an anonymised general practice database to estimate the prevalence of diagnosed hip osteoarthritis and pain in the hip that was not associated with a diagnosis of gout, rheumatoid arthritis or fracture, among people aged 45 years and older during 2004-10. Rates of 4% and 7% were determined for men and women aged 45-64 years. While the diagnostic criteria may have lacked specificity (not all unexplained hip pain will have been attributable to osteoarthritis), it is unlikely that all cases in the population covered by the database will have presented to their general practitioner, and comparison of the prevalence at age 75 years and older (11% in men and 16% in women) with findings from the Global Burden of Disease study suggests that estimates were reasonably accurate.

Severe hip osteoarthritis is often treated by, and is the main indication for total hip arthroplasty. During 2012-13, some 20,000 such procedures were performed in England over a 12-month period in patients aged 45-64 years, indicating a substantial burden in people of working age [8].

Non-occupational risk factors

Apart from demographic variables such as sex and age, a number of other non-occupational risk factors for hip osteoarthritis are well-established (Table 1). As well as contributing to disease that may then impact on capacity to work, these risk factors have potential to confound or modify the effects of occupation on development of the disorder.

Genetic predisposition

Twin and family studies point to an important role of genetic predisposition [9], especially in generalised osteoarthritis that affects multiple joints [10], and several molecular mechanisms have been identified that might be involved [10,11]. Genetic factors may contribute to the variation in prevalence of hip osteoarthritis that has been observed between different parts of the world [6].

Developmental abnormalities

Developmental abnormalities of the hip joint such as congenital dislocation, Perthes' disease and slipped capital femoral epiphysis are associated with a clearly elevated risk of hip osteoarthritis [9]. This is thought to occur because structural deformities alter the distribution of mechanical stresses in the joint. There is some evidence that more minor, sub-clinical acetabular dysplasia may also be a risk factor, although this is less certain [9].

Hip injury

Structural deformity may also occur as a consequence of traumatic injury to the hip, and there is some evidence that such injury increases the risk of later osteoarthritis [12]. However, the link to injury is not as well established as for osteoarthritis of the knee.

Body mass index

Like other joints, the hip is more likely to be affected by osteoarthritis in people with higher body mass index (BMI). However, the relationship is weaker than for knee osteoarthritis [9]. A systematic review and meta-analysis that included 14 epidemiological studies indicated a relative risk of 1.11 (95%CI 1.07-1.16) for an increase in BMI of 5 kg/m^2 [13]. The underlying mechanism is likely to be partly mechanical, with greater stresses on the joint in people who are heavier. However, obesity may also lead to systemic changes in metabolism that predispose to osteoarthritis.

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Importance as confounders

Apart from sex and age, the most important potential confounder of associations between hip osteoarthritis and occupation is BMI. Major developmental abnormalities of the hip are relatively rare and account for only a small proportion of cases, while genetic predisposition would not be expected to associate strongly with occupational exposures except insofar as people may give up physically demanding work if they have developed osteoarthritis. Nevertheless, some studies of occupational risk factors have adjusted for the presence of Heberden's nodes as a marker for systemic tendency to osteoarthritis, including from genetic predisposition.

Work as a cause of hip osteoarthritis

Given the assumed role of mechanical loading in the development of osteoarthritis, it is plausible that risk would be increased by occupational activities which place unusual physical stresses on the hip.

Evidence for a role of occupation

Epidemiological studies have explored the association of hip osteoarthritis with various types of work and occupational activities. A systematic review published in 2012 identified 30 such investigations [14], 28 of which are summarised in Table 2 (the other two did not give results for osteoarthritis of the hip specifically) along with six further studies that are relevant. The total body of evidence comprises 9 cohort studies, 14 case-control investigations and 11 cross-sectional surveys.

Assessing the role of occupation in hip osteoarthritis poses methodological challenges. Ideally, research would be carried out in large samples of people representative of the target populations about which conclusions are to be drawn; relevant exposures would be ascertained with complete accuracy, as would all potential confounding variables; and the occurrence of disease would be fully determined according to uniform and reliable criteria. In practice, however, these objectives cannot all be achieved, and compromises are necessary. What matters then is not simply the likelihood of bias, confounding and chance error (as might be characterised by a summary score for quality), but the potential direction and magnitude of their impact on risk estimates, and the conclusions that can be drawn when these are taken into account.

Overall, there is a remarkable consistency of findings, almost all studies showing elevated risks in association with heavy manual work and/or employment in farming or the construction industry, especially in men. The only exceptions are three cross-sectional studies – one that used a rather non-specific case definition [15], one with very low statistical power [27], and a third that specifically excluded people with hip pain and those with more severe radiographic changes of osteoarthritis [38]. Some studies may have been liable to inflationary biases. For example, it is possible that patients with physically demanding jobs are more disabled by hip osteoarthritis and seek medical care for it earlier, which could lead to overestimation of risks in studies that ascertain cases according to surgical treatment. However, it seems implausible that such biases could account for risk

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estimates of the magnitude observed, and studies using other case definitions and methods of ascertainment have also been consistently positive.

While all of the research is observational in nature, the consistency of associations and magnitude of relative risks point strongly to a causal effect of mechanical loading. This accords with current understanding of the pathogenesis of osteoarthritis, which is thought to result from the interplay of systemic predisposition and abnormal physical stresses, either because of heavy loading or deformity of the joint [49].

