

# 8 Osteoarthritis Affecting the Hip and Knee

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## 1 Summary

### Introduction

Osteoarthritis (OA) is extremely common, particularly among elderly people. It represents a major cause of morbidity, disability and social isolation, especially where the hip and knee are involved. The classification and nomenclature of OA are problematic and the multifactorial nature of OA is well recognised. Classification might arguably be based on radiological, clinical or symptomatic features; however, each system overlaps with another and no one scheme is ideal. Nevertheless, for the purpose of defining health care need, it is the symptomatic features that truly matter.

### Sub-categories

Enormous difficulties are encountered in defining the presence of OA using any single set of criteria, and different criteria are, in any case, generally needed for different joints. Similarly, no one method of categorising OA is ideal, yet once again, a number of constitutional and external risk factors for OA appear to depend crucially on the site affected. We have therefore adopted the simplest sub-categories based on the site – hip or knee – throughout this chapter. Further distinctions are also made according to the severity of symptoms – where available data permit such distinctions to be made.

### Prevalence and incidence

Precise estimates of the prevalence and incidence of OA remain elusive. Reasons for this include problems associated with definition and diagnosis, as well as coding practices. Based on radiographic evidence, it is estimated that between 10 and 25% of people over the age of 55 have OA of the hip and between 14 and 34% of people over the age of 45 have OA of the knee. There is, however, little correspondence between radiographic, clinical or symptomatic evidence of OA. In addition, the presence and extent of radiographic OA does not predict its likely progression to a symptomatic state.

A recent study estimated that symptomatic hip OA affects between 0.7 and 4.4% of adults, while the prevalence of hip disease severe enough to require surgery (which includes causes other than OA) has been put at 15.2 per 1000 people aged 35–85 years. Corresponding prevalence rates for symptomatic OA of the knee are 6.1% for people over 30 and around 7.5% for those in the age-group 55+. A study of people aged

## 550 Osteoarthritis Affecting the Hip and Knee

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55+ in North Yorkshire further ascertained that between 2 and 3% of individuals reported pain and disability at severity levels consistent with the need to consider knee arthroplasty.

There are a number of factors which modify the risk of OA and which are often joint specific. Thus OA of the hip has little association with obesity, has some association with race but limited association with gender and a strong association with particular occupations, e.g. farming; whereas OA of the knee is strongly associated with obesity, has little or no association with race, chiefly affects women and is related to types of work that involve frequent squatting. It does not appear to be associated with farming.

### Services and their costs

Pain is usually the main presenting problem for which patients seek relief and, in general, the first port of call is the general practitioner (GP). Musculoskeletal problems account for around one in ten of all new GP consultations, 18% of which are estimated to be for arthritis. Many services are available to GPs – although there is much local variation – and these include assessment centres, day centres and physiotherapists. However, GPs do not appear to have access to comprehensive sources of information regarding the local services which they may use. The variable extent of direct access to such services and a shortage of specialist physiotherapists are two areas of unmet need of particular relevance to OA. Many inappropriate hospital referrals could be avoided if such services were expanded.

Patients with mild or even moderate symptoms can generally avoid the use of drug therapy altogether – at least for some considerable time. Education, regular telephone contact and improved patient self-efficacy can all help enormously and there is considerable scope for the use of specialist nurse practitioners in this regard.

Where treatment is needed, the majority of patients will require simple analgesia, while – in cases where inflammation is active – non-steroidal anti-inflammatory drugs (NSAIDs) may achieve better results but should be used with great care. NSAID usage may increasingly take the form of highly selective cyclooxygenase isoform-2 (COX-2) inhibitors which have fewer side-effects, although long-term evaluation is still lacking.

Specialist referral is considered where there are doubts about the diagnosis or when a patient's symptoms have become difficult to control with physical therapy and analgesia and/or their mobility and independence are threatened (although at present referral may be necessary to gain access to various therapists and orthotic services). Where the main consideration is surgery, referral to a surgeon is appropriate, whereas problems concerning diagnosis may be best referred to a rheumatologist. Rheumatology referral is also recommended for assistance with the control of symptoms in those felt to be inappropriate for surgery (which includes the unwilling) where availability permits. Waiting times for hospital outpatient appointments are very variable. Influences on waiting times include the local availability of clinical specialists and the frequency with which consultants follow-up patients.

Potential targets for primary prevention include occupational activities, such as repeated lifting and squatting, and there is an enormous need for education and reorganisation of working practices. In practice these are often hard to influence. The avoidance of obesity (in particular) and the encouragement of regular moderate low-impact exercise represent other recurrent themes. In OA of the knee, exercise also encourages the maintenance of muscle strength which is particularly important in this condition. Weight loss, in the overweight, and exercise can also play a role in reducing symptoms once painful symptoms have developed.

Congenital dysplasia of the hip is a known precursor for hip OA in a minority of people and screening can improve the likelihood of obtaining early corrective treatment. The screening method needs to be highly sensitive, however – which current methods appear not to be. It is suggested that such efforts should be concentrated on babies who are known to be at an increased risk based on family history and a number

of birth and pre-natal factors. Secondary and tertiary prevention is otherwise generally hampered due to ignorance about the causes of symptoms in OA. However, limited evidence suggests that there may be a role for some nutritional factors.

Waiting periods for surgery within the NHS vary across the country although these statistics are not entirely reliable. Joint replacement (arthroplasty) is only one of a number of forms of surgical intervention that may alleviate OA symptoms of the hip and knee.

Hospital Episode Statistics (HES) reveal that 33 320 primary total hip replacements (THR) and 23 846 primary total knee (TKR) replacements were carried out (chiefly for OA) in English NHS hospitals during 1995–96. It is likely that the demand for TKR surgery will continue to increase, relative to THR during the next decade and there is currently a considerable unmet need for TKR surgery. This will increase the overall demand for resources within orthopaedics. Revision operations represented just over 12% of all THR surgery and almost 6% of all TKRs carried out in the same period. The likely continuing increase in demand for revision operations may lead to longer waiting times for all orthopaedic surgery because such operations are lengthy and require considerable specialist expertise. They also frequently require bone grafting and, in the absence of alternative techniques, a limited supply of allografts may increasingly affect waiting times for these operations.

## Effectiveness of services and interventions

There is some evidence to suggest that many GPs are inadequately trained in the management of OA and would welcome further training. While evidence-based guidelines on the management of OA do not exist, practical guidelines – based on professional consensus – do. These could help to encourage better management, although their existence does not appear to be well publicised.

Education, counselling and self-management programmes can all play a very important role in the management of people with OA. In addition, it is recommended that emphasis is placed on increasing the strength of often underused joint-supporting muscles. This alone may alleviate joint pain – particularly in patients with OA of the knee. Patients may also need re-educating in how best to go about their everyday tasks to avoid aggravating the condition. Both methods are best tailor-made to the individual's needs and the involvement of physiotherapists, occupational therapists and other professionals allied to medicine (PAMs) is recommended. Another benefit of involving PAMs includes the assessment and training that they can provide in the use of many orthotic devices (e.g. shoe implants, appropriate use of walking sticks, patella taping) which can assist in significantly relieving symptoms, even in patients whose disease is severe.

For some individuals, available treatments may subject them to considerably greater risks than the underlying condition. The use of NSAIDs, for example, resulted in 147 per 100 000 of the adult UK population being admitted with emergency gastrointestinal problems during 1990–91 and there is now good evidence to show that in almost all cases, simple analgesics, e.g. paracetamol, and topical applications, e.g. NSAIDs, capsaicin, are indicated in preference to orally administered NSAIDs, and their effectiveness is generally the same if taken at adequate levels. Many clinicians appear unaware of this evidence. Highly selective COX-2 inhibitors may alter this view of NSAIDs – but their thorough evaluation is as yet limited.

The success of surgery depends crucially on the appropriate selection of patients and this is relevant to GP referral practices. Currently, there are no evidence-based referral guidelines for GPs, nevertheless a number of professional consensus guidelines are available. There is little evidence that these guidelines are used. The availability of orthopaedic specialist services may also affect referral practices and timing, and currently, such provision is inadequate in some areas.

## 552 Osteoarthritis Affecting the Hip and Knee

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Regarding surgery itself, in younger individuals, osteotomies may buy time, since arthroplasty is generally more successful and cost-effective for the less active, older age groups, indeed advanced age, on its own, is rarely a contraindication to surgery. An appropriate standard case-definition is once again required for this and all other forms of surgery for OA of the hip and knee which takes account of the best evidence concerning effectiveness, acceptability and cost to patients of treatments. Without such a formulation it is impossible to gauge the extent of any unmet need for treatment in the community. Currently a number of consensus guidelines exists, but further research based on best evidence is required in this area.

THR and TKR are each now considered similarly effective and most people can expect to enjoy more than 15 years' symptomatic relief. The volume of surgery currently differs between the two, however, and while symptomatic OA of the knee is more prevalent than OA of the hip, considerably more hips are replaced. Hip and knee replacement surgery are each considered to be cost-effective. Nevertheless, there is much evidence for considerable variation in outcomes and further evidence to suggest that surgeons' routine practice is not always based on best evidence. There are currently more than 65 hip and 40 knee prostheses on the market, most of which are inadequately evaluated. Indeed, some joint prostheses continue to be used which have been discredited in research studies. Purchasers may in due course wish to specify the use of preferred implants in contracts and limit the use of new, relatively untested ones.

### Models of care/recommendations

Areas identified as deserving particular attention for future public health interventions are: (i) raising general awareness regarding the benefits of moderate, regular exercise for OA and other conditions; (ii) targeting the avoidance of obesity in both men and women; (iii) increasing education and awareness in the workplace among workers and employers regarding work that involves regular lifting; and (iv) the evaluation of alternative or additional means of screening for congenitally abnormal hip joints among infants identified as being at increased risk.

Owing to the large and increasing prevalence of OA it is recommended that all doctors require training in the management of musculoskeletal problems. Primary care physicians also need continuing training to include this emphasis. Improvements are needed regarding dissemination of information and advice to GPs. This includes the need for evidence-based guidelines on the management and referral of people with OA. There is also an urgent need for comprehensive and regularly updated information regarding the local services that are available to GPs. It is recommended that such information is provided via the Internet and that the responsibility for providing this service needs to be decided – perhaps centrally.

There is currently a shortage of orthopaedic and rheumatology specialist services and there is an acute need for considerable expansion in orthopaedic and rheumatology provision. This need will increase over the next 30 years. An expansion in services provided by professionals allied to medicine, e.g. physiotherapists, is also recommended.

### Outcome measures

There has been a lack of standard acceptable outcome measures in the past. Clinical assessments may overly represent the concerns of the clinician, rather than those of the patient and their reproducibility is often questionable. A number of patient-based, condition-specific measures (questionnaires) now exist which make the long-term follow-up of patients more feasible. This is particularly relevant for patients following surgical treatment, because their use reduces the need for additional hospital-based clinical assessments. Such measures are nevertheless designed to compare different treatment groups and study

populations and are not generally considered appropriate for the individual assessment of patients. Because outcomes in OA are frequently of a long-term nature and most of these measures are relatively new, a thorough evaluation of their usefulness over the long term is not as yet available.

## Information and research requirements

GPs require up-to-date information on all services that are available to them in one local source book. Such information needs to be updated regularly and might best be provided on computer websites.

Evidence-based guidelines are needed on the everyday management of hip and knee OA, on indications for specialist referral and for appropriateness and prioritising for surgery. In the meantime, a number of expert consensus guidelines are available. These guidelines need advertising. Much work is currently in progress concerning outcomes assessment – particularly those outcomes which emphasise the patient's perspective. This may help in the future development of guidelines that are evidence based. Research in this area would also benefit from improvements in the quality of hospital-based information, which includes the better application of standard coding practices, many of which are out of date. This in turn relies on the adequate recording of information by clinical personnel.

With some considerable planning and adequate resources, the establishment of national THR and TKR registers could theoretically help to bring about a number of these requirements within one efficient framework.

## 2 Statement of the problem/introduction

Osteoarthritis (OA), also often called osteoarthrosis or degenerative joint disease, is the most common form of arthritis.<sup>1</sup> It is extremely common in persons over 40 years of age and is one of the most prevalent diseases of elderly people.<sup>2</sup> OA may affect one or many joints in the same individual and represents a major cause of morbidity, disability and social isolation. This is particularly so when the main weight-bearing joints, such as the hip and knee are involved, as this may lead directly to reduced mobility.<sup>3–7</sup> This chapter focuses on these particular joints.

In the UK, the proportion of those in the population aged 65 years and older is expected to rise by a quarter from 15% in 1985 to 21% by 2030.<sup>8</sup> This change in population structure, together with the acknowledged association between OA and increasing age, means that OA is assuming recognition as a major public health problem and strain on health care resources.<sup>6,9–14</sup> At the same time, research is leading to rapid changes in the understanding of the disease. It is likely that ultimately this may lead to changes in treatments and policy.<sup>15</sup>

With regard to planning services for OA of the hip and knee, a fundamental requirement is to define the distribution in the population of those people for whom treatment is indicated and desired.<sup>16</sup> While radiographic evidence of OA is common and has been demonstrated to exist in the majority of people by the age of 65 years and in about 80% of those aged 75 years and above,<sup>2</sup> such evidence does not correspond with clinical criteria, patient-centred criteria or uptake of treatment, and many people with radiographic evidence of OA have few or only mild symptoms. The extent to which a person will be incapacitated by the presence of hip or knee OA, and the likelihood that they will seek a medical opinion or treatment is hard to predict and the precise role of underlying OA in determining this behaviour is problematic.<sup>17</sup> Nevertheless, from the point of view of health care need, it is *symptomatic* disease that is important.