Particularly high relative risks (generally greater than three) have been reported in men who have farmed for >10 years [18,22,23,29,47]. Attempts to identify aspects of farming that account for this hazard have not convincingly implicated any specific activity, but from the pattern of risk in other occupations, tasks such as heavy lifting seem the most likely candidate. If so, the risk may decline in the future, as a consequence of the increased mechanisation of agriculture over recent decades. The tendency to higher relative risks in men than women, may reflect men's greater exposures to physical loading within specified categories of work, and does not necessarily indicate increased vulnerability to a given level of exposure.

Interaction with other risk factors

Interactions between occupational and other risk factors could be relevant to the targeting of prevention (are there some subgroups of workers who are at particularly high risk?), and might even offer alternative approaches to prevention where harmful occupational activities are unavoidable. For example, reducing obesity might help to protect workers whose need to perform heavy lifting cannot be eliminated.

The nature of such interactions has been studied less for hip than for knee osteoarthritis (see chapter XXX). When assessing risks associated with occupational activities, most studies have adjusted for possible non-occupational confounders, by making a default assumption that their odds ratios will multiply those associated with the occupational exposure of interest. However, Flugsrud and colleagues explored the interaction of physical activity at work with body mass index in a large cohort study [35]. In both men and women, absolute risks tended to be highest with exposure to the combination of both risk factors.

Prevention in the workplace

The balance of evidence indicates that work for prolonged periods in jobs that entail frequent heavy lifting is associated with substantially increased risk of hip osteoarthritis. Given the biological plausibility of an adverse effect from high mechanical loading, it is reasonable to expect that controls on lifting in the workplace would reduce risk. This has not been tested in intervention studies, in part because of the long follow-up that would be needed before any benefit was likely to be detectable. Nor have limits been placed on lifting at work, expressly to prevent hip osteoarthritis. However, in the UK, the Manual Handling Regulations [50], which implemented a wider EU directive [51], require employers to identify lifting and other manual handling tasks that their employees undertake, assess the associated risks to health, and take steps to reduce those risks if they are judged unacceptably high. Actions that might reduce exposures to heavy lifting include the elimination of unnecessary activities, redesign of processes (e.g. packaging in smaller containers) and use of mechanical aids (e.g. powered lifting devices).

The impetus for the legislation on manual handling was primarily the prevention of more acute musculoskeletal illness such as low back disorders, but its benefits may extend to longer term hazards such as osteoarthritis.

Occupational activities might also impact on long-term outcomes following surgical treatment for osteoarthritis, in particular by total hip arthroplasty, as is discussed later in this chapter.

Compensation for hip osteoarthritis caused by work

Depending on national arrangements, patients who have developed hip osteoarthritis as a consequence of their employment may be eligible for compensation, either through social security/insurance provisions or through litigation.

In the UK, following advice from the Industrial Injuries Advisory Council, hip osteoarthritis has been classed as a prescribed occupational disease, eligible for industrial injuries benefit, in employed earners who have worked in agriculture as a farmer or farm worker for an aggregate period of 10 years or longer. It should be noted that this applies only to work as an employee, and not to self-employed work, which is not covered by the industrial injuries scheme. Patients who might be eligible for such compensation can obtain further information from the GOV.UK website [52], and may also be assisted by their trade union if they belong to one.

Obtaining compensation for occupational diseases through the courts is more complex and takes longer than claiming social security benefits, although awards in successful cases are often larger. In the UK, it is necessary to prove, on the balance of probabilities, that the employer’s negligence or breach of a statutory duty contributed materially to the claimant’s symptoms, disability or financial loss. Patients who are considering litigation may be able to access advice through their trade union or through the websites of legal firms who specialise in industrial injuries claims.

Impact of hip osteoarthritis on capacity to work

Although only a minority of hip osteoarthritis is attributable to employment, the disease impacts on capacity to work in many more patients. Symptoms such as pain and stiffness can compromise mobility, and are a particular problem in people who undertake heavy manual tasks or have jobs that entail extensive walking or climbing of stairs or ladders. And even in non-manual office workers, pain and disturbance of sleep may impair occupational performance.

Impacts on employment thus include sickness absence, health-related job-loss, and “presenteeism”. The latter, which is defined as impaired performance while at work owing to a health problem, may lead to reduced productivity or poorer quality of work, and in certain circumstances could even threaten the safety of the affected worker or of others.

However, it is much harder to assess and quantify than sickness absence and job loss, and has therefore been studied less.

Sickness absence and job loss

A number of studies provide information about the impacts of hip osteoarthritis on attendance at work and job retention.

An early investigation in California collected information by questionnaire from 178 (85.2%) of a retrospective series of patients aged 60 years or less, who had undergone total hip arthroplasty during 1969-77 at a university hospital in California for a primary diagnosis of degenerative, congenital or post-traumatic disease, and who did not have serious co-morbidity (including disabling problems of other joints) before surgery [53]. At one month before surgery, 45 participants had stopped working and were unemployed because of the problem with their hips, and a further 13, although in employment, had been absent from work because of hip disease. Also, among the 81 who were employed, 21 (25.9%) had changed their job because of their hip disorder.

In another follow-up study, Jensen and colleagues [54] collected data by questionnaire after an interval of 2-11 years from patients who had been admitted for treatment of hip disease at an orthopaedic department in Copenhagen during 1971-79. Among 99 responders who had undergone hip arthroplasty before age 60 years, 53 had been working pre-operatively, 19 were on sick leave, 22 were in receipt of an invalidity pension, and nine had an age-related pension.

In Sweden, among a series of 118 patients who underwent total hip replacement for primary osteoarthritis before age 60 years during 1970-82, 14 had retired before the time of surgery, including nine who had done so mainly because of their hip problem [55].