## **The clinical characteristics of OA**

In most people, OA signs and symptoms are limited to one or only a few joints, and symptoms related to primary OA are generally uncommon in people under the age of 40 years – even when evidence exists of pathological changes having taken place. The involvement of many joints may, therefore, suggest a systemic form of OA<sup>18</sup> and the presence of severe symptoms in younger persons will most usually be associated with underlying factors such as pre-existing joint disorders (e.g. congenital dysplasia of the hip), repetitive occupational-related trauma, old fractures, avascular necrosis or metabolic disorders.<sup>19,20</sup>

The onset of OA is frequently insidious. Symptoms may be continuous or intermittent and their characteristics will depend on the joint involved, although these almost always include pain, which tends to be poorly localised.<sup>18</sup> At first the pain may only be noticed after the joint is used and be relieved by rest. However, when OA becomes severe and advanced, pain is experienced at rest and often awakens the person at night. Joint stiffness is also a feature of OA. It is generally localised and of short duration – less than 30 minutes. Stiffness tends to follow periods of inactivity and is characteristically present first thing in the morning after waking.<sup>18</sup> By the time OA is producing sufficient symptoms to provoke a clinical consultation a cluster of these complaints are quite likely to have emerged.<sup>21</sup>

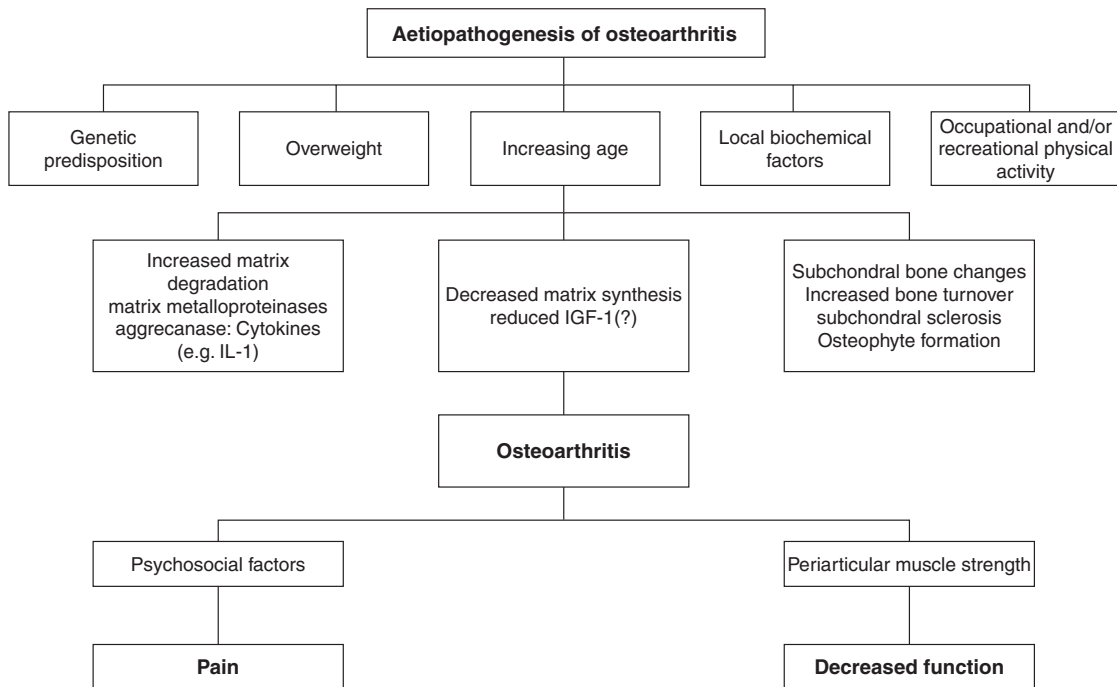
Severely affected weight-bearing joints bring particular problems with ambulation. A limp is common with hip or knee OA – and is in itself often disturbing to people – but an additional distressing feature, common in OA of the knee, is that the joint may feel unstable, as if it might give way. This sensation can reduce an individual's self-confidence and ultimately their functional independence.<sup>2,18</sup> Advanced disease brings limitation in the range of joint movement, although total loss of movement is rare. Deformity, instability and muscle wasting are all features of advanced, long-standing disease.<sup>18</sup>

## **Pathogenesis**

The known main features of OA aetiopathogenesis are summarised in Figure 1 (*see opposite*).

While a dominant pathological feature of the osteoarthritic joint is focal loss of damaged articular (Hyaline) cartilage, it is now understood that OA is a disorder of the whole joint organ and not just the cartilage.<sup>22</sup> The main functions of this particular type of connective tissue are to absorb and accommodate stress in response to mechanical load and to provide a smooth load-bearing surface to facilitate low-friction movement of the joint. Nevertheless, this in turn depends upon loads being properly distributed across its surface and also upon the maintenance of joint stability during movement. A stable joint also requires the integrity of ligaments, muscles and tendons supporting the joint, as well as a well-coordinated nervous system which controls these structures.<sup>23</sup>

At the macroscopic level, the key characteristics of an OA joint are swelling, fibrillation, erosion and eventual loss of articular cartilage, together with the remodelling of underlying bone resulting in subchondral sclerosis, bone cysts, an increase in metaphyseal bone and the development of osteophytes (spurs). The end point of OA is eburnation, in which the focal loss of cartilage at the articulating surface of a bone reaches the stage where the underlying bone becomes exposed and subjected to increasingly localised overloading.<sup>23,24</sup>



**Figure 1:** Aetiopathogenesis of osteoarthritis (reproduced with permission from Creamer P, Hochberg MC. Osteoarthritis. *Lancet* 1997; **350**: 503–8).

## Prognosis of OA

While the incidence of OA increases with age, there is evidence to suggest that it does not occur as a necessary consequence of ageing, neither is it necessarily a progressive condition.<sup>25,26</sup> Pathological changes in OA tend to either remain stable or to worsen. Nevertheless, both rapid progression and spontaneous regeneration have been described and patients often experience improvement in their symptoms irrespective of any underlying pathological change.<sup>18</sup> In general, most mild OA does not progress to severe joint damage.<sup>22</sup> There is some evidence to suggest that the risk factors for progression are different from those for the initiation of OA<sup>27</sup> and more limited evidence suggesting that worsening of symptoms may be related to the presence of risk factors, e.g. previous injury, obesity.<sup>28</sup> However, most longitudinal studies have not succeeded in finding any possible explanations for progression.

Examples which illustrate these points include an 11-year follow-up study of people with OA of the hip which found that of 84 subjects who had osteophytes alone on their baseline radiograph, only one developed joint space narrowing. In addition, while two-thirds of patients with symptomatic hip OA progressed radiographically, 5% exhibited radiographic regression.<sup>29</sup> This study also reported that two-thirds of those who entered the study with symptomatic hips experienced a decrease in their pain symptoms over time – despite exhibiting a reduction in the range of movement and difficulties with activities of daily living. Nevertheless, a quarter of patients experienced severe pain.

Another study looked at patients who had been referred to hospital for their hip symptoms.<sup>30</sup> A minority of patients progressed radiographically – albeit over a shorter period of follow-up (median 28 months). It was noted that certain patient characteristics made rapid progression more likely. These characteristics included being female and being of older age at the onset of symptoms. Hip replacement

surgery was also used as an indicator of deterioration in this study, with reported symptoms of rest or night pain or poor functional capacity at baseline making hip replacement more likely.<sup>30</sup>

While the natural progression of OA affecting the knee has received considerably more attention than has the hip, the majority of literature is based upon radiographic – rather than symptomatic – assessment of progression. The prognosis for untreated OA of the knee is noted to be worse than that for the hip (few cases, if any, improve spontaneously), yet progression may be slower<sup>31,32</sup> and disability may increase without an accompanying increase in pain severity.<sup>33</sup> One particular study followed 71 patients for 10–18 years.<sup>32</sup> Radiographic progression was reported in the majority of cases, although changes remained confined to the compartment in which they had first developed. Progression was also more common in women than in men and correlated with worsening symptoms, varus deformity and instability. Overall, evidence would indicate that, in the majority of cases, knee OA will progress radiographically in line with increasing pain and disability, but that this process may be slow.<sup>31</sup> Nevertheless, radiographic change remains a poor surrogate for clinical outcome.<sup>33</sup>

## **3 Sub-categories of osteoarthritis**

### **Issues of definition and measurement**

OA can, theoretically, be classified in a number of different ways – based on radiological, clinical or symptomatic features – and historically this has been the case. Thus, from an aetiological point of view, OA might be considered primary (idiopathic) or secondary to other disorders (e.g. congenital dislocation of the hip). It may also be monoarticular (affecting one joint) or polyarticular (affecting many joints) and genetic influences can apply here. However, none of these methods of classification is ideal and some may appear rather artificial, particularly since the multifactorial nature of OA is well recognised.

In a minority of people with OA, the condition is of a generalised nature and involves three or more groups of joints (e.g. hands, feet, knees, hips, spine). It follows that for a proportion of people, OA of the hip or knee will constitute just one of a number of joints affected, often contemporaneously and in accordance with a diagnosis of ‘generalised OA’. Although genetic factors are known to be involved in this condition, the genes related to its development remain largely undetermined.<sup>34</sup>

Overall, during recent years OA has increasingly been thought of as a disease process with common risk factors and a variable outcome where subsets could be differentiated according to the site of involvement, associated conditions or patterns of outcome.<sup>35–37</sup> With regard to the hip and knee, a number of constitutional and external risk factors appear to predispose to the development of OA which depend crucially on which of the two sites is affected.

Because of some of the difficulties encountered in defining the presence of OA by any single set of criteria and also because different criteria are needed for different joints, we adopt the simplest sub-categories of hip and knee throughout this chapter. Further distinctions follow according to the severity of symptoms – where available data permit such distinctions to be made.

### **Diagnostic criteria and differential diagnosis**

It is currently considered not appropriate, desirable or realistic that one set of clinical diagnostic criteria be developed for OA. This is because many of the key features come and go and are strongly influenced by other factors, such as general health. In addition, many of the signs and symptoms are non-specific or



highly subjective and lack reproducibility. In addition, current clinical and radiographic techniques commonly used to diagnose and assess OA are relatively insensitive to changes in the disease.<sup>35</sup>

Pain and functional impairment are the most usual presenting problems and it is important to determine whether these reported concerns are due to OA or some other condition. This requires careful questioning and physical examination. Many elderly people have radiographic changes of osteoarthritis which are not associated with symptoms and X-ray confirmation of the diagnosis is frequently not needed – particularly in the general practice setting. An exception to this is when there is doubt about the diagnosis and some other kind of arthropathy is possible.<sup>38</sup> In addition, symptom severity in people with hip or knee OA is frequently associated with anxiety, depression and feelings of social isolation, and it is now known that pain, disability and handicap may, to some extent, be determined or mediated by such psychological factors.<sup>39,40</sup>

Bony swelling and joint crepitus are features that are found more commonly in OA than in other forms of arthritis. Other main features include use-related joint pain and tenderness, bony and soft tissue swelling, morning stiffness, stiffness related to inactivity, restricted range of movement and problems such as bursitis or tendinitis. Rest or night pain, instability and joint deformities may also be present.<sup>35</sup> The distribution of joint involvement is important in distinguishing between OA and other diagnoses. The differential diagnosis of OA is shown in Table 1.

**Table 1:** Differential diagnosis of osteoarthritis.

Rheumatoid arthritis
Crystal arthritis (gout and pyrophosphate crystal deposition disease)
Seronegative arthritis, e.g. psoriatic arthritis
Periarticular syndromes, e.g. bursitis and tendinitis

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## 4 Prevalence and incidence

### General points

An assessment of the overall prevalence of OA is made difficult due to differences in the criteria and definitions that have been used in different studies.<sup>41,42</sup> Indeed, there is no clinical, radiological or pathological ‘gold standard’ against which the epidemiology of OA can be tested.<sup>43</sup> Historically, OA prevalence has therefore been assessed in a number of different ways resulting in a range of rates. The majority of estimates have, however, been based on radiographic assessment. This method commonly uses a system developed by Kellgren and Lawrence in 1957,<sup>44</sup> (see Table 2), in which cases are defined and

**Table 2:** Kellgren and Lawrence grading system for osteoarthritis.<sup>44</sup>

Grade	Criteria
0	Normal
1	Doubtful narrowing of joint space, possible osteophytes
2	Definite osteophytes, absent or questionable narrowing of joint space
3	Moderate osteophytes, definite narrowing, some sclerosis, possible deformity
4	Large osteophytes, marked narrowing, severe sclerosis, definite deformity

## 558 Osteoarthritis Affecting the Hip and Knee

graded according to the presence of certain radiographic features, such as osteophytes and joint space narrowing. Grading is performed by comparing the index radiograph with reproductions in a radiographic atlas.

The Kellgren and Lawrence system has received much criticism, as it is vulnerable to inconsistent interpretation.<sup>25</sup> Application of the system also revealed the difficulty associated with developing a single formula that is equally suitable for the grading of different joints. For example, the measurement of joint space narrowing is relatively straightforward for the hip and is more often associated with pain than is the presence of osteophytes, whereas osteophyte grade has been demonstrated to have greater validity in defining OA at the knee joint.<sup>45,46</sup> Other problems concern the quality and interpretation of radiographs. Regardless of the difficulties associated with the measurement and classification of OA, radiographically based prevalence estimates are of limited value in defining population requirements for treatment. The main reasons for this are:

- past joint replacement surgery increasingly affects the figures, because people who have had their painful joint replaced are thereafter excluded from the 'numbers at risk' for primary joint replacement surgery, they also generally have minimal symptoms and so will not appear in symptom-based study samples
- in the absence of pre-symptomatic disease-modifying agents, treatment is currently targeted only at reducing symptoms
- there is a lack of agreement between radiographic evidence of the presence of OA – on which so many prevalence estimates are based – with (i) that of symptoms, and (ii) its likely progression (and the timing of that progression) to a symptomatic state.

These general points should be born in mind for the remainder of this section.

### The hip

A number of study prevalence estimates for OA of the hip based on radiographic evidence (with or without symptoms) is summarised in Table 3.

**Table 3:** Prevalence (%) of radiographic hip OA (Kellgren and Lawrence grades 2–4 and 3 & 4).

Study population (race)	Age (years)	Males			Females		
		<i>n</i>	% with grade <sup>a</sup> 2–4	3 & 4	<i>n</i>	% with grade <sup>a</sup> 2–4	3 & 4
Wensleydale, England (white)	55+	102	22	9	149	16	11
Leigh, England (white)	55+	236	25*	7	265	15	5
Watford, England (white)	55+	39	12	4	38	7	0
Oberholen, W. Germany (white)	55+	50	16	6	69	10	5
Piestany, Czechoslovakia (white)	55+	180	17	3	196	10	3
Azmoos, Switzerland (white)	55+	93	17	7	130	7	4
Jamaica (black)	55–64	87	1*	0	91	4	4
Nigeria & Liberia (black)	55+	66	3*	2	60	2	1
Phokeng, South Africa (black)	55+	61	3*	1	138	3*	0
All surveys	55+	914	17	6	1,136	10	4
All surveys	55–64	576	14	4	664	8	2

Reproduced with permission from Felson DT. *Epidemiol Rev* 1988; **10**: 1–28. \* $p < 0.01$  compared with unweighted mean rate for sex in all surveys (either 55+ or 55–64 years).

<sup>a</sup> All figures reported are unweighted means.

Rates range from 3.1% (age 55–74 years)<sup>47</sup> to between 10 and 25% of European Caucasian individuals (over the age of 55 years).<sup>21</sup> In older age groups (> 85 years) the prevalence of hip OA has been put at around 10%.<sup>48</sup> In marked contrast to other OA affected sites, OA of the hip is more frequent in males than females in the 45–64 year age group, although this becomes less obvious with more severe disease.<sup>49</sup>

While radiographic methods of assessing the presence of OA of the hip or knee show poor agreement with rates obtained by other forms of assessment, e.g. clinical examination,<sup>50,51</sup> evidence currently suggests that radiography is less subject to bias than is clinical assessment.<sup>31</sup> However, a poor relationship has also been demonstrated between radiographic signs of OA affecting the hip and the presence of symptoms or disability. Thus, the proportion of patients with (moderate) radiographic hip OA who also report hip pain on most days in the last month has been put at around 28%.<sup>52–54</sup>

### Prevalence of symptomatic OA of the hip

Estimates of the prevalence of symptomatic OA of the hip vary. One study reported that symptomatic hip OA affects between 0.7 and 4.4% of adults.<sup>55</sup> Further evidence comes from a recent cross-sectional study of 28 080 people aged 35 and over, resident in the west of England, using questionnaires and clinical examinations (performed on a proportion of the respondents) to assess the prevalence of hip disease. This was assumed to be due to OA in the majority of cases (and hence may be an overestimate). Based on a screening question: having ‘hip pain occurring on most days for 1 month or longer during the 12 months before completion of the questionnaire’ the prevalence of self-reported hip pain was estimated to be 107 per 1000 for men and 173 per 1000 for women.<sup>16</sup> The prevalence of hip disease severe enough to require surgery was 15.2 per 1000 aged 35–85 years. The prevalence rates of symptomatic disease per 1000 for different sexes and age bands may be seen in Table 4.

**Table 4:** Self-reported pain in either hip.

Age (years)	Men			Women			All usable responses		
	<i>n</i>	Number screen positive	Rate per 1000 (95% CI)	<i>n</i>	Number screen positive	Rate per 1000 (95% CI)	<i>n</i>	Number screen positive	Rate per 1000 (95% CI)
35–44	2,692	150	56 (47–65)	3,052	283	93 (83–104)	5,744	433	75 (69–83)
45–54	2,417	235	97 (86–110)	2,646	442	167 (153–182)	5,063	677	134 (124–143)
55–64	2,194	313	143 (128–158)	2,385	499	209 (193–226)	4,579	812	177 (166–189)
65–74	1,840	244	132 (117–149)	2,212	477	214 (199–233)	4,052	721	178 (166–190)
75–84	887	123	138 (117–163)	1,387	308	220 (200–245)	2,274	431	190 (174–206)
≥85	141	20	140 (89–211)	351	75	211 (172–260)	492	95	193 (159–231)
Total	10,171	1,085	107 (101–113)	12,033	2,084	173 (166–180)	22,204	3,169	143 (138–147)

Reproduced with permission from Frankel S, Eachus J, Pearson N *et al. Lancet* 1999; **353**: 1304–9.

Population incidence studies for OA are all but non-existent, although crucial to an understanding of population requirements for surgery. However, while not specific to OA, and therefore representing a likely overestimate, Frankel *et al.*<sup>16</sup> derived a figure for the incidence of hip disease (‘severe enough to require surgery’) based on New Zealand clinical hip scores.<sup>56</sup> The incidence rate was calculated from the

## 560 Osteoarthritis Affecting the Hip and Knee

increase in age-specific prevalence between consecutive age bands. This produced an annual rate of 2.23 (95% confidence interval 1.56–2.90) per 1000 population in people aged 35 and over.

### The knee

OA of the knee is more prevalent than OA of the hip. Once again, a poor relationship has been demonstrated between radiographic signs of OA knee and the presence of symptoms or demonstrable disability.<sup>52–54,57,58</sup> Study estimates based on radiographic evidence are summarised in Table 5.

**Table 5:** Age-specific prevalence rates (%) of radiological knee OA (Kellgren and Lawrence grades 2–4) in different population groups.

Study location and population		Age group (years)					
		23–34	35–44	45–54	55–64	65–74	75+
NHANES (USA) (N=6,913)	M	0.0	1.7	2.3	4.1	8.3	
	F	0.1	1.5	3.6	7.3	18.0	
Goteberg (Sweden) (N=81)	M						33.3
	F						45.0
Sofia (Bulgaria) (N=4,318)	M	3.1	3.6	7.0	10.0	9.6	
	F	1.6	4.7	9.6	11.3	9.6	
Northern England* (N=1,448)	M		7.0	12.1	28.7	42.3	
	F		6.0	17.4	48.6	56.3	
Zoetermeer (Holland) (N=2,957)	M			9.3	16.8	20.9	22.1
	F			13.9	18.5	35.2	44.1
Framingham (USA) (N=1,420)	M					30.8	30.5
	F					30.8	41.8
Malmo (Sweden) (N=1,179)	M		0.0	3.0	4.5	4.5	4.5
	F		7.0	4.0	11.0	26.5	36.0

\* A combined sample from Leigh, Wensleydale and Watford.

Rates range from 3.8% (ages 25–74 years)<sup>59</sup> to between 14 and 34% (over the age of 45 years).<sup>60</sup> In older age groups (75–79 years) the prevalence of OA knee is high, at around 40%.<sup>21</sup> Rates tend to differ between men and women, however, for example, Kellgren and Lawrence reported a prevalence of 40.7% in females and 29.8% in males aged 55–64 years.<sup>61</sup> By the age of 65 years the female to male ratio varies between 1.5:1 and 2:1.<sup>62</sup> The proportion of patients with (moderate) radiographic knee OA who also report knee pain on most days in the last month has been put at 63% of patients (compared with 28% with equivalent definition for the hip) by one American study.<sup>53</sup>

### Prevalence of symptomatic OA of the knee

Estimates of the prevalence of symptomatic OA of the knee also vary. A community-based study of Nottingham residents aged 40–79 years reported an overall prevalence of knee pain of 28.7%, increasing

with age.<sup>63</sup> However, this was not confirmed as OA-related and other studies have produced much lower figures where confirmatory radiographic evidence was also obtained, these are 6.1% for people aged over 30 and 7–8% for those in the 55+ age group.<sup>21,41,64,65</sup> A study of people aged 55+ in North Yorkshire<sup>66</sup> further ascertained that between 2 and 3% of individuals reported pain and disability at severity levels consistent with the need to consider arthroplasty.

Population incidence studies of knee OA are, once again, extremely rare and data tend to come from studies of those seeking treatment. These include a primary TKR incident rate calculated by Williams *et al.*<sup>67</sup> applying age-specific surgical rates taken from a study of Olmsted County residents, Minnesota<sup>68</sup> to the 1990 English population. These rates were 1.3, 162.1, 208.3 and 391.8 for age groups 45–54, 55–64, 65–74 and 75+ respectively for males, and 44.3, 169.9, 268.4, 642.5 and 235.2 for age groups 45–54, 55–64, 65–74, 75–84 and 85+ respectively for females. The overall calculation produced an annual TKR requirement figure of 28 657. The authors nevertheless stressed that differences in case-definition, population characteristics and demographic features between the two countries were all acknowledged to undermine the usefulness of such generalisations.<sup>67,68</sup>

## **Relationship between population prevalence of hip and knee OA and health care need**

### *Prevalence and incidence of OA based on 'demand'*

'Demand' data refer to those people who seek medical advice for their problem, in OA usually pain. However, the onset of pain may be very gradual and the presence of pain may not automatically result in a medical consultation. For example, some individuals may believe that OA is simply an inevitable condition of old age for which little can be done. In this case, sufferers might delay seeking medical assessment and treatment until symptoms become moderately severe. There is thus a dearth of figures representing meaningful incidence rates of OA that are based on 'demand' data.

Demand data may also reflect differences in GPs' referral patterns, and their awareness of the facilities to which they have access.<sup>69</sup> They may also reflect regional variations in the availability of particular health care resources, such as hospital screening services (X-ray or MRI facilities) as well as specialist outpatient departments.<sup>70</sup> The quality of data concerning consultation rates for particular conditions, as well as those of hospital clinic attendance, is often questionable in terms of completeness and consistency of coding over time (*see* Appendix). Such data are also unreliable in determining the population requirements for treatments such as surgery. Nevertheless people currently on 'the waiting list' for surgery – or indeed, for outpatient appointments – have been considered by some to represent a degree of unmet need<sup>71</sup> – particularly since waiting times may vary from one region to another.

One method has used hospital utilisation rates from the USA (in locations where utilisation approximates roughly to population need), to calculate population needs for primary joint replacement surgery in England. For example, Williams *et al.*<sup>67</sup> applied to the 1990 English population, 1987–90 age-specific rates of primary THR per 100 000 person-years based on residents of Olmsted County, Minnesota.<sup>72</sup> These were then used as a very rough proxy for English incident surgical requirements. The rates were 6.8, 56.8, 96.2, 305.7, 173.0 and 147.9 respectively in males, and 4.6, 23.1, 166.3, 350.2, 421.3 and 162.0 for females, for the age groups < 45 years, 45–54, 55–64, 65–74, 75–84 and 85+. Application of these rates produced an annual THR requirement of 32 600.

An equivalent calculation for TKR requirement was reported earlier.

## Factors that modify risk

While it is agreed that population prevalence figures for hip and knee OA tend to increase steadily with increasing age, there are several additional factors which influence the risk – or timing – of OA development in individuals. OA of different joints involves a different balance of risk factors. In particular, except where OA hip and/or knee are involved as part of a generalised, polyarthritic syndrome, each is associated with broadly different risk factors.<sup>21</sup> The most notable examples of where risk factors differ between hip and knee OA are summarised at the end of this section.

### *Genetic factors*

#### **Sex**

The relationship of gender to the prevalence of OA is most noticeable in the latter half of adult life. Female gender has been identified as a significant risk factor for OA. Greater life-expectancy among women, together with the increasing prevalence of OA with age results in OA being twice as prevalent in women than men beyond 55 years of age.<sup>73,74</sup>

OA not only occurs more frequently in females, but it also tends to be more severe (particularly beyond age 50) and to involve a greater number of joints. Gender is also associated with the pattern of distribution of OA, with involvement of the interphalangeal joints, the first carpometacarpal joint and knee joints constituting the most usual pattern for women. In contrast, men are more likely to have OA affecting the metacarpophalangeal joints and hips.<sup>75</sup>

The association of OA with gender, along with other particular risk factors (e.g. increased weight and bone mass) and the increasing prevalence of OA in women following the menopause, has signalled the role of oestrogen as an influence.<sup>76</sup> There are theoretical reasons to suspect that female hormones may play a role in OA.

#### **Race/ethnicity**

Racial differences have been shown to exist in both the prevalence of OA and the pattern of joint involvement. For example, OA affecting the hips is relatively common in white populations, much less common among black and American Indian populations and extremely rare in Asian populations.<sup>75,77</sup> Fewer racial differences are observed for OA of the knee and such differences that have been observed may have been affected by occupational factors.<sup>78</sup> Overall, the question of whether racial differences rest primarily with genetic rather than 'environmental' explanations remains unresolved.

### *Non-genetic host factors*

#### **Age**

Age is the most powerful risk factor for OA.<sup>25,79</sup> Lawrence *et al.*<sup>80</sup> showed that not only was there a marked increase in the occurrence of severe OA (equivalent to Kellgren and Lawrence system<sup>44</sup> grades 3 and 4) with advancing age, but that this age-related increase appeared to be exponential after 50 years of age. Nevertheless, the interrelationship between ageing and OA is not yet clear. For example, OA may begin at a relatively young age but only progress to become clinically apparent or symptomatic, and therefore 'more prevalent' as people grow older. There is certainly some evidence to suggest that OA does not occur as a direct consequence of normal ageing and studies have shown articular cartilage from patients with OA differs in a number of ways from cartilage of normal elderly individuals.<sup>81,82</sup>

### **Body weight**

Obesity has been strongly linked to OA of the knee and, to a lesser, and less consistent,<sup>49</sup> extent, the hip, in cross-sectional and prospective studies.<sup>83,84</sup> For those in the highest quintile for body mass index (BMI) at baseline examination, the relative risk for developing knee OA over the subsequent 36 years has been estimated as 1.5 for men and 2.1 for women in one study.<sup>85</sup> For severe knee OA, the relative risk increased to 1.9 for men and 3.2 for women. In addition, one particular study conducted over a 40 year period was able to show that for women whose baseline BMI values were at least 25 (above the median), weight loss significantly lowered the rate of knee OA.<sup>86</sup> The same study also showed that for women whose baseline weight was under the median, neither weight gain nor weight loss significantly affected their future risk of OA of the knee.

### *Environmental factors*

#### **Occupations and repetitive usage**

There is a considerable amount of convincing literature regarding certain occupations which require repetitive use of particular joints over long periods and the subsequent development of site-specific OA. Several studies have found substantially higher rates of hip OA (in men) associated with jobs which require prolonged and frequent heavy lifting – particularly farming – such that hip OA is increasingly regarded as an occupational disease in such cases. By comparison, work which involves kneeling, squatting and climbing stairs, e.g. shipyard work and carpet fitting, are associated with higher rates of OA affecting the knee (in both men and women).<sup>21,83,87–92</sup>

#### **Nutritional factors**

There is evidence that antioxidants from the diet and other sources may prevent or delay the development of OA. In particular, vitamin C has been shown to delay the onset of OA in animals in experimental studies and in the Framingham osteoarthritis study, people in the lowest tertile of vitamin C intake had a threefold increased risk of OA knee progression compared with those having a higher intake.<sup>94</sup> Inadequate levels of vitamin D also appears to be an important factor in OA progression.<sup>94–96</sup>

#### **Leisure and sports activities**

Participation in sport has been associated with an increased risk of lower limb OA.<sup>75,83</sup> This finding is reported for a number of different types of sporting activity. For example, weight-bearing sports activity in women is associated with a two- to threefold increase in radiographic OA affecting the hip and knee.<sup>97</sup> Both hip and, to a greater extent, knee OA have also been shown to be more prevalent among former soccer players – particularly elite players.<sup>98</sup>

As with most other sporting activities, findings regarding risk of hip and knee OA and running are mixed.<sup>99–101</sup> However, there appears to be broad agreement that recreational jogging, rather than high-intensity, competitive running, does not appear to increase the risk of OA hip or knee providing the joints involved are biomechanically normal.

In summary, *OA of the hip* has little association with obesity, has some association with race but limited association with gender and a strong association with particular occupations e.g. farming, whereas *OA of the knee* is strongly associated with obesity, has little or no association with race, chiefly affects women, is related to types of work which involve frequent squatting. It does not appear to be associated with farming.

## **5 Available services and their costs**

In general, the services that are available for people who have either hip or knee OA are similar, although each condition requires a differing approach. On the occasions when information or treatment differs for either of these joints, this information is highlighted.

### **Primary care and the primary/secondary care interface**

GPs manage the day-to-day care of patients with arthritis and related conditions.<sup>102</sup> In addition to performing the primary assessment of patients with OA, GPs are also responsible for evaluating a patient's need for referral to specialist services and hospital care, and act as gatekeepers in this regard.

Musculoskeletal problems account for around one in ten of all new consultations, 18% of which are estimated to be for arthritis (affecting any site).<sup>103</sup> The annual GP consultation rate for OA is known to have been increasing steadily throughout the last 50 years,<sup>104</sup> although the precise number of GP consultations for OA is unknown and figures relating to those specifically for hip or knee OA are more elusive still. (This is in large part explained by inadequacies and idiosyncrasies inherent in diagnostic coding of primary care databases. Illnesses that are not treated with a drug or occur in people who are not referred may not be recorded on computer.<sup>105</sup> In addition, GPs are only required to record the reason [diagnosis] for a prescription on the first occasion that the drug is prescribed.<sup>106</sup>)

There is some evidence to suggest that GPs may only be aware of the more severely affected patients in their practice as many people with symptoms do not consult their GP about the problem.<sup>107</sup> In some cases patients' perceptions regarding the likely benefit to be gained from a medical consultation – at least before symptoms become moderately severe or disabling – may be low. In general, however, the reasons why some people consult and some do not is known to be complex.<sup>108–111</sup>

The 1990 NHS and Community Care Act led to an expansion in the practice of GPs employing professionals allied to medicine (PAMs), on site. General practice-based specialist outreach clinics and day centres in community hospitals represent other services available to only a proportion of GPs. Arrangements and facilities in these centres differ across the country, although most provide nursing, physiotherapy and/or occupational therapy personnel together with X-ray facilities.

### ***Specialist referral***

Indications for referral are discussed later in the chapter (*see* section on effectiveness of specialist referral and indications for hip and knee joint replacement surgery). When specialist referral is deemed necessary, waiting times to see a specialist vary by region and hospital (and have, in some cases, resulted from manpower shortages<sup>112</sup>), and despite hospital consultants' views on the inappropriateness of many of the referrals that they deal with, GPs have nevertheless expressed concern at the inadequate provision of orthopaedic surgical services leading to lengthy waiting periods for their patients.<sup>113,114</sup> In some cases this may encourage discussion of private referral, where people have private medical insurance or feel able to afford it.

There are no wholly reliable routine data available regarding GP referral practices for OA of the hip and knee specifically. However, a study of referrals to specialist outpatient clinics throughout the Oxford region revealed joint pain (a category which is likely to have included a high proportion of people with OA) to be the most common reason for referral to hospital-based specialists at a rate of 43/10 000 population per annum.<sup>70</sup> This figure breaks down to 31/10 000 referred to an orthopaedic surgeon and 10/10 000 referred to a rheumatologist.<sup>115</sup> However, in addition, referral figures coded specifically for people already



diagnosed as having OA were given separately: 8/10 000 referred to an orthopaedic surgeon annually; 2/10 000 referred to a rheumatologist.<sup>115</sup> The basis on which GPs choose between surgical versus rheumatological referral is unknown.