Fautrel and colleagues collected information on a nationally representative sample of patients in France, who consulted general practitioners or rheumatologists because of osteoarthritis during 2000 [56]. They included 1,411 people with hip osteoarthritis with a mean age of 65.5 years and mean disease duration of 6.9 years. Of these, 19.3% were employed as compared with 17.5% of a control group with similar distribution by sex and age; and among those in work, 60.5% experienced occupational limitations and 18.6% had missed work because of their osteoarthritis.

In the UK, Mobasheri and colleagues reported a consecutive series of 86 patients below age 60 years, who underwent total hip arthroplasty under a single orthopaedic team at a district general hospital during 1993-2003 [57]. Among 30 who were not working pre-operatively, 12 indicated that this was because of hip pain.

Bohm surveyed 118 patients aged less than 65 years who were on a waiting list for primary hip replacement at a hospital in Winnipeg, Canada [58]. Among 84 responders, 60 were employed, including 12 who were currently off work because of their hip problem. In comparison with patients who were still working, those off work were older, and had fewer dependants, lower household income, poorer physical function and hip-specific scores, more limitation from co-morbidities, and lower job motivation.

Also in Canada, Sayre et al sought information from a random sample of 6000 patients with osteoarthritis, who were selected from the database of the Medical Service Plan in British Columbia [59]. A total of 688 responders (mean age 62.1 years) provided data about employment and other relevant variables, including 259 with hip osteoarthritis. Of these, 110 had stopped work because of osteoarthritis, and a further 28 were working reduced hours.

In the USA, a telephone survey (response rate 68.3%) was used to collect information after a follow-up interval of at least one year, from patients aged less than 60 years, who had undergone hip arthroplasty during 2005-2007, and who had been at least moderately active before the onset of their symptoms [60]. Among 806 who were eligible for analysis (mean age at surgery 49.5 years), 705 (87.5%) were in paid employment during the three months before surgery, and of the 101 who were not working, 30 were unable to do so.

Most recently, Kleim et al reported vocational outcomes in 52 patients (response rate 36%) with osteoarthritis, who had undergone total hip arthroplasty before age 60 years at a hospital in Newcastle upon Tyne, UK [61]. Of these, 23 (44%) had required periods of sick leave because of their hip disease, and three (6%) had suffered unemployment as a direct result of the hip problem.

Conclusions

Interpretation of these findings requires some care. Some of the data relate to patients undergoing hip arthroplasty, and not specifically to osteoarthritis. However, osteoarthritis is by far the main indication for hip arthroplasty, and this is therefore unlikely to have biased results substantially. More important is the potential for variation according to case-mix. Severity of disease will be a major determinant of ability to work, and employment outcomes can also differ importantly by age [58]. Other factors that may influence work participation in people with large joint disease include the physical demands of a person's job, and the size of the employer [62].

Nevertheless, it seems clear that a substantial proportion of people with hip osteoarthritis manage to remain in employment even when their disease is quite advanced. At the same time, sickness absence is quite frequent among those awaiting joint surgery.

Presenteeism

Fewer empirical data are available regarding the effects of hip osteoarthritis on performance among patients who manage to remain at work. However, in the early case series of hip arthroplasty from California, among 81 patients who were still working one month before surgery, six (7.4%) had reduced working hours, 55 (67.9%) were limited in physical activities of work, and 36 (44.4%) were restricted in the kind or amount of work that they did [53]. In a Canadian case series, patients who returned to work after total hip replacement reported improved ability to meet workplace demands and improved productivity [63], implying that their productivity had been impaired before surgery. Similarly, in a more recent study from Newcastle upon Tyne, 63% of patients felt that their performance at work had been improved following hip arthroplasty, although the nature of pre-operative limitations was not specified [61].

These findings suggest that adverse impacts of hip osteoarthritis on performance while at work are common, and further research is needed to define the nature, severity and drivers of the problems that occur. From the perspective of the employer, underperformance while at work may be even more troublesome than non-attendance and ill-health retirement.

Management of hip osteoarthritis in the workplace

In the UK, the Equality Act [64] now places an onus on employers to make reasonable adjustments to accommodate employees with long-term disabilities. Such adjustments might entail a change of role (e.g. redeployment of a postman to the sorting office), elimination of specific parts of a job that are made difficult by the disability (e.g. tasks that require a gas fitter to work in awkward, confined spaces such as low cupboards), or reduced working hours. Modifications of this type are not always feasible, especially in small organisations that have less scope for transfer to alternative duties, but they are well worth exploring, including in countries that do not have equivalent legislation.

When considering the need and scope for accommodations at work, clinicians caring for patients with hip osteoarthritis should start by asking them the nature of their job, the tasks that it entails, which tasks are difficult or impossible because of the hip problem, and whether they are aware of opportunities for modified work that could be done more easily. If the patient wishes, it may then be possible to give advice to their employer concerning the health problem and changes to work that might be helpful. In general, this should focus on what the patient can and cannot do, and it is not essential to give detailed medical information. If the employer has an occupational health service, that may be the most useful point of contact.

Employment following surgery for hip osteoarthritis

Surgical treatment for hip osteoarthritis, in particular by total hip arthroplasty, is becoming increasingly common, including among people of working age. This raises questions about the impacts of such treatment on employment, and the advice which should be given to patients regarding occupational activities following surgery, including both the timing of return to work (how soon after operation is it reasonable to return to different forms of employment?) and also the nature of the work that is undertaken.