## Prevention

While the risk of developing OA increases with age, it does not occur as a direct consequence of normal ageing and this insight, together with evidence about risk factors, suggests that certain primary preventive strategies could be usefully employed where OA of the hip and knee are concerned.

In general, an understanding of the role of exercise in relation to OA has changed considerably in recent years, although information may not have filtered through to all health care practitioners,<sup>116</sup> and it is now believed that regular moderate levels of low-intensity exercise within all age groups may help to at least delay the development of symptoms in OA.<sup>117,118</sup> Some of this effect may well be indirect and related to the attenuation of age-related weight gain or the overall beneficial effects on general – including psychological – health.<sup>119</sup> However, an additional benefit of exercise is the maintenance of muscle strength and accompanying improvements in balance,<sup>118,120</sup> as these combine to reduce the risk of falls in elderly people, a factor which contributes to high morbidity.<sup>121–124</sup> Oestrogen replacement is one other potential area of promise in that a number of studies have now reported a reduction in the risk of hip and knee OA associated with its use.<sup>125,126</sup>

### *Primary prevention most relevant to hip OA*

The higher rate of hip OA in men that is associated with occupations in which frequent and heavy lifting is involved suggests a need for increased education and raised awareness among workers at risk and their employers. A concomitant increase is required in the provision and use of lifting aids and machinery – where appropriate – and overall modification of working conditions.

### *Primary prevention most relevant to knee OA*

The major known risk factor for symptomatic OA of the knee, particularly in women, is obesity.<sup>85,127</sup> It follows that every effort should be made to encourage both men and women to eat sensibly and exercise regularly in order to avoid gaining weight during the course of their lifetime.<sup>119</sup> Exercise should aim to strengthen the leg muscles – particularly the quadriceps – since weak quadriceps are known to be associated with symptomatic knee OA.<sup>118</sup>

The high rate of symptom development in people with radiographic evidence of OA suggests that secondary prevention might be practicable. Nevertheless, it is currently unclear precisely what causes the onset of symptoms in people with radiographic changes and certainly no method is known to prevent their development.<sup>64</sup> Tertiary prevention is hampered by similar problems as there are no modifiable risk factors that are known unequivocally to affect the risk of progression of pain or disability. Nevertheless, recent evidence from the Framingham study suggests that some nutritional risk factors – including vitamin D – have a different effect on late OA than appears to be the case in its early stages and this effect may be to limit progression.<sup>96</sup>

## Treatment and rehabilitation

The appropriate management of individuals with symptomatic OA is necessarily influenced by the age and occupation of the patient, the degree of pain and other symptoms experienced, their medical history

## 566 Osteoarthritis Affecting the Hip and Knee

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and specific circumstances. Nevertheless, management is likely to include elements of patient education, 'training', alleviation of symptoms (particularly pain) and eventually, where acceptable, surgical intervention.<sup>128–130</sup> There will, however, always be a proportion of people for whom surgery is not an option, due either to reluctance on their part, the primacy of treatment for other co-existing conditions or to their extremely poor operative risk. For these people, and indeed for those waiting – sometimes for lengthy periods – for surgery, other forms of management are required.

The impact of OA means that a multidisciplinary approach is often needed to treat both the disease and the person. This involves the skills of various health care professionals with a major responsibility falling on the primary care team.<sup>131</sup> The overall aim is to assist patients in attaining their maximum potential in everyday life through the use of education, rehabilitation, medication, surgery and other interventions, including health visitors, social workers, counsellors, dieticians and complementary therapists. The appropriate application of these different elements of treatment rests, in the first instance, on appropriate assessment.

### *The initial assessment*

Most patients present with pain and/or functional impairment as well as anxiety about the underlying cause and prognosis. The GP will need to determine, in the first instance, whether these concerns are due to OA or some other condition. Good management requires a patient-centred rather than a disease-focused approach and careful questioning is required as well as a physical examination. Indeed an examination of the joint should be carried out even if the history clearly points to OA, as this in itself provides reassurance to patients.<sup>132</sup>

It is necessary to assess and acknowledge the severity of symptoms in a way that is empathetic. While a number of methods exist for measuring the severity of OA symptoms and functional impairment, e.g. arthritis impact measurement scales, WOMAC, Lequesne and others,<sup>133–135</sup> they are not often used within a routine clinical context and it is not clear how useful they would be. Certainly none of these measures make any detailed reference to the co-existence – and impact – of other medical conditions; nor do they take account of peoples' individual home circumstances, all of which make a crucial difference to the impact of symptomatic hip and knee OA on peoples' lives. Through careful questioning, the GP will be made aware of a patient's unique clinical and social context and their assessment of the appropriate management will aim to take account of all of these aspects as well as the person's fears and expectations regarding their diagnosis. For example, some people may harbour the fear that a diagnosis of OA means a rapid and inexorable descent into a state of constant pain, extreme disability and dependency.

Details of all remedies that the patient is currently using need to be obtained. This is important and should include any prescribed, 'over-the-counter' or complementary/alternative remedies, as the possibility of drug interactions needs to be borne in mind before initiating any new systemic form of therapy.<sup>136,137</sup> In fact, drug therapy can often be avoided in patients with only localised damage.<sup>138</sup>

The initial assessment by the GP will generally include many elements of education that are outlined below. This includes an explanation about the condition and its likely prognosis, discussion about the various treatment options together with reassurance that these can help. An emphasis should be placed on the importance of practical elements of self-help, such as ways of protecting the joint (using a walking-stick, wearing shock-absorbing soles) and obese patients should be counselled and offered assistance regarding the importance of losing weight and the positive effect that this can have on symptoms (especially OA of the knee). The role of exercise should also be discussed, particularly as some people will need 'permission' to use a painful joint.

An important adjunct to the GP's initial assessment is the provision of written information for the patient to take away. This can take the form of key points that were discussed during the consultation,

together with information about access to individuals within the primary care team who can provide continuing support and advice. Treatment and progress should be reviewed on a regular basis.<sup>132,139,140</sup>

### *Education and social-psychological interventions*

It is vital that patients are told about the nature and likely outcomes of their condition as this will aid their treatment and serve to allay anxiety. It is important that they are made aware of the differences between OA and other forms of arthritis and they should also be informed that the condition frequently stabilises and that surgery is not usually necessary.<sup>133</sup> Patients also need to feel involved with their own management – an increased sense of self-efficacy and empowerment helps to militate against depression and lethargy and may encourage increased social contact.<sup>141–143</sup> Self-management programmes, training in coping strategies, regular telephone contact and counselling, are all low-cost interventions of proven benefit which can be offered to patients with OA of the hip or knee.<sup>144–146</sup> There are also a number of organisations that can provide patients with further written information and advice, such as the Arthritis and Rheumatism Council<sup>147</sup> and Arthritis Care.<sup>148</sup>

### *Exercise, physiotherapy, occupational therapy and orthosis*

While specific components of non-pharmacological therapy for patients with symptomatic OA of the hip and knee are often highly joint-specific, a number of general considerations applies to both and in each case the role of physiotherapists and occupational therapists is of central importance in providing individualised assessment, education and training for patients and their carers.<sup>135,136</sup>

At first, therapists will commonly encounter negative beliefs from patients about the role of exercise.<sup>149</sup> This may be influenced by the widely accepted association between high-level activity, injury and OA, together with the very understandable assumption that painful conditions should be rested. Rest is certainly important, and it is crucial that patients rest when a joint becomes painful during exercise. They are also usually told to keep stair climbing to a minimum.<sup>136,137</sup> Nevertheless, patients, relatives and carers, will often need careful explanations and counselling about the detrimental effect of under-using a joint and are therefore taught to balance rest with activity, joint protection with joint loading, weight-bearing with non-weight-bearing, and aerobic with non-aerobic exercise. Hydrotherapy may be offered as a part of physiotherapy, although this may not be widely available.

As with most interventions in OA, the goals of exercise therapy are to reduce pain and improve function. Improving the efficiency and safety of a person's gait is also important, and this can be achieved – in part – through exercises and training. The importance of walking every day should be emphasised and the judicious use of various orthotic devices may prove invaluable in this regard.

A reduction in the loading forces on the joint is often associated with decreased pain and improved function. A number of safe, simple and cheap orthotic devices are available that can assist in this aim and significantly relieve symptoms, even in patients whose disease is severe. One of the simplest devices, relevant to both hip and knee OA, is the walking-stick (cane). To be most effective, it needs to be held in the hand on the opposite side to the affected joint. This may, however, feel counter-intuitive and often requires some training.<sup>150–153</sup>

The use of shock-absorbing insoles, can lessen the impact of heel strike, and shoes with very hard soles should be avoided – as should those which threaten gait stability.<sup>136,137,154,155</sup> The use of a heel lift may confer substantial and dramatic pain relief for many people with OA of the hip.<sup>156</sup>

Medial taping of the patella may relieve painful symptoms in those with OA of the knee which involves the patellofemoral compartment.<sup>157</sup> A light-weight knee brace may also reduce pain in patients with severe medial compartment OA or with lateral instability.<sup>158,159</sup> In addition, lateral heel and sole wedges may relieve symptoms in selected patients.<sup>162</sup>

## 568 Osteoarthritis Affecting the Hip and Knee

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### *Diet*

People with OA should aim to eat a balanced diet that is rich in vitamins C and D.<sup>93,95,96</sup>

Some individuals may benefit from dietary advice given by a dietician – particularly those with special dietary needs, e.g. weight reduction. Nutraceuticals, such as avocado/soybean saponifiables may help to reduce symptoms.

### *Complementary/alternative therapies*

It has been estimated that around 90% of ‘rheumatic patients’ have each tried on average 13 unproven or ‘controversial’ remedies<sup>161,162</sup> and many people feel that they derive benefit from a variety of alternative/complementary therapies, e.g. acupuncture, massage, reflexology. Acupuncture is now available, on site, in some GP medical centres. Part of the benefit of such therapies undoubtedly relates to the individualised manner of delivery.

### *Other non-pharmacological treatments for symptomatic OA*

A variety of non-invasive, non-pharmacological treatments is available for the relief of pain in OA. These include narrow band light therapy, cryotherapy (cold air or ice chips), transcutaneous nerve stimulation (TENS),<sup>163,164</sup> pulsed electrical stimulation (Bionicare electrical stimulator) *particularly used for OA of the knee*, and heat treatments – including diathermy and ultrasound.

## **Orthodox drug treatment**

Medications for OA are generally directed at the relief of pain, rather than disease modification. A study reported in the 1970s that one-sixth of the population believed that medicine could do little or nothing to relieve the symptoms of the various forms of arthritis.<sup>165</sup> Although this figure may well have changed, non-compliance with treatment certainly remains a problem in the management of arthritis generally, with a number of studies suggesting that between only 40 and 60% of patients followed prescribed regimes correctly.<sup>166</sup>

### *Local/topical application*

Topical analgesics, such as methylsalicylate or capsaicin creams, are commonly used as an adjunctive therapy or on their own for *patients with knee OA* who do not respond to oral analgesics or do not wish to take systemic treatment. Some of these preparations may cause a burning sensation, however, which a proportion of people find unacceptable.<sup>167</sup> Many NSAIDs, such as Ibuprofen, are also available over-the-counter as a topical preparation and these are commonly used for the relief of mild to moderate OA pain.

### *Intra-articular injections*

Local steroid injection into the joint space may temporarily reduce pain quite considerably and increase mobility. This technique may theoretically be used for any joint but is almost never used for the hip, it is *commonly used for knee OA*, however. The possible reasons for such short-term relief are unclear.<sup>168–170</sup> There is little convincing evidence that repeated use of this treatment may cause harm and for elderly people with moderate to severe symptoms, for whom surgery is not an option, this treatment may prove very beneficial.

Intra-articular injections of hyaluronan and other forms of viscosupplementation may also improve symptoms for some individuals.<sup>171,172</sup>

### *Systemic pharmacological treatments*

Systemic pharmacological treatments are usually required when topical pain relief is insufficient. Analgesics, including low doses of NSAIDs, are commonly used in the treatment of mild to moderate OA pain. Simple non-opiate analgesics, such as paracetamol, often work well and while they have no anti-inflammatory effect, side-effects are uncommon and those which might occur, particularly in overdosage – such as hepatotoxicity – are equally likely to occur with NSAIDs. In contrast, side-effects from NSAIDs are common – particularly in elderly people – and can be life-threatening. For the moment, therefore, NSAIDs should be used as a last resort for pain relief.<sup>138</sup> Highly-selective COX-2 inhibitory NSAIDs are increasingly available and may promise fewer side-effects.<sup>173–175</sup>

Where stronger pain relief is required, combination analgesic therapy consisting of paracetamol together with a mild opioid form of analgesic, for example dextropropoxyphene (i.e. coproxamol), codeine (cocodamol) or dihydrocodeine (codydramol), are also considered less risky than NSAIDs.<sup>138</sup>

## **Surgery**

While there is hope that new therapies and preventative measures might one day significantly reduce the extremes of OA disability, it is likely that surgical techniques will always play a role for a minority of people with OA. In recent years, total joint replacement (arthroplasty) has displaced many other forms of surgical treatment for OA. Nevertheless, indications remain for these other surgical techniques – often used as a means of prolonging the life of the natural joint. This is because arthroplasty generally has a limited life and involves an enormous loss of bone stock which cannot (as yet) be replaced.

In OA of the knee, disease can affect (and be limited to) different compartments of the joint and this has a bearing on which surgical procedures are deemed the most appropriate.

### *Arthroscopy, joint lavage and viscosupplementation*

Arthroscopy is a surgical technique that permits internal examination of a joint in a way that is minimally invasive. It can be carried out under local anaesthesia as an outpatient procedure. Joint lavage – particularly for the knee – will frequently confer symptomatic relief for pain in the earlier stages of OA, although results may be longer lasting in those cases uncomplicated by inflammation.<sup>176</sup>

### *Osteotomy*

Osteotomy involves realigning the articulating surfaces of a joint to allow healing and reduce overloading. It is a preventative procedure used to delay the need for future joint replacement and has a place in the treatment of both the hip and the knee. One particular indication regarding the hip concerns conditions present early in life (e.g. acetabular dysplasia) which can give rise to premature.<sup>177</sup>

### *Arthrodesis*

Arthrodesis involves the surgical fusion of bones across a joint space which eliminates all movement at that joint. This procedure is rarely carried out but may be performed on the hip or the knee as a treatment for severe OA when joint replacement would be inadvisable or impossible. This situation may arise if the

## 570 Osteoarthritis Affecting the Hip and Knee

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patient is very young,<sup>178,179</sup> when a joint is grossly deformed or when previous arthroplasty has failed – particularly if failure was due to sepsis.<sup>180–183</sup> Arthrodesis is generally considered a salvage operation and is a relative contraindication for later arthroplasty since the range of movement likely to be achieved is very limited.<sup>184</sup>

### *Hemiarthroplasty*

Arthroplasty involves replacing the patient's diseased joint tissue with metal, plastic or ceramic components. Hemiarthroplasty entails the replacement of only one of the two opposing surfaces of a joint. With regard to the hip, this operation is chiefly carried out for the treatment of fractured femur, which results most usually from trauma (attended in addition by osteoporosis rather than OA). Unicompartmental arthroplasty (UCA) of the knee is indicated when disease is limited to one compartment of the knee only (e.g. lateral or medial condyle), when osteotomy is contraindicated (or has failed), or when the patient is too young, active or heavy to consider total knee replacement (TKR).

### *Total joint replacement (arthroplasty)*

Total joint replacement – or arthroplasty – involves fully replacing all articulating surfaces of a joint. The demand for both primary hip and knee replacement surgery continues to rise and while more THR than TKR operations are carried out in the UK at present, rates of TKR have been increasing much more rapidly in recent years and demand for TKR should equal that for THR in the not-too-distant future.

As the number of primary operations rises, so too does the demand for revision surgery. While 'revision' increasingly takes many different forms – some more invasive than others – this surgery is, on average, more costly<sup>185</sup> and less successful than a primary arthroplasty, particularly when it is performed on younger individuals.<sup>73,186</sup> Factors that contribute to both the cost and the success of revision surgery include the higher cost of the prosthesis, the complexity, and therefore the length, of the operation and the frequent need for bone grafting, since bone loss (resorption) tends to accompany aseptic loosening – the most common form of arthroplasty failure. While autograft is obviously the preferred option, lack of bone stock frequently leads to the need for allografting. Currently, 1700 femoral heads are collected annually and stored by the Scottish National Blood Transfusion Service for revised THR operations. It has been estimated that this quantity will be insufficient to meet the growing demand if supplies remain at this level.<sup>187</sup> Elsewhere bone banks are gradually being set up. One or two studies have highlighted the small but serious risk of transmitting infection that is associated with using allografts and the need for stringent screening.<sup>188,189</sup>

### *Total hip replacement specifics*

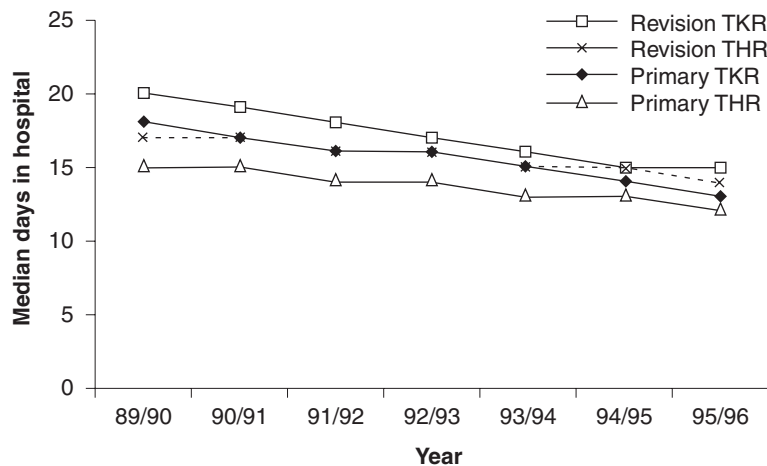
The artificial hip joint normally comprises three elements: (i) a ball (usually metal) which replaces the original femoral head that rests on (ii) a metal stem which is inserted into the femur and (iii) a plastic cup which is inserted into the acetabulum. These three elements are collectively referred to as a prosthesis (or implant) and are manufactured by a large number of private companies. Each company makes its own brand which differs from those of competitors in details of design, material and cost.<sup>190</sup>

Early hip prostheses were fixed directly to bone without the use of cement. These were relatively prone to loosening and during the 1960s acrylic bone cement came into use for the fixation of both acetabular and femoral components with considerably improved results. These early advances were pioneered by Charnley who also gave his name to a type of prosthesis which was widely used and still is – except that the prosthesis design has now changed more than once while the name remains largely unchanged.

From the 1970s onwards the number of prosthetic designs has proliferated together with various fixation techniques. For example, further attempts have been made to eliminate the need for bone cement, in particular threaded acetabular cups have been devised which are intended to screw directly into bone. Implants with porous and/or beaded surfaces have also been developed that encourage adjacent bone to grow into the superficial crevices to produce firm fixation. A more recent development has been the introduction of products such as hydroxyapatite as a coating on prostheses. This substance stimulates bone growth with the intention of producing a tighter fit around the prosthesis.

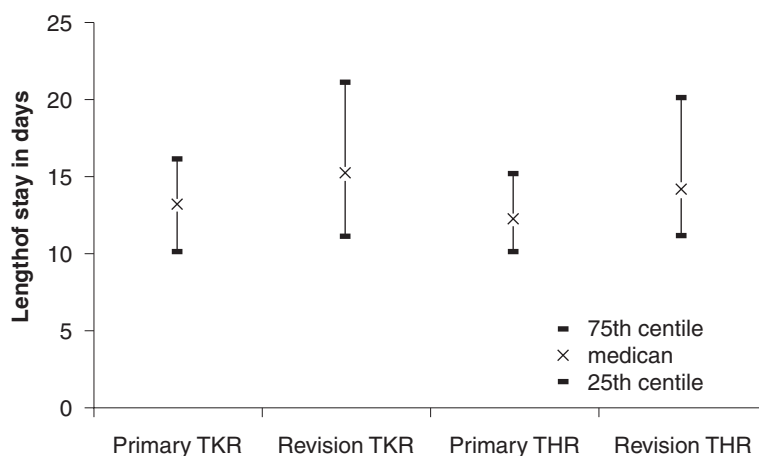
Methods are now increasingly used by which cement may be introduced into the medullary canal of the femur under pressure, although according to a 1996 survey a cement gun is used by only a minority of surgeons (9% of respondents).<sup>191</sup> It is suggested that such techniques have been responsible for a significant reduction in the rate of aseptic loosening of femoral components in recent years<sup>192</sup> although the technique is also accredited with an increased risk of provoking fat embolism, hypotension and death<sup>193</sup> and awaits thorough evaluation. Other developments have included the use of ceramic rather than metal femoral heads to reduce wear. Many prostheses are now a hybrid where the femoral component is cemented and the cup cementless. Most recently, acetabular and femoral components are being made modular. Most of the different types of prosthesis remain relatively unevaluated.

Data regarding length of hospital stay (LOS) are shown in Figures 2 and 3 (*see overleaf*). The median LOS has decreased gradually for primary THR and to a lesser extent for revision THR. In fact, the LOS varies considerably for people undergoing primary THR and while the majority of patients require between 8 and 14 days,<sup>194,195</sup> this requirement will be strongly influenced by patients' age and the availability of separate convalescent or rehabilitation facilities.<sup>196,197</sup>



**Figure 2:** Median length of hospital stay for joint replacement surgery in England, 1989–96.

Following surgery, most patients require at least 3–5 months to gain full strength and energy and some will take longer. Depending on the type of prosthesis and technique used, rehabilitation may include a period of 6–12 weeks requiring protected weight-bearing on two crutches, followed by gradual transition to walking with a stick.<sup>198</sup> Patients can normally continue with exercises at home after initial instruction although outcome evaluation every 2–3 years by outpatient visit, questionnaire and/or X-ray is increasingly thought to be of value.<sup>198</sup>



**Figure 3:** Length of stay plus interquartile ranges for total hip and knee replacement surgery in England, 1995–96.

### Total knee replacement specifics

The knee comprises a number of anatomical elements and is in many ways a more complex organ than the hip. While it is essentially a hinge joint, it also allows a small amount of rotation when in flexion. Sixty-five degrees of flexion is required to walk at a normal pace, 95° to go up and down stairs and 110° to rise from a chair with relative ease.<sup>199</sup>

While OA of the knee is more prevalent than OA of the hip, for reasons that are unclear, rates of joint replacement are currently lower in this country. One reason may be due to the poorer perceived outcomes following TKR relative to THR based on their past performance. In fact, there has been a significant improvement in the techniques and design of TKRs during the past 20 years,<sup>200,201</sup> such that long-term observational studies now suggest that >90% of particular designs survive for between 13 and 15 years,<sup>202</sup> and TKR for OA is increasingly being viewed as more reliable and durable than is THR.<sup>203</sup> The early higher failure rates were associated with the use of simple hinged designs, while subsequent designs have attempted to duplicate the anatomy, motion and stability of the knee and have employed the patient's normal soft tissues and ligaments to that end.<sup>204</sup>

The basic design of the modern TKR or 'total condylar arthroplasty' consists of two principal components: a high-density polyethylene tibial bearing which articulates with a polished (usually stainless steel) femoral component. The two parts are not linked mechanically and the stability of the new joint is achieved by a combination of reciprocal shaping of the articulating surfaces and surgical technique, which aims to ensure sufficient tension in the surrounding ligaments and muscles to maintain the two components under compressive loading.

In all TKR prosthetic designs both medial and lateral collateral ligaments are preserved, and in most the anterior cruciate ligament is resected – if it is still intact. Beyond this, two variants of the basic TKR prosthetic design have evolved. One form involves the retention of the posterior cruciate ligament (PCL) and the other substitutes the PCL. To date, survival has not been shown to differ between these two variants.<sup>202,205</sup>

Length of hospital stay (Figures 2 and 3) is, on average, slightly longer for people undergoing TKR, but is also influenced by patient age, the availability of separate convalescent or rehabilitation facilities<sup>196,197</sup> and the timing of rehabilitation.<sup>195</sup>



### *The future – therapies for OA disease modification*

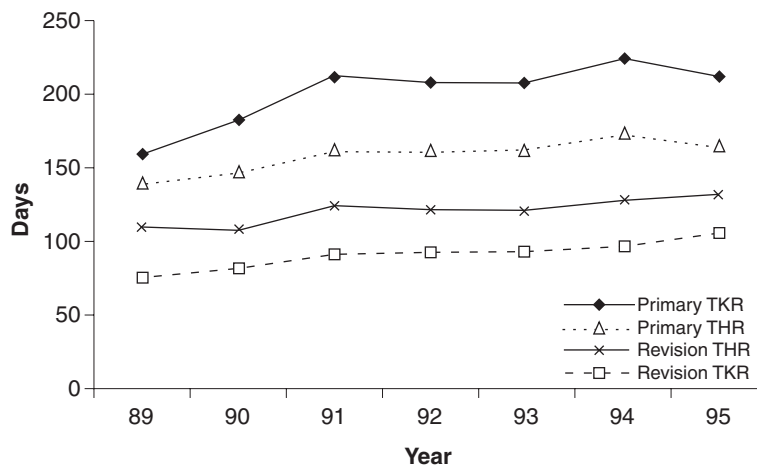
New therapies which modify the disease itself, rather than simply alleviating symptoms, include agents that aim to restore the equilibrium between cartilage synthesis and degradation. Of particular potential are agents, such as doxycycline, which selectively block either the release, or the action, of cytokines, thereby reducing the severity of OA lesions.<sup>206,207</sup>

Another area of increasing interest is that of nutraceuticals. Avocado/soybean unsaponifiables may increasingly be used for the treatment of symptomatic hip and knee OA.<sup>208–210</sup> Glucosamine, chondroitin sulphate and collagen hydrolysate are other examples.<sup>210</sup>

## **Hospital activity**

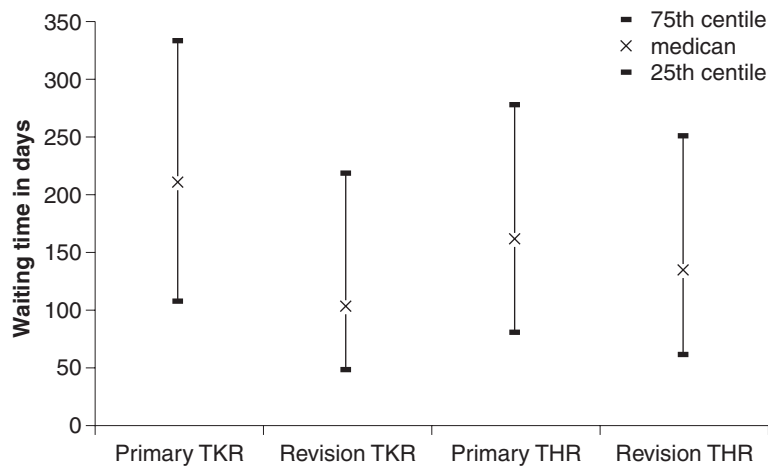
### *Waiting times for surgery*

Official data on waiting times for THR and TKR surgery are given in Figures 4 and 5 (*see overleaf*). Median waiting periods (days) for primary THR (163), primary TKR (210), revision THR (131) and revision TKR (105) all increased gradually during the period 1989–96. Of the four operations, waiting times are consistently longest for primary TKR and shortest for revision TKR. During the 7-year period, the largest increase in waiting time (about 2 months) was for primary TKR. While revision surgery would appear to be treated more urgently than primary surgery, there is much variation, as demonstrated by the interquartile ranges for 1995–96.



**Figure 4:** Median waiting times for total hip and knee replacement surgery in England, 1989–96.

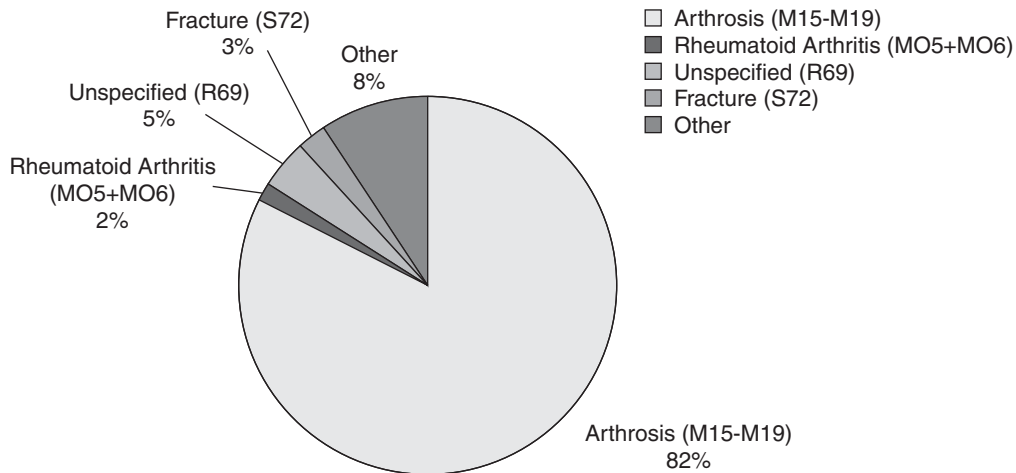
**574** Osteoarthritis Affecting the Hip and Knee



**Figure 5:** Waiting times plus interquartile ranges for total hip and knee replacement surgery in England, 1995–96.

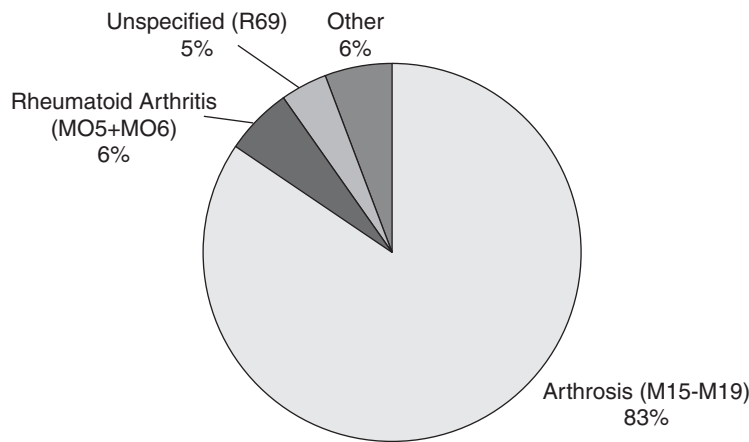
*Surgical rates (based on HES data)*

In 1995–96 the principal diagnosis (reason) reported for the majority of people undergoing primary hip and knee replacement was OA (82 and 83% respectively; Figures 6 and 7). The principal reason given for revision surgery is poorly described (or to be precise, poorly coded).