Impacts of surgery on employment

Although no randomised controlled trials have assessed the impact of hip replacement surgery on employment, a number of descriptive studies have documented vocational outcomes after hip arthroplasty.

In the case series from California reported by Nevitt et al (see above), among 81 patients who were working up to the time of operation, 75 successfully returned to work by one year, and 65 were still in employment after four years [53]. In addition, of 58 patients who had been unable to work a month before surgery, 20 attempted to return to a job within a year, and 22 were working after four years. The net increase in employment following operation was greatest in patients with no previous hip surgery and no other joint pain.

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High employment after surgery was also reported by Jensen and colleagues in Denmark. Among patients working pre-operatively, 92% remained at work, and 70% of those on sick leave went back to work [54]. Only 9% of those who were at work or off sick before operation had become invalidity pensioners when followed up after 2-11 years.

In a Swedish study of total hip arthroplasty for osteoarthritis, 69 of 104 patients aged less than 60 years returned to work within two years [55]. Risk of retirement was higher in those with longer pre-operative sick leave and heavier work; and among those who remained in employment, there was a tendency to shift to jobs that were less demanding physically.

In a series of patients from Guildford, UK, continuing employment after surgery was reported by 49 of 51 patients who had previously been in work, while 13 out of 30 who had not been employed obtained some form of work after their operation, including 11 of the 12 who attributed their earlier unemployment to hip pain [57]. Among the total of 62 patients who went back to work, six moved to jobs that entailed fewer physical demands.

In Winnipeg, Canada, Bohm questioned 54 patients who had been in the workforce before total hip arthroplasty [63]. Thirty eight (86%) of the 44 who were in work pre-operatively were still working one year after surgery, 34 having returned to the same job. However, only two of the ten who were not working pre-operatively had resumed employment. Factors significantly associated with return to work included younger age, better physical function, fewer limitations from co-morbidities, not being in receipt of disability insurance, and perhaps surprisingly, lower job satisfaction pre-operatively.

In the study by Nunley and colleagues in California that has already been described, 714 (90.4%) of patients returned to work after hip arthroplasty, most (94.1%) to their pre-operative occupation [60]. At follow-up, only 12 had changed job because of their hip problem, while 20 had been permanently restricted in their jobs. In addition, 185 had required some form of temporary work restriction. It should be noted, however, that the study group was relatively young (mean age 49.5 years) and active.

All of these investigations were included in a systematic review by Tilbury et al, which evaluated 14 studies during 1986-2013 that provided quantitative information on work status before and after surgery for 3,872 patients undergoing total hip arthroplasty [65]. The authors concluded that most patients who were employed before surgery, returned to work post-operatively. Risk factors for worse employment outcomes included female sex, older age, pain in other joints, failure of the surgical procedure, physical work, unskilled work, work as a farmer, lower education, and not working one month before operation. However, there was no association with the type of prosthesis or surgical procedure.

A prospective cohort study in Toronto, Canada, included 190 patients undergoing total hip replacement, who were working or on short-term disability before surgery, and who were questioned before, and then 1, 3, 6 and 12 months after their operation [66]. By 12 months, 166 (87%) had returned to work.

Trusczczynska and colleagues reported that in a series of 54 patients who underwent hip arthroplasty for degenerative hip disease at an orthopaedic department in Poland while aged

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<65 years and still in employment, 32 (59.3%) returned to work [67]. And in a similar study in the UK, the rate of return to work by 6 months to 3 years after surgery among 46 patients who were employed pre-operatively, was 75% [61].

Timing of return to work

Several reports also provide information about timing of return to work. In a series of patients undergoing minimally invasive total hip arthroplasty followed by accelerated rehabilitation, the mean interval before return to work was only 8 days [68]. However, in most studies, it has taken longer. with mean intervals of 6.5 weeks and 9.5 weeks [69], 10.5 weeks [57], 6.9 weeks [60] and 12 weeks [61]. In their systematic review, Tilbury et al reported that average time to return to work ranged from 1.1 to 13.9 weeks [65]. Sankar et al noted that earlier return to work (i.e. by one month) was associated with male sex, university education, working in business, finance or administration, and low physical demands at work [66].

While it is clear that some patients can successfully recommence work soon after hip replacement for osteoarthritis, and especially those with jobs that are less demanding physically, published data do not provide a strong evidential basis for guidance on the timing of return to employment following such surgery. Advice to patients should take into account their clinical condition (e.g. satisfactory wound healing), level of function (including any impacts from co-morbidity), and the demands of their job (including travel to and from work, and any adjustments that might be made to their duties).

Types of occupational activity

As well as guidance on the timing of return to work, patients undergoing total hip arthroplasty for osteoarthritis may also need advice on the types of work to which they should return, both in the short- and the longer term. Currently it is unclear whether they should avoid heavy manual work, and in particular heavy lifting, in their future employment. Such a restriction could lead to unemployment, with a reduction in income and loss of the psychological benefits that are associated with rewarding employment [70]. On the other hand, heavy lifting is known to carry an importantly increased risk of hip osteoarthritis, and there are theoretical reasons to expect that it might increase the incidence of joint failure, necessitating surgical revision. Currently there is no direct evidence regarding the risk of long-term symptoms, disability or joint failure, according to types of occupational activity that are undertaken following hip arthroplasty, and this is a priority for future research. Meanwhile, decisions should take into account the patient’s concerns in the face of the uncertainty, and how they weigh them against the inconvenience, and possibly financial losses, that would follow from restrictions on the types of work that they undertake. Some will adopt a more precautionary approach than others.