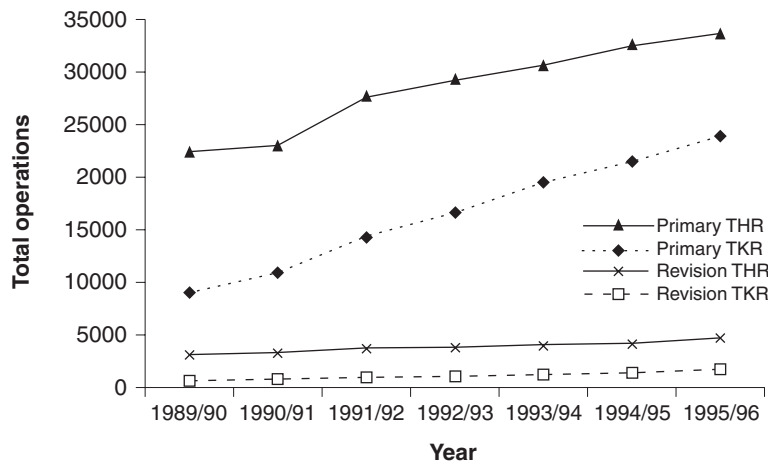
**Figure 6:** Principal diagnosis for patients undergoing primary total hip replacement surgery in NHS hospitals in England, 1995–96.

Overall, only a tiny proportion (< 5%) of total joint replacement operations are carried out as emergencies. These tend to be THRs (rather than TKRs) for fractured head or neck of femur, although primary implantation of a femoral component alone (hemiarthroplasty) would be a more frequent operation in this case.



**Figure 7:** Principal diagnosis for patients undergoing primary total knee replacement surgery in NHS hospitals in England, 1995-96.

The total numbers of operations for total hip and knee replacements that were carried out (for all diagnoses) in NHS hospitals, in England during the period 1989-96 are shown in Figure 8. The rate rose steadily for both operations during this period. These figures include a very small proportion of private patients occupying NHS pay-beds (*see below*).

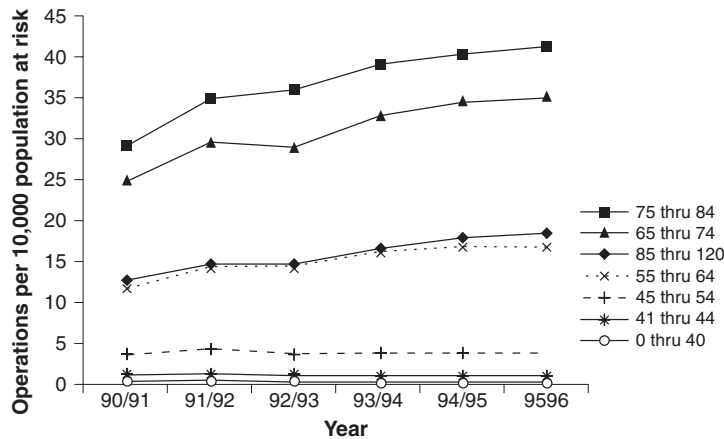


**Figure 8:** Number of hip and knee replacements in English NHS hospitals, 1989-96.

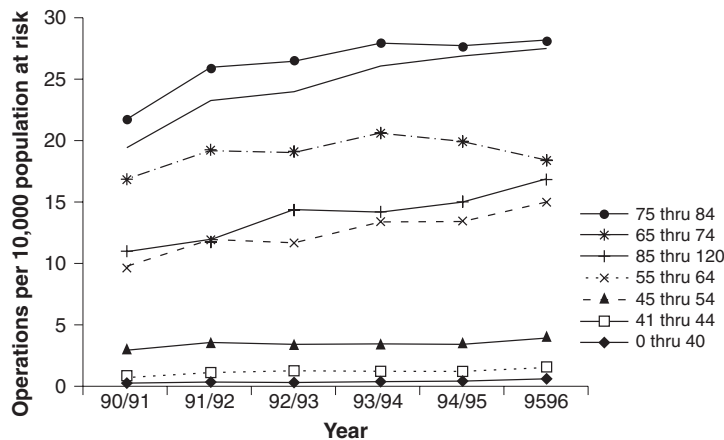
In 1989-90 22 230 primary THR operations were performed, compared with 9068 primary TKRs. By 1995-96 the number of primary THRs had risen to 33 320, while the number of primary TKRs had now reached a similar level (23 846) to that of primary THRs 6 years earlier. The increase in the numbers of TKRs was faster throughout the period than for THRs. It is believed that demand for TKR will either equal or overtake that for THR during the next decade as has already happened in the USA. Currently, evidence would suggest that the population demand for TKR surgery is inadequately provided for and represents a large unmet need.<sup>66,108,198,199,211</sup>

## 576 Osteoarthritis Affecting the Hip and Knee

Figures 9–12 show that among women, an increasing uptake of primary THR has occurred mainly within the 75–84 and 65–74 age groups, (rates were 41.5 vs. 35.4 per 10 000 women at risk respectively for 1995–96). The number of THRs performed is negligible in women below the age of 45 and is small and constant in women aged 45–54 (rate around 1 per 10 000 women at risk). In men, overall rates of THR are lower than for women. However, the highest rates for primary THR also occur in the age groups 75–84 and 65–74 (27.9 vs. 18.3 per 10 000 men at risk respectively, 1995–96), although the rate for the latter age group decreased throughout the period 1993–96, while the rate rose among the over 85s. This oldest age group exhibited the most noticeable rate increase over the last 6 years.

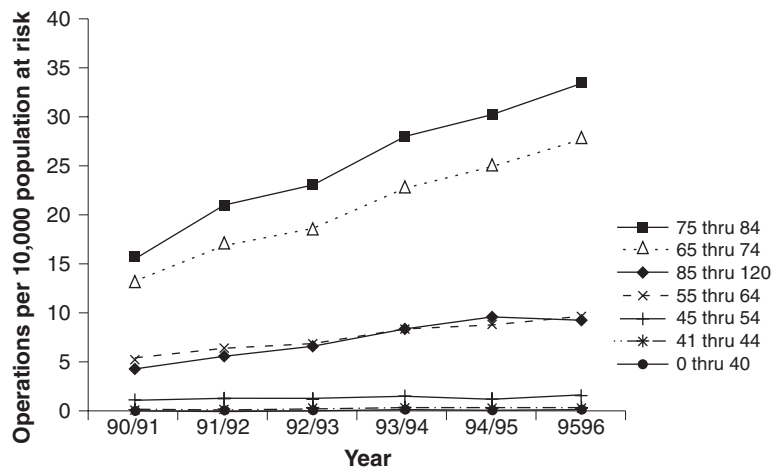


**Figure 9:** Age-specific rates for primary total hip replacement in English NHS hospitals, females 1990–96.

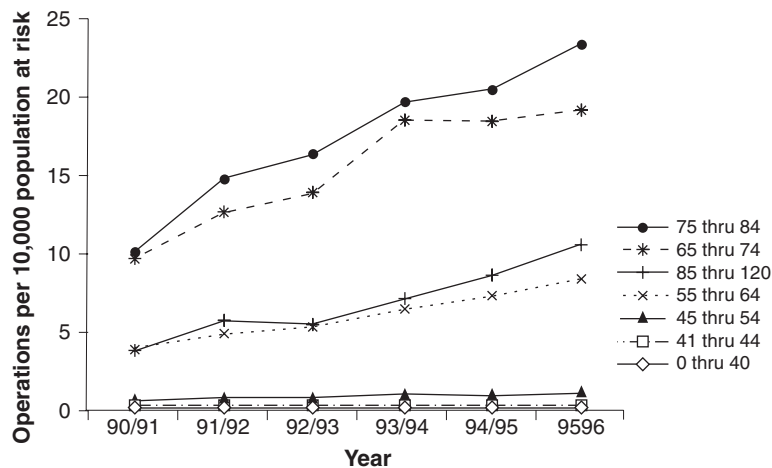


**Figure 10:** Age-specific rates for primary total hip replacement in English NHS hospitals, males 1990–96.

For TKR, once again, an increase in surgical uptake has chiefly occurred within the 75–84 and 65–74 age groups in women (rates were 33.6 vs. 27.7 per 10 000 women at risk respectively for 1995–96). Similarly, the number of TKRs performed is negligible in women below the age of 45.



**Figure 11:** Age-specific rates for primary total knee replacement in English NHS hospitals, females 1990-96.

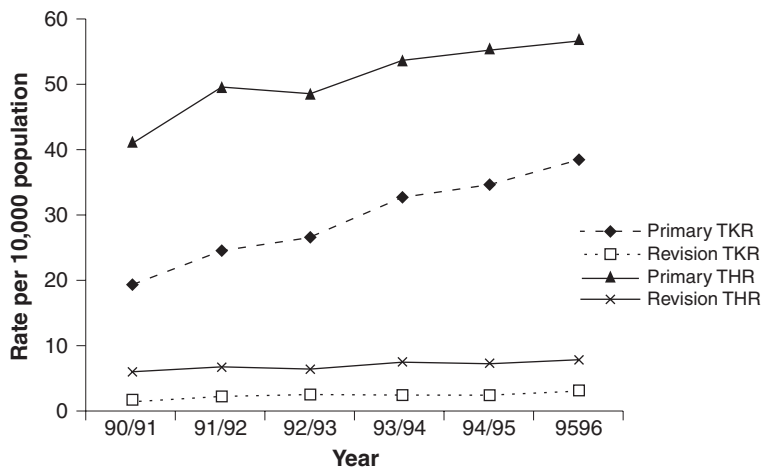


**Figure 12:** Age-specific rates for primary total knee replacement in English NHS hospitals, males 1990-96.

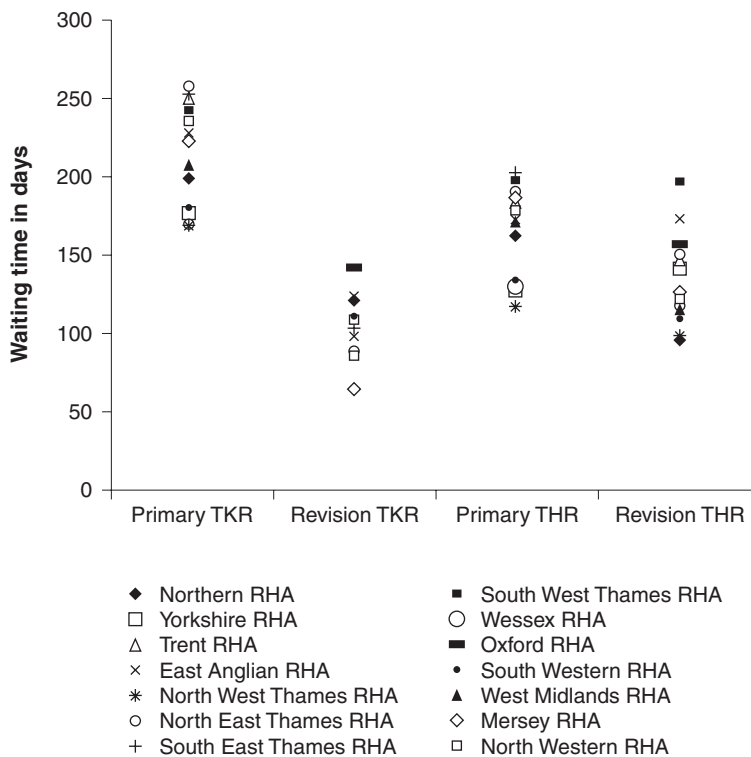
The overall volume of TKR surgery has remained much lower for men than for women, although age-specific rates of surgery are similarly low for men under the age of 45 (around 1 per 10 000 men at risk) and are also similar in the age groups 55-64 and 85+ (8.4 and 10.5 per 10 000 men at risk in 1995-96). However, the rates of surgery for men aged 65-74 and 75-84 are much lower than for women (19.1 and 23.4 per 10 000 men at risk respectively, 1995-96).

Age- and sex-standardised rates for THR and TKR operations (Figure 13, overleaf) suggest that the rate of THR surgery is levelling off while TKR surgical rates continue to increase, albeit slowly. Standardised rates for revision surgery appear relatively static.

**578** Osteoarthritis Affecting the Hip and Knee



**Figure 13:** Age- and sex-standardised operation rates for English NHS hospitals, 1990–96.



**Figure 14:** Median waiting times for total hip and knee joint replacement surgery in England during 1995–96 by region of residence.

**Regional rates**

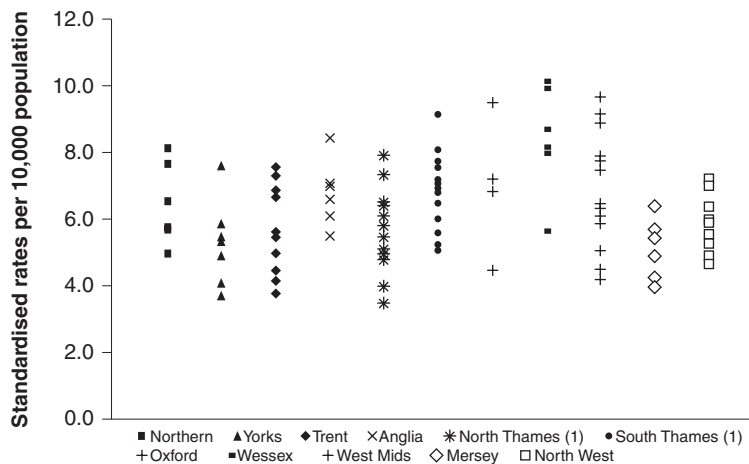
In an ideal world, once joint replacement had been deemed necessary, any period of waiting might represent an unmet need. Nevertheless, given that a period of delay or preparation is fairly inevitable, regional variation in waiting times may prove more revealing than aggregated figures.

Regional variation in median waiting times for primary and revision THR and TKR for 1995–96 is given in Figure 14. The range was between 117 days (NW Thames RHA) and 203 days (SE Thames RHA) for primary THR; and between 95 days (Northern RHA) and 196 (SW Thames RHA) for revision THR.

For TKR median waiting times the range was between 168 days (NW Thames RHA) and 257 (NE Thames RHA) for primary operations; and between 63 days (Mersey RHA least) and 123 days (E Anglia RHA) for revision surgery.

The extent to which these figures can be considered reliable is unknown. Nevertheless, such variation suggests that there may be an unmet need in areas with the longest waiting times. The disparity between waiting times for revision THR, which are similar to those for primary operations, and those for revision TKR, which are considerably shorter than for primary surgery, is worthy of note.

Figures 15 and 16 (*see overleaf*) show that there is enormous variation in surgical rates for both THR and TKR between districts within each region. The two most compelling explanations for this are either that different districts apply different criteria in the decision to proceed to joint replacement surgery or that orthopaedic provision differs between districts (or both). Unfortunately, in the absence of nationally agreed, standard, objective indications for THR/TKR surgery in this country, it is not possible to examine this issue.<sup>212</sup>

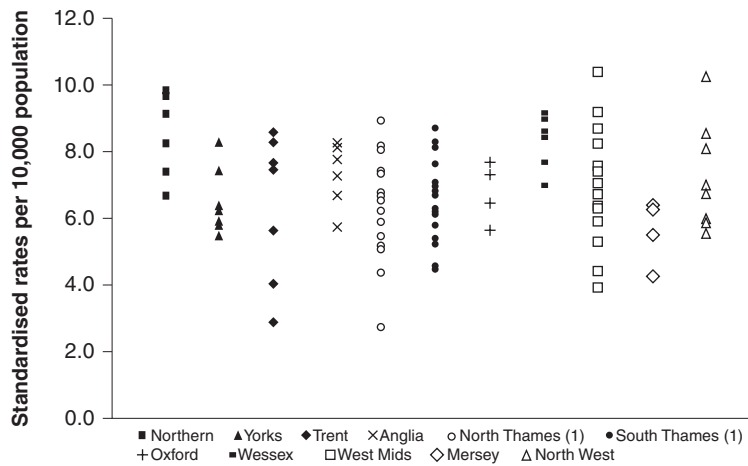


**Figure 15:** Age- and sex-standardised primary total hip replacement rates for district health authorities in England categorised by region, 1995–96.