Summary

Although it is most frequent at older ages, many cases of hip osteoarthritis occur before retirement. There is now a substantial body of evidence that risk of the disease is importantly elevated in people who carry out heavy manual work. While all of the research has been observational, the consistency of findings and magnitude of relative risks point strongly to a hazard from mechanical loading, which accords with current understanding of the pathogenesis of osteoarthritis. Actions that may reduce harmful exposures include the elimination of unnecessary harmful activities, redesign of processes (e.g. packaging in smaller containers) and use of mechanical aids (e.g. powered lifting devices). Reducing obesity might help to protect workers whose need to perform heavy lifting cannot be eliminated.

Particularly high relative risks have been reported in men who have farmed for >10 years, and in the UK, hip osteoarthritis is a prescribed occupational disease, eligible for industrial injuries benefit, in workers who have been employees in agriculture for 10 years or longer.

Whether or not it is attributable to employment, hip osteoarthritis impacts importantly on capacity to work, causing sickness absence, health-related job-loss, and presenteeism. Factors that may influence work participation include the severity of disease, the physical demands of the job, age, and the size of the employer.

Published research does not provide a strong evidential basis for guidance on the timing of return to employment following hip arthroplasty for osteoarthritis. Moreover, it is unclear whether patients should avoid heavy manual work in their future employment.

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Practice points

- In the UK, hip osteoarthritis is a prescribed occupational disease, eligible for industrial injuries benefit, in employed earners who have worked in agriculture as a farmer or farm worker for an aggregate period of 10 years or longer. Patients who might be eligible for such compensation can obtain further information from the GOV.UK website, and may also be assisted by their trade union if they belong to one.
- When considering the need and scope for accommodations at work, clinicians caring for patients with hip osteoarthritis should start by asking them the nature of their job, the tasks that it entails, which tasks are difficult or impossible because of the hip problem, and whether they are aware of opportunities for modified work that could be done more easily. If the patient wishes, it may then be possible to give advice to their employer concerning the health problem and changes to work that might be helpful. If the employer has an occupational health service, that may be the most useful point of contact.
- Published data do not provide a strong evidential basis for guidance on the timing of return to employment following hip arthroplasty. Advice to patients should take into account their clinical condition (e.g. satisfactory wound healing), level of function (including any impacts from co-morbidity), and the demands of their job (including travel to and from work, and any adjustments that might be made to their duties).
- Currently it is unclear whether patients should avoid heavy manual work, and in particular heavy lifting, in their employment after total hip arthroplasty. Decisions on this should take into account the patient’s concerns in the face of the uncertainty, and how they weigh them against the inconvenience, and possibly financial losses, that would follow from restrictions on the types of work that they undertake.

Research agenda

- Further research is needed to determine the impacts of hip osteoarthritis on performance while at work (presenteeism), including the nature, severity and drivers of the problems that occur.
- More research is required to establish how rapidly patients can safely return to different types of work following total hip arthroplasty.
- There is an urgent need for research to assess the risk of long-term symptoms, disability and joint failure, according to types of occupational activity that are undertaken following hip arthroplasty.

Table 1
Established non-occupational risk factors for hip osteoarthritis

- Genetic predisposition
- Developmental abnormalities of hip joint
    - ♦ Congenital dislocation of hip
    - ♦ Perthes' disease
    - ♦ Slipped capital femoral epiphysis
- Hip injury
- Higher body mass index

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Table 2

Epidemiological studies investigating possible occupational causes of hip osteoarthritis

Reference	Country	Study design	Study sample	Case definition and ascertainment	Exposures and methods of assessment	Confounders considered	Risk estimates (95% CIs)
Lindberg and Danielsson 1984 [15]	Sweden	Cross-sectional	332 male shipyard workers (heavy labour), 352 male white-collar workers and 438 men from general population	Previous radiograph of hip showing joint space <4mm at <70 years, <3mm at >70 years or ≥1 mm difference between hips	Occupational group or general population	Sex, age	No significant differences between the three groups in prevalence of hip osteoarthritis
Typpö 1985 [16]	Finland	Case-control	Cases with hip osteoarthritis and controls without, who had attended medical or surgical out-patient clinics	Based on measurements of osteophyte size, minimal joint space and size of subchondral cysts in radiographs taken for various reasons	Classes of work and occupation determined by questionnaire. Unclear how changes of job were handled.	None	131/251 cases were heavy manual workers vs. 110/254 controls 90/224 cases were farmers vs. 70/255 controls 22/224 cases were construction workers vs. 14/255 controls
Jacobsson et al 1987 [17]	Sweden	Cross-sectional	85 men listed for total hip arthroplasty, 21 men with urography films showing joint space <3 mm, and 190 controls with normal joint space on urography	Group a) Listed for hip arthroplasty; or Group b) joint space<3 mm, identified form hospital records	Occupational history, including physical activities, by questionnaire	None	Heavy labour in 84% of Group a) and 90% of Group b) vs. 72% of controls Farm work in 55% of Group a) and 67% of Group b) vs. 40% of controls Heavy lifting in 85% of Group a) and 86% of Group b) vs. 73% of controls
Thelin 1990 [18]	Sweden	Case-control	98 men aged 55-70 years with hip osteoarthritis and 201 controls from general population	Surgery for hip osteoarthritis	Years in farming from lifetime occupational history by postal questionnaire	Sex	>10 vs. <1 year in farming RR: 3.2 (1.8-5.5)
Vingård, Alfredsson et al 1991 [19]	Sweden	Cohort	207,638 men and 42,579 women from general population with same occupation in each of 1960 and 1970 censuses, followed during 1981-83	Hospital admission for hip osteoarthritis from national discharge register	Occupation at censuses and inferred exposures to dynamic and static forces on lower extremity	Age, sex, county and degree of urbanisation	High vs. low exposure to forces on lower extremity RR: 2.2 (1.6-2.8) in men born 1905-1924 RR: 2.0 (1.6-2.3) in men born 1925-45 RR: 1.6 (0.9-3.1) in women born 1905-1924 RR: 1.1 (0.9-1.5) in women born 1925-1945 Farmers vs. low exposure to forces on lower extremity RR: 3.78 (2.91-3.88) in men RR: 1.47 (0.86-2.85) in women Construction workers vs. low exposure to forces on lower extremity RR: 1.66 (1.32-1.87) in men

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Reference	**Country**	**Study design**	**Study sample**	**Case definition and ascertainment**	**Exposures and methods of assessment**	**Confounders considered**	**Risk estimates (95% CIs)**
Vingård, Hogstedt et al 1991 [20]	Sweden	Case-control	239 men aged 50-70 years with hip osteoarthritis and 302 controls randomly selected from general population	First-time hip arthroplasty for idiopathic osteoarthritis from hospital clinics	Occupational histories to age 49 years by interview, and inferred exposures to static and dynamic forces on hip	Age, body mass index, smoking, sports activities up to age 29 years	High vs. low exposure to static and dynamic forces on hip RR: 2.42 (1.45-4.04)
Vingård et al 1992 [21]	Sweden	Case-control	140 men with hip osteoarthritis and 298 controls form general population	Receipt of disability pension with physician diagnosis of hip osteoarthritis	Occupational history by interview, and inferred exposures to physical loading	Age, sex	High vs. low exposure to forces on hip RR: 12.4 (6.7-23.0) Farmers or forest workers for ≥10 years vs. never in exposed occupationRR: 13.8 (4.0-48.1) Construction worker for ≥10 years vs. never in exposed occupation RR: 5.3 (2.6-10.6)
Croft, Coggon et al 1992 [22]	UK	Cross-sectional	167 men aged 60-76 years who had farmed for ≥1 year and 83 controls from mainly sedentary jobs	Joint space ≤1.5mm or previous total hip arthroplasty	Lifetime history of work in specified jobs by questionnaire	Age, height, weight and Heberden's nodes	1-9 years in farming OR: 4.5 (0.8-26.3) ≥10 years in farming OR: 9.3 (1.9-44.5)
Croft, Cooper et al 1992 [23]	UK	Case-control	53 men with hip osteoarthritis on intravenous urogram and 294 controls with minimum joint space ≥3.5 mm on intravenous urogram	Previous total hip arthroplasty for osteoarthritis or minimum joint space ≤1.5 mm in at least one hip	Lifetime occupational history including detail of specified activities, by interview	Age and hospital where intravenous urogram was performed	Work for ≥10 vs. <1 year in farmingOR: 2.0 (0.9-4.4)Work for ≥10 vs. <1 year in constructionOR: 0.5 (0.1-2.3)Work involving lifting/moving weights >56 lb by hand for ≥ 20 vs. <1 year OR: 2.5 (1.1-5.7)
Axmacher and Lindberg 1993 [24]	Sweden	Cross-sectional	716 farmers from across Sweden and 2,500 controls from general population of Malmö, all of whom had undergone radiographic examination of bowel or urinary tract	Joint space <4 mm and/or osteosclerosis, cyst formation or other structural changes	Work in farming vs. control	Age and sex	Hip osteoarthritis in 45/565 male farmers vs. 10/1250 controls, and in 2/151 female farmers vs. 10/1250 controls
Heliövaara et al 1993 [25]	Finland	Cross-sectional	3,322 men and 3,895 women aged ≥30 years from general population,	Cases defined by standardised clinical assessment in subset with questionnaire responses suggestive of musculoskeletal diseases	Exposure to each of five physically stressful activities in either current/most recent or longest duration job	Age, sex, body mass index, injury to lower limb	4-5 vs. 0 physically stressful activities at work OR: 2.7 (1.7-4.4)
Roach 1994 [26]	USA	Case-control	99 men >40yrs with hip osteoarthritis and 233 controls with no osteoarthritis on intra-venous pyelogram	Hip pain and Kellgren and Lawrence grade 3 or 4 from hospital records	Years in different occupational categories from postal questionnaire	Age, sex, race, previous cancer diagnosis, obesity aged 40 years, running for exercise.	Heavy vs. light work OR: 2.5 (1.5-5.0)