**Private treatment**

Pay-beds in NHS hospitals represent a small fraction of overall private joint replacement activity and represented a fairly steady 900–1200 THRs per year and 400–500 TKRs per year, in England, throughout the period 1990–91 to 1995–96 (HES data).

Recent data provided from a Nottingham study (B Williams, personal communication) reveal estimates for the numbers of THR and TKR operations carried out in the independent health care sector (England



**Figure 16:** Age- and sex-standardised primary total knee replacement rates for district health authorities in England categorised by Region, 1995–96.

and Wales only) for the period 1997–98 (see Tables A4–A7). In total, 11 332 THRs and 5965 TKRs (primary and revision operations) were performed in this period. The numbers of primary operations were 10 493 and 5786 respectively. Additional considerations regarding private treatment also appear in the Appendix.

### Costs of OA treatment

A number of studies has attempted to measure the total costs that may be attributed to arthritis (although not specifically for hip and knee OA). OA accounts for the vast majority of these calculations and 56% of people with arthritis are reported as having locomotor disabilities.<sup>213</sup> A full assessment of the costs should include consideration of time lost to work and production, the personal costs to individuals and their families, as well as the costs of all medical and pharmaceutical services used. One such estimate put the total cost of arthritis at around £1200 million for the UK at 1990 prices.<sup>214</sup>

A number of medical costs for arthritis has also been calculated. For example, in the UK, it has been estimated that arthritis accounted for £231.3 million of hospital costs during 1989, amounting to around 1.6% of total expenditure. These figures included the cost of all inpatient and outpatient services – although the figure is acknowledged to be a likely underestimate. Arthritis-related general practice costs for the same year were estimated at £44.8 million (2.2% of total expenditure), while pharmaceutical services added a further £219.0 million to the bill. This last figure amounted to almost 10% of the total costs of pharmaceutical services but did not include the costs of ‘over-the-counter’ products and therefore represents a considerable underestimate of the true costs of medication provision for arthritis. The overall cost of arthritis to the NHS for 1989 was nevertheless estimated to be £495.08 million.<sup>214</sup>

Costs relating to other aspects of arthritis are even more difficult to estimate. However, the number of days lost from work due to arthritis has been estimated at over 41 million for 1989, leading to approximately £308 million being spent on annual benefit payments. Other costs are less readily quantifiable but include earnings lost due to reduced employment and promotion opportunities as well as early retirement.<sup>215</sup> In addition, people with arthritis may have special requirements and equipment,



e.g. handrails, raised toilet seats, to reduce the impact of disability and maintain mobility and independence.<sup>213</sup> Other costs are even harder to quantify but include the impact of pain, loss of self-esteem and depression which all commonly accompany the condition of arthritis.<sup>214–216</sup>

Recent NHS reference costs for specific services and procedures are given in Table 6.

**Table 6:** Costs of various services and procedures relevant to the treatment of OA of the hip and knee.

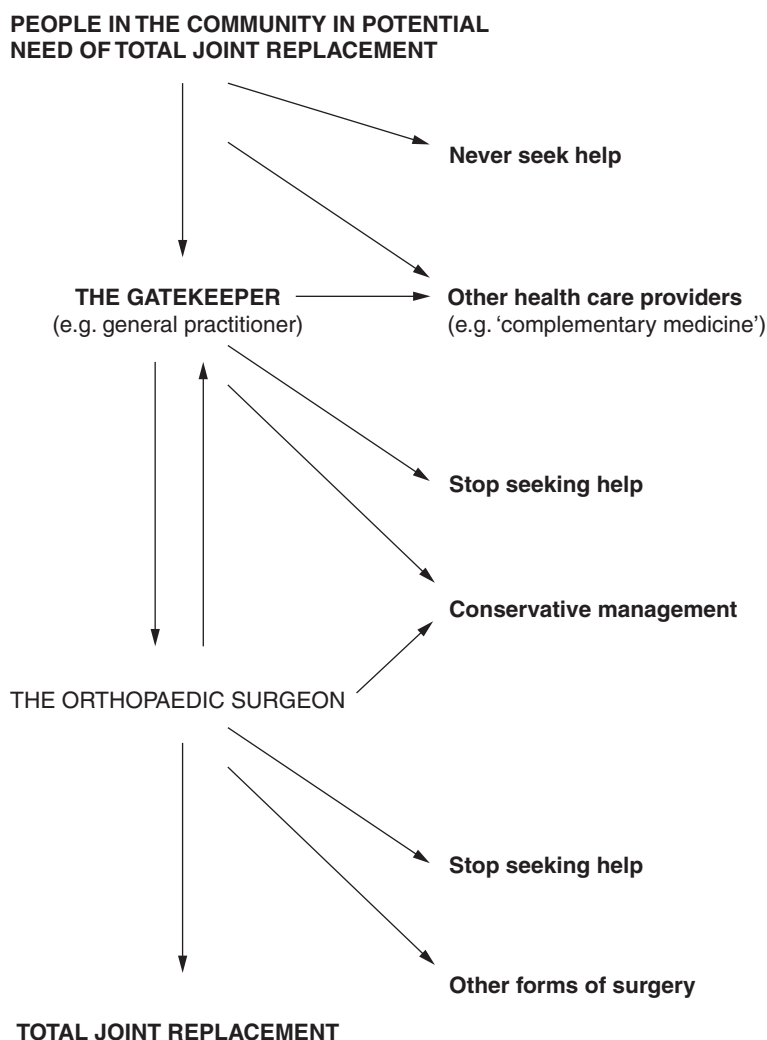
	(£)
Consultation with a GP – in GP surgery	10.00 <sup>a</sup>
Consultation with a GP – home visit	30.00 <sup>d</sup>
Outpatient consultation with an NHS rheumatologist	68.57 <sup>b</sup>
Outpatient (O/P) consultation with an NHS orthopaedic surgeon	53.87 <sup>b</sup>
Private hospital consultation	80.00 <sup>c</sup>
Session with an NHS physiotherapist (hourly rate)	30.00 <sup>a</sup>
Session with an NHS occupational therapist in an orthopaedic hospital	26.00 <sup>a</sup>
NHS hospital transport to and from O/P appointment (ambulance)	33.59 <sup>b</sup>
Home visit by district nurse	12.00 <sup>a</sup>
Home visit by health visitor	19.00 <sup>a</sup>
Home visit by geriatric social worker (hourly rate)	78.00 <sup>a</sup>
Knee arthroscopy – NHS as day-case	511.00 <sup>d</sup>
Private arthroscopy	1,650.00 <sup>c</sup>
Primary total hip replacement operation (NHS patient in NHS hospital)	3,737.00 <sup>d</sup>
Private primary total hip replacement operation (private wing in NHS hospital)	7,500.00 <sup>c</sup>
Primary total knee replacement (NHS patient in NHS hospital)	4,207.00 <sup>d</sup>
Private primary total knee replacement operation (private wing in NHS hospital)	8,250.00 <sup>c</sup>
Revision total hip replacement operation (NHS patient in NHS hospital)	4,613.00 <sup>d</sup>
Private revision total hip replacement operation (private wing in NHS hospital)	9,500.00 <sup>c</sup>
Revision total knee replacement (NHS patient in NHS hospital)	4,613.00 <sup>d</sup>
Private revision total knee replacement operation (private wing in NHS hospital)	9,500.00 <sup>c</sup>

Sources of information: <sup>a</sup> Unit Costs of Health and Social Care 1998;<sup>438</sup> <sup>b</sup> Trust Financial Return 1998;<sup>439</sup> <sup>c</sup> Nuffield Orthopaedic Centre, NHS Trust, Oxford (NB costs subject to variation); <sup>d</sup> National Health Service Reference Costs 1999.<sup>437</sup> These cost figures were obtained by Dr A Gray, Health Economics Research Centre, HIS, Oxford.

## 6 Effectiveness of services and interventions

### Evidence in support (or otherwise) of the various services and interventions available

Figure 17 (*see overleaf*) illustrates points of decision-making relevant to the treatment of both hip and knee OA, while Table 7 (*see pp. 585–6*) summarises the overall management of hip and knee OA addressed in this section (this table has adopted the format of a previously published table which summarised data from an earlier date).<sup>139</sup> The quality of scientific evidence regarding different available treatments is shown according to the key given beneath Table 7, together with the strength of any recommendation in support (or otherwise) for their use.



**Figure 17:** The hypothetical pathway to joint replacement (adapted with permission from Dieppe P *et al.* *The hypothetical pathway to TKR*).

There is, in fact, a paucity of detailed, clear and relevant evidence from which clinicians, patients and purchasers may make reliable choices about treatment for OA and outcomes research in OA and orthopaedics has received considerable criticism in the past.<sup>217–221</sup> Many of the criticisms have centred on the lack of relevant available standard, validated outcome measures – in particular measures that take account of the patient’s perspective, but there has also been a dearth of well-designed, large-scale – let alone randomised, controlled – studies in this area.

Part of the reason for the poor quality of research-based information on the assessment of outcomes in OA has to do with the long-term nature of these outcomes. For example, with surgical treatment, measurable differences in outcomes between different treatment groups may not arise for 5–10 years. Following up large numbers of people for this length of time is both problematic and costly, and may

**Table 7:** Management of hip and knee osteoarthritis: the evidence base.

Topic	Quality of evidence*	Strength of recommendation**	Patient selection important	Applies to hip (H) or knee (K)	Reference
<b>Non-pharmacological therapy</b>					
Physiotherapy/muscle exercise programmes	I	A		H or K	Kovar <i>et al.</i> , <sup>254</sup> Panush & Brown, <sup>440</sup> Callaghan <i>et al.</i> , <sup>441</sup> Minor <i>et al.</i> , <sup>269</sup> Ettinger <i>et al.</i> , <sup>271</sup> Fisher <i>et al.</i> , <sup>264</sup>
Hydrotherapy/balneotherapy	II-2	B		K	Verhagen <i>et al.</i> , <sup>275</sup> Ahern <i>et al.</i> , <sup>276</sup>
Shock-absorbing shoe implants	II-2	B	✓	H or K	Voloshin & Wosk, <sup>154</sup> Tohyama <i>et al.</i> , <sup>442</sup>
Walking-stick (opposite side to symptoms)	III	B		K (or H)	Bount, <sup>151</sup> Brady, <sup>152</sup>
Patella taping	I	A	✓	H (or K)	Cushnaghan <i>et al.</i> , <sup>157</sup> Balint <sup>128</sup>
Knee bracing	II-2/III	A		K	Matsuno <i>et al.</i> , <sup>159</sup>
Heat treatments	IV	C		H or K	Brandt, <sup>145</sup>
Transcutaneous Electrical Nerve Stimulation (TENS)	I	B		H or K	Fargas-Babjak <i>et al.</i> , Taylor
Cryotherapy (for inflammation)	II-2	B	✓	K	Olson & Stravino, <sup>278</sup> 1972, Brandt, <sup>145</sup>
Weight loss/dietition	II-2	B	✓	K (or H)	Felson, <sup>282</sup> Martin <i>et al.</i> , <sup>283</sup> Williams & Foulsham <sup>284</sup>
Other diets – food allergies	IV	C (but rare)	✓	H or K	Panush <i>et al.</i> , <sup>443</sup>
Other diets – Vitamin D	II-3	B	✓	H or K	McAlindon <i>et al.</i> , <sup>96</sup>
Other diets – Vitamin C	II-3	B		H or K	McAlindon <i>et al.</i> , <sup>93</sup>
Other diets	II-3	B and D		H or K	Bourne <i>et al.</i> , <sup>444</sup> McAlindon <i>et al.</i> , <sup>93</sup>
Acupuncture	I	D		H or K	Ernst
Arthritis self-help programmes	I	A		H or K	Lorig <i>et al.</i> , <sup>244</sup> Keefe <i>et al.</i> , <sup>141</sup>
Telephone contact	II-2	B		H or K	Lorig <i>et al.</i> , <sup>244</sup>
Social support	I	A		H or K	Weinberger <i>et al.</i> , <sup>445</sup>
	II-2	B	✓	H or K	Weinberger <i>et al.</i>
<b>Pharmacological therapy</b>					
Neutraceuticals – avocado/soybean unsaponifiables	I	A		H or K	Maheu <i>et al.</i> , <sup>208</sup>
– Glucosamine, chondroitin sulphate, collagen hydrolysate	II-1/II-2	B		H or K	Leffler <i>et al.</i> , <sup>446</sup> Deal & Moskowitz <sup>210</sup>
Topical analgesics – capsaicin – NSAIDS	I	A	✓	H or K	Deal <i>et al.</i> , <sup>289</sup>
Non-opioid analgesics	IV	C	✓	H or K	McCarthy <i>et al.</i> , <sup>167</sup> Altman <i>et al.</i> , <sup>290</sup>
	I	A		H or K	Bradley <i>et al.</i> , <sup>293</sup> Williams <i>et al.</i> , <sup>447</sup>

Table 7: Continued.

Topic	Quality of evidence*	Strength of recommendation**	Patient selection important	Applies to hip (H) or knee (K)	Reference
Opioid analgesic	II-1	B	✓	H or K	Quiding <i>et al.</i> , <sup>448</sup> Rousi <i>et al.</i> , <sup>449</sup> Kjersgaard Andersen <i>et al.</i> , <sup>414</sup> Williams <i>et al.</i> , <sup>447</sup>
NSAIDS	I II-1	B and D	✓	H or K	Dieppe <i>et al.</i> , <sup>450</sup> Schnitzer <i>et al.</i> , <sup>451</sup> Tambllyn <i>et al.</i> , <sup>452</sup> Tannenbaum <i>et al.</i> , <sup>453</sup> Tannenbaum <i>et al.</i> , <sup>455</sup> Shield <sup>303</sup>
Adjuvant cytoprotection e.g. Misoprostol	II-2	B	✓	H or K	
Arthrotec (diclofenac & Misoprostol)	II-1	B	✓	H or K	
Intra-articular corticosteroids	I	C	✓	K	Towheed & Hochberg, <sup>454</sup> Creamer <sup>168</sup>
<b>Surgical interventions</b>					
Joint lavage/arthroscopy	I	B and D	✓	K	Ike <i>et al.</i> , <sup>455</sup> Chang <i>et al.</i> , <sup>311</sup> Livesley <i>et al.</i> , <sup>176</sup>
Viscosupplementation/ Hyaluronan injections	I	A	✓	K	Adams <i>et al.</i> , <sup>456</sup> Lohmander <i>et al.</i> , <sup>457</sup>
Osteotomy	II-2	B	✓	H or K	Weidenhielm <i>et al.</i> , <sup>458</sup> Werners <i>et al.</i> , <sup>459</sup> Santore & Dabezius <sup>316</sup>
Joint replacement – THR	I/II-2 <sup>a</sup>	A	✓	H	Bourne <i>et al.</i> , <sup>460</sup> Herberts & Malchau, <sup>381</sup> Laupacis <i>et al.</i> , <sup>461</sup> Rorabeck <i>et al.</i> , <sup>462</sup>
– TKR	II-2 <sup>a</sup>	A	✓	K	Knutson <i>et al.</i> , <sup>463</sup> Kirwan <i>et al.</i> , <sup>464</sup>

Table format adapted from Lane NE, Thompson JM. *Am J Med* 1997; 103: 25S–30S.