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Reference	Country	Study design	Study sample	Case definition and ascertainment	Exposures and methods of assessment	Confounders considered	Risk estimates (95% CIs)
Van Dijk 1995 [27]	Netherlands	Cross-sectional	19 female former ballet dancers aged 50-70 years and 19 pair-matched controls from surgical outpatient department with no long-term sports participation or physically demanding work	Measurement of joint space and grading to Hermodsson scale, using standardised radiographs	Work as ballet dancer vs. control	Sex, age (but did not perform appropriate analysis for matched data)	No significant difference in hip osteoarthritis between dancers and controls
Vingård et al 1997 [28]	Sweden	Case-control	230 women aged 50-70 years with hip osteoarthritis and 273 controls from general population without hip problems	Total hip arthroplasty for primary osteoarthritis ascertained from national register	Occupational history to age 50 years and associated physical activities by interview	Age, body mass index, smoking, sports activities, number of children and hormone therapy	High vs. low exposure to heavy lifting RR: 1.5 (0.9-2.5).
Thelin et al 1997 [29]	Sweden	Case-control	216 men with hip osteoarthritis who had undergone radiological examination of hip and 479 controls from general population	Joint space <3mm	Lifetime occupational history, including specified tasks, by postal questionnaire	None	Worked on farm for >30 vs. 0 years OR: 4.45 (2.90-6.83) Heavy physical work before age 16 years OR: 2.06 (1.48-2.86)
Coggon et al 1998 [30]	UK	Case-control	210 men and 401 women aged 45-91 years with osteoarthritis and 611 controls from general population matched for sex, age and general practice,	Listed for total hip arthroplasty because of primary osteoarthritis	Lifetime occupational history and associated physical activities up to 10 years before entry to study by interview	Age, sex, body mass index, history of hip injury, Heberden's nodes	Lifting >25 kg for ≥20 v 0 years OR: 2.3 (1.3-4.4) in men OR: 0.8 (0.4-1.5) in women Maximum lifted for ≥10 years ≥50 kg v <10 kg OR: 3.2 (1.6-6.5) in men OR: 1.1 (0.5-2.5) in women
Cvijetic et al 1999 [31]	Croatia	Cross-sectional	298 men and 292 women aged ≥45 years, randomly sampled from general population	Kellgren and Lawrence grade 2-4 on radiograph of right hip	Categories of activity in current or most recent job determined by interview	Age, sex and body mass index	Jobs with high physical strain vs. mostly sedentary jobs OR: 1.15 (0.52-2.52) in men OR: 1.34 (0.52-3.04) in women
Yoshimura et al 2000 [32]	Japan	Case-control	114 men and women aged ≥45 years with osteoarthritis, and 114 individually matched controls from general population	Listed for total hip arthroplasty for primary osteoarthritis	Lifting in main lifetime job by interview	Age, sex, district of residence, history of knee pain and age left school	Heavy lifting (weights of ≥50 kg) vs. no lifting OR: 4.1 (1.1-15.2)
Chitnavis et al 2000 [33]	UK	Cross-sectional	107 male patients with hip osteoarthritis and 52 undergoing total knee arthroplasty	Total hip arthroplasty for osteoarthritis with no identifiable cause in joint replaced	Work as a farmer by interview	Sex	16% of men with hip osteoarthritis had worked as farmers vs. 7% of men with total knee arthroplasty
Lau et al 2000 [34]	Hong Kong	Case-control	138 patients with hip osteoarthritis and 414 controls, individually matched for age and sex,	Attended orthopaedic clinic with primary hip osteoarthritis of Kellgren and Lawrence grade 3 or 4	Lifting in main lifetime job by interview	Age, sex, height, weight, history of joint injury, regular sports activities	Lifting ≥10 kg >10 times per week in main job vs. no lifting ≥10 kg OR: 3.1 (0.7-14.3) in men OR: 2.4 (1.1-5.3) in women

Reference	Country	Study design	Study sample	Case definition and ascertainment	Exposures and methods of assessment	Confounders considered	Risk estimates (95% CIs)
			from general practice clinics from general practice clinics				
Flugsrud et al 2002 [35]	Norway	Cohort	50,034 participants in cardiovascular screening programme followed for 9 years	First total hip arthroplasty for primary hip osteoarthritis	Physical activity in current job at time of screening by postal questionnaire	Age at screening, sex, height, body mass index, marital status, leisure time physical activity, smoking habits	Intensive vs. sedentary physical activity at work RR: 2.1 (1.5-3.0) in men RR: 2.1 (1.3-3.3) in women
Tüchsen 2003 [36]	Denmark	Cohort	All employed Danish men aged 20-59 in Jan 1981, 1986, 1991 and 1994 followed during 1981-85, 1986-90, 1991-93 and 1994-99 respectively	First admission to hospital for hip osteoarthritis, ascertained from national patient register	Main occupation at beginning of each follow-up period from national register	Age and sex	Self-employed farmers 1981-1985 SHR: 281 (259-304) 1986-1990 SHR: 283 (269-298) 1991-1993 SHR: 285 (268-302) 1994-1999 SHR: 286 (262-313) Self-employed in agricultural tractor pools 1981-1985 SHR: 210 (97-455) 1986-1990 SHR: 200 (122-327) 1991-1993 SHR: 192 (116-315) 1994-1999 SHR: 183 (86-387) Employees in farming and horticulture 1981-1985 SHR: 114 (89-147) 1986-1990 SHR: 138 (118-161) 1991-1993 SHR: 160 (140-183) 1994-1999 SHR: 189 (158-227)
Thelin et al 2004 [37]	Sweden	Case-control	369 farmers with hip osteoarthritis and 369 control farmers individually matched for sex, age and residential area	Surgery for hip osteoarthritis or hip symptoms and joint space <3 mm, ascertained from medical files	Lifetime history of farming activities by interview	Handling straw, sacks, fodder and/or manure and tractor driving	Work >5 hours/day in animal barns since age 30 vs. no work in animal barns OR 13.3 (1.22-144.98) No associations with daily working time, working time per year or hours of tractor driving per year
Jacobsen et al 2004 [38]	Denmark	Cross-sectional	2,572 participants in Copenhagen City Heart study with no hip pain and at most only one of joint space narrowing or osteophytosis on hip radiograph	Minimal joint space determined from pelvic radiographs	Lifetime occupational history including levels of lifting, ascertained by questionnaire	None	No significant differences in mean minimal joint space by measures of occupational lifting

Reference	Country	Study design	Study sample	Case definition and ascertainment	Exposures and methods of assessment	Confounders considered	Risk estimates (95% CIs)
Thelin and Holmberg 2007 [39]	Sweden	Cohort	1,220 male farmers,1,130 non-farming rural residents and 1,087 urban controls matched for sex and age, followed for 14 years	First hospital care for hip osteoarthritis,, ascertained from national register	Owned or rented a farm and farmed for >25hrs/week	Age	Farmers vs. urban controls HR: 3.0 (1.7-5.3) Non-farming rural men vs. urban controls HR: 1.2 (0.8-1.6)
Riyazi et al 2008 [40]	Netherlands	Case-control	93 patients with familial osteoarthritis involving hip and at least one other joint site, and 345 controls from general population	Pain or stiffness in groin or hip on most days plus osteophytes or joint space narrowing on radiograph, or previous arthroplasty	Lifetime occupational activities inferred from job title ascertained by questionnaire.	Age, sex and body mass index	Ever vs. never physically demanding work OR: 3.3 (1.3-8.2)
Järvholm et al 2008 [41]	Sweden	Cohort	204,741 men aged 15-67 years employed in construction industry, followed for up to 12 years	Hospital admission for hip replacement with a diagnosis of osteoarthritis, ascertained from national register	Job title reported at entry to a health control programme	Age and body mass index	RRs > 1 for 13/14 manual occupations vs. white-collar workers. Highest RR 1.58 (0.93-2.68) for floor layers.
Juhakoski et al 2009 [42]	Finland	Cohort	371 men and 469 women from general population, free from hip osteoarthritis at baseline, followed up after 22 years	Clinical diagnosis of hip osteoarthritis by physicians based on disease history, symptoms and clinical findings according to standardised criteria	Physical workload at baseline based on responses to a questionnaire	Sex, age, education, body mass index, smoking, alcohol, leisure time physical activity, injury	Heavy manual vs. light sedentary work OR: 6.7 (2.3-19.5)
Allen et al 2010 [43]	USA	Cross-sectional	2,506 men and women (mean age 63.6 years) from general population	Symptomatic hip osteoarthritis defined as pain, aching or stiffness in hip on most days and Kellgren and Lawrence grade 2+ radiographic changes in same joint	Lifetime exposure to specified occupational activities elicited at interview	Age, race, gender, body mass index, prior hip injury, smoking and household tasks	Heavy work, standing vs. none in longest held job OR: 1.75 (1.17-2.61) Ever vs. never exposed to lifting50kg ≥ 10×/week OR: 1.88 (1.20-2.92)
Franklin et al 2010 [44]	Iceland	Case-control	1,008 men and women treated for hip osteoarthritis at >60 years and 1082 controls (first degree relatives of cases of hip and knee osteoarthritis)	Total hip arthroplasty for osteoarthritis from patient records	Longest held occupation from questionnaire	Age, sex, body mass index, recreational physical activity	Farmers vs. managers and professionalsOR 3.6 (2.1-6.2) in menOR: 0.62 (0.36-1.0) in women
Ratzlaff et al 2011 [45]	Canada	Cohort	2,918 men and women aged 45-85 years, with no hip osteoarthritis at baseline, followed for 2 years	Self-reported diagnosis of hip osteoarthritis by a health professional	Cumulative lifetime occupational force on hip estimated from occupational history by online questionnaire	Sex, age, earlier injury, sporting activity, domestic activity	Highest vs. lowest fifth of cumulative lifetime occupational force on hip HR: 1.80 (0.95-2.82)
Kaila-Kangas et al 2011 [46]	Finland	Cross-sectional	3,110 men and 3,446 women from general population	Clinical diagnosis of hip osteoarthritis according to standardised criteria based	Occupational activities in current	Age, sex, body mass index,	Manual handling of loads >20 kg for >24 v 0 years OR: 2.3 (1.2-4.3) in men

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Reference	Country	Study design	Study sample	Case definition and ascertainment	Exposures and methods of assessment	Confounders considered	Risk estimates (95% CIs)
				on disease history, symptoms on disease history, symptoms on disease history, symptoms	and clinical findings jobs by interview and clinical findings	smoking and traumatic fractures	OR: 1.2 (0.7-2.1) in women
Andersen et al 2012 [47]	Denmark	Cohort	217,055 farmers, 487,156 construction workers and 912,228 office workers, identified from a national database over 1981-2006, and followed for up to 11 years	First hip replacement surgery with a diagnosis of osteoarthritis from national patient register	Occupation from national database	Age, sex, calendar period, income and unemployment	Farmer for >10 years vs. office workers HR: 3.00 (2.71-3.32) in men HR: 1.62 (1.19-2.20) in women Construction worker for >10 years vs. office workers HR: 1.83 (1.68-2.00) in men HR: 1.57 (0.97-2.52) in women
Rubak et al 2013 [48]	Denmark	Cohort	1,010,944 men and 899,549 women from general population with ≥10 years full-time employment, followed over up to 11 years	First total hip arthroplasty for primary osteoarthritis	Cumulative physical workload inferred from industries of employment in national register over up to 42 years	Age, sex, calendar year, socioeconomic status and county of residence	Highest cumulative physical workload vs. never worked in industry with intermediate or high physical workload OR: 1.33 (1.17-1.53) in men OR: 1.01 (0.88-1.16) in women

RR = relative risk; OR = odds ratio; SHR = standardised hospitalisation ratio; HR = hazard ratio