\* Quality of evidence:

- I Evidence obtained from at least one properly designed randomised controlled trial
- II-1 Evidence from well-designed controlled trials (includes underpowered randomised controlled trials)
- II-2 Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one centre or research group
- II-3 Evidence obtained from multiple time series with or without intervention.
- III Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence
- IV Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.
- Evidence inadequate and conflicting.

\*\* Strength of recommendation

- A There is good evidence to support the use of the procedure
- B There is fair evidence to support the use of the procedure
- C There is poor evidence for the use of the procedure
- D There is fair evidence to *reject* use of the procedure
- E There is good evidence to support the *rejection* of the use of the procedure

<sup>a</sup> RCTs have compared various technical factors in arthroplasty, e.g. cemented versus uncemented, but none have been carried out to compare arthroplasty with an alternative form of treatment.

explain why few studies are carried out. Another problem has had to do with appropriate and acceptable outcome measures. Improvements have occurred in this area in recent years and this is discussed further in a later section.

### **Effectiveness in the primary care setting – diagnosis, management and referral practice**

There is scant information on the effectiveness of OA management in the primary care setting in this country and studies based in other countries have different health care systems, so their findings may not be generalisable to the UK. This limits any conclusions that may be drawn from reviewing such studies but their results may nevertheless suggest promising subjects for future study or audit in this country.

One such area of enquiry concerns the comparison of treatment provided by primary care physicians with that of rheumatologists and other hospital-based doctors. Study findings suggest that while primary care physicians are largely responsible for diagnosing and treating joint problems, they may be inadequately trained in this area.<sup>222–230</sup> A UK study also found some aspects of the management of common musculoskeletal problems by primary care physicians to be sub-optimal.<sup>69,231–233</sup> In particular, there is an acknowledged lack of rheumatological expertise in the primary care setting.<sup>139</sup> One way in which this situation might be improved involves the use of rheumatology specialist outreach clinics. A pilot study to evaluate English rheumatology specialist outreach clinics found increased satisfaction expressed by patients and GPs compared with situations in which reliance was solely on hospital outpatient departments. GPs also reported an increase in their own skills and expertise in rheumatology occurring as an indirect effect of these clinics being held in their practice.<sup>234</sup>

In the absence of such facilities, many primary care physicians state that they would welcome management guidelines, either in written format, or simply via improved telephone access to consultants for advice.<sup>225,233</sup> In the absence of evidence-based guidelines, consensus guidelines have in fact been produced which usefully cover many key aspects of the management of OA of the hip and knee which are published in this country.<sup>38,140</sup>

One UK study found that many hospital referrals were, in some sense, inappropriate.<sup>69</sup> This same study identified GPs' frequent lack of direct access to facilities such as physiotherapy, occupational therapy and orthotics as a major reason for such referrals. General practice-based specialist outreach clinics and day centres in community hospitals are extremely useful to GPs in assisting with the initial assessment of new cases of suspected OA and in providing direct access to therapists. In the absence of such direct access, GPs are obliged to refer patients via a hospital consultant. Interestingly, the same 1991 study also discovered that many GPs *did* in fact have open access to physiotherapy (and other) services about which they were unaware. Nevertheless, many GPs do indeed have no such access currently.

Appointments to see hospital specialists frequently involve a waiting period. One possibility for reducing the waiting time for such appointments is supported by early results from a (UK) randomised study which recently compared outcomes for specialist physiotherapists vs. subconsultant surgeons in the initial assessment and management of new GP referrals to outpatient orthopaedic departments. Here, results showed orthopaedic physiotherapy specialists to be equally effective on the basis of a number of patient-centred outcomes and superior on measures of patient satisfaction.<sup>235</sup> The provision of such services might considerably reduce inappropriate consultant referral (with the associated likely delay in initiation of treatment).<sup>69</sup> At present, such services are very rarely provided.

Because there is a considerable overlap between guidelines for specialist referral and issues regarding indications and appropriateness for joint surgery, further consideration of this whole area will be reported in a later section.

## Effectiveness of screening

A proportion of hip OA occurs secondary to a congenital or childhood hip disorder (acetabular dysplasia, congenital dislocation, slipped epiphysis or perthe's disease).<sup>236</sup> The exact proportion that can be accounted for in this way is unclear, but is likely to be small.<sup>236–239</sup> Hip screening has the potential to identify such problems and, in theory, prevent or delay future cases of OA by encouraging their early correction (although data to support this are lacking). However, the neonatal hip screening programme (first introduced in 1969) has been reported as inherently unreliable,<sup>240</sup> with cases no more likely to be detected now than in the past.<sup>241</sup> Whether other methods, e.g. ultrasound, may in due course, prove to be more reliable and more cost-effective is currently unknown. Overall, there is wide variation in screening practices and management of this condition throughout the UK, which largely reflects the lack of research.<sup>243</sup> While methods of screening for the presence of pre-symptomatic OA (e.g. genetic screening and biological markers) continue to be developed, there seems little reason currently to recommend such practice on a large scale.

## Effectiveness of education, counselling, training and psychological support

Education, counselling, self-management programmes, training in coping strategies and regular telephone contact, have each been shown to independently reduce pain, decrease the number of visits to physicians and generally to improve the quality of life of people with OA. They may also assist with individuals' continued motivation with any prescribed therapy.<sup>141,144,243–250</sup> Nevertheless, a recently published health technology assessment<sup>251</sup> stands as a notable exception to the generally positive findings reported by other studies regarding education, self-efficacy and OA.

This particular study involved an economic evaluation of a primary care-based education programme for patients with osteoarthritis of the knee and, overall, while the study authors acknowledged that the study suffered from a number of limitations, it failed to demonstrate that any improvements in knowledge, self-efficacy in arthritis management, or health outcomes had occurred after 1 year.

## Effectiveness of rehabilitation, exercise and orthosis

While 'joint overload' and vigorous exercise involving damaged or non-normal joints is known to predispose to OA, in general, there is compelling evidence to suggest that a moderate level of regular exercise can often reduce pain and disability. It, therefore, has a palliative role in the management of OA of the hip and knee.<sup>252–256</sup> This may in part be related to the association between lower limb muscle weakness and OA, particularly OA of the knee, since muscle weakness has a mediating role with regard to pain and loss of mobility in people with OA.<sup>257,258</sup> In addition, an interesting relationship was suggested between regular joint motion and osteophyte development in a study reporting increased osteophyte formation in the knees of people who stopped running (for reasons other than knee pain or stiffness) compared with people who continued<sup>259</sup> and a recent study has demonstrated that muscle strengthening is the intervention that is most likely to have a significant impact on reducing levels of severe mobility limitation in older women with knee pain.<sup>260</sup>

Many studies have now demonstrated the beneficial effects of simple walking exercises for OA of the main weight-bearing joints and the majority of people with symptomatic OA will benefit from appropriate exercises.<sup>3,145,256,261,262</sup> A moderate level of low-impact aerobic exercise increases

cardiovascular endurance and stamina. This is important, because patients with OA usually have decreased endurance. Easy to perform, low rate aerobic exercises, such as walking, swimming, golf and tennis, have now been shown to offer a safe and effective means of improving general fitness, reducing OA-related pain and disability, and increased performance – despite a lack of change in radiological evidence. The overall benefit of patients' perceptions of improvement and improved confidence in their physical ability should not be underestimated.<sup>254,261–273</sup> Even among elderly people with OA, those with no disability but whose physical performance is low have been identified as more likely to develop joint disability within a 4-year period than similarly affected individuals who were more active.<sup>276</sup> However, compliance with exercise regimens is not assured.

Relevant to both symptomatic hip and knee OA is the walking-stick. When used properly, this is one of the simplest and most effective orthotic devices for modifying symptoms and increasing confidence.<sup>150–153</sup>

### *Orthotic devices for OA of the hip*

The use of shock-absorbing insoles, can lessen the impact of heel strike, and broad-based shoes increase gait stability.<sup>136,137,154,155</sup> In addition, the use of a heel lift has been shown to confer substantial and dramatic pain relief for many people with OA of the hip.<sup>156</sup>

### *Orthotic devices for OA of the knee*

Medial taping of the patella has been shown to relieve painful symptoms in those whose OA involves the patellofemoral compartment.<sup>157</sup> A light-weight knee brace has also been used with some considerable success in reducing pain in patients with severe medial compartment OA and also for those patients experiencing lateral instability.<sup>158,159</sup> In addition, lateral heel and sole wedges may produce excellent results in selected patients, including those with advanced disease.<sup>160</sup>

The benefits of hydrotherapy has been the subject of a Cochrane systematic review.<sup>275</sup> This concluded that despite an overall lack of good randomised controlled trial design, hydrotherapy (spa or otherwise) appeared to confer positive effects on patients with OA and such therapy may be of particular benefit to people with severe symptoms. One of the better designed studies<sup>276</sup> confirmed significant improvements in self-assessed pain and self-efficacy, after only 4 days' individual hydrotherapy treatment with a physiotherapist. Improved self-efficacy scores remained for some time after 4 days' hydrotherapy had ceased, while pain score improvement was only maintained for the duration of the treatment. As with other forms of exercise, this treatment is likely to improve general fitness and overall sense of well-being.

In general, evidence suggests that the majority of people with OA of the major weight-bearing joints will benefit from initial physiotherapy assessment and intervention at all stages and that a relatively short and inexpensive course of therapy may confer long-lasting benefits.<sup>272</sup>

## **Effectiveness of other miscellaneous forms of therapy**

Evidence for the efficacy of other forms of therapy is mixed. Narrow-band light therapy has resulted in highly significant and long-lasting (4–6 months) improvement in pain and decreased disability in patients studied in a small double-blinded randomised controlled trial which compared infrared with placebo therapies.<sup>277</sup> Cryotherapy (cold air or ice chips) may in some cases relieve pain by reducing inflammation, e.g. for synovitis.<sup>145,278</sup> Transcutaneous nerve stimulation (TENS) has also been shown to relieve pain despite the presence of a strong placebo effect.<sup>261</sup> Similarly, pulsed electrical stimulation of the OA knee has produced significant improvement compared with placebo, although effects may be short-term only.<sup>279,280</sup> A review of randomised trials<sup>261</sup> recently concluded that therapeutic heat treatment, including diathermy and ultrasound, did not improve pain or function above the placebo effect in OA joints.

## **Effectiveness of dietary advice and weight reduction**

Dietary advice to encourage weight reduction is recommended, ideally from a dietician, in patients who are overweight. Evidence for the effects of weight reduction once OA has developed is sparse, although a few studies have shown weight reduction to be associated with a slowing of the rate of progression of OA and/or a favourable effect on symptoms.<sup>281–284</sup> However, patients who are being considered for hip or knee replacement surgery are frequently told to lose weight before surgery when there is no convincing evidence that obesity results in a poorer outcome.<sup>285</sup>

An adequate intake of vitamins C and D should be encouraged, as inadequate levels appear to encourage disease progression in OA.<sup>93–96</sup>

Neutraceuticals, in particular, avocado/soybean unsaponifiables, have shown very promising results in recent trials as a treatment for symptomatic hip and knee OA, providing a reduction in symptoms which were equivalent to NSAIDs and better than placebo. This effect persisted beyond treatment cessation.<sup>208–210</sup> Glucosamine, chondroitin sulphate and collagen hydrolysate have also been used with some measurable success.<sup>210</sup>

Beyond this, no evidence exists in support of other specific dietary therapy in the treatment of OA.<sup>136,137,287</sup>

## **Effectiveness of complementary and alternative therapies**

A review of published trials cited three acupuncture studies for treatment of severe symptomatic OA of the knee,<sup>128,287</sup> only one of which found a significant difference in outcome between those who received treatment and controls. All three showed an extremely strong placebo effect. On balance, there is little evidence to support the use of acupuncture in the treatment of OA although equally, there is no reason to discourage people from trying it, given that some people find it helpful.

The placebo effect is clearly present in many alternative/complementary medicine methods (and this is also true of orthodox treatments of course) but is hard to quantify. Therefore, it is sometimes argued that scientists cannot easily refute the benefits claimed by therapists. The individualised manner of delivery is certainly welcomed by patients<sup>161,162</sup> and, to this extent, patients' search for alternative and complementary therapies may represent a need unmet by orthodox practitioners and the health care system as a whole. One important problem with some complementary therapies lies in the risk that patients will discontinue conventional agents without first seeking advice. Use of alternative therapies may also delay the process leading to a medical diagnosis – which may be particularly important if the condition is something other than OA. Other risks stem from the use of 'natural substances,' such as Chinese medicine, which have occasionally been found to contain harmful elements – including undeclared prescription drugs.<sup>162,288</sup>

Overall, orthodox practitioners would be wise to present an open mind about the value of some complementary therapies, if questioned by patients, while at the same time warning them of the possible risks in particular instances.

## **Effectiveness of analgesia**

One study compared topical 10% triethanolamine salicylate with placebo for patients with knee OA and found no difference between the two.<sup>162</sup> There are no published data assessing the effectiveness of topical NSAID preparations. Capsaicin cream has been demonstrated to give a significant improvement in pain scores compared with placebo,<sup>167,289,290</sup> although some people may find the initial local burning sensation that it produces unacceptable.



Regarding systemic treatment, the effect of simple analgesics is quick but tends to last for only a few hours, whereas the effects of anti-inflammatory preparations build up over a few days.<sup>291</sup> A moderate level of pain requires effective pain management and this usually calls for a continuous level of analgesia to be maintained, i.e. given in anticipation of, rather than in response to, pain.<sup>292</sup> The use of paracetamol has been compared with an NSAID (ibuprofen) in a double-blind study of patients with knee OA, in which both treatments were found to be equally effective.<sup>293</sup> The use of opioid analgesics – while preferable to NSAIDs from the point of view of some side-effects – may increase the risk of falls and accidents and the use of any analgesic may permit overload and further damage to occur to an affected joint.<sup>294</sup>

## Effectiveness of NSAIDS

The use of NSAIDs – which include aspirin – should only be considered when simple analgesics are found to be inadequate for pain control or during inflammatory stages of the disease. The chief consideration at present is the high cost of the side-effects.<sup>138,294</sup>

The mode of action of NSAIDs is complex and not fully understood in OA. Grouping NSAIDs together in any discussion of their action can prove misleading because different NSAIDs have been shown to affect differing actions on inflammation mediators. In addition, NSAIDs are now known to have other modes of action in relation to OA cartilage.

There have been many studies of large populations confirming the potency and efficacy of NSAIDs in the treatment of both hip and knee OA. However, Cochrane systematic reviews of the more recent studies of NSAID use for OA in the knee<sup>295</sup> and the hip<sup>296</sup> concluded that there was insufficient evidence to distinguish any one NSAID as superior in action. This was published prior to results being available on more recently developed highly-selective COX-2 inhibitors, although how these newer NSAIDs might affect elderly people with multiple morbidities is as yet unknown, nevertheless, the avoidance of side-effects remains a primary consideration. Examples to illustrate the importance of side-effects include findings from one study which has shown that emergency admissions in 1 year (1990–91) for upper gastrointestinal disease, which resulted from NSAID use, amounted to an overall incidence of 147 per 100 000 (or nearly 15 per 10 000) of the adult in UK population, with around 3700 deaths in the UK resulting directly from complications of peptic ulcer in NSAID users.<sup>297</sup>

Paradoxically, as NSAIDs with more selective effects become available on prescription, the more harmful, non-selective NSAIDs are likely to become increasingly available to patients ‘over-the-counter’ thus increasing the risks associated with self-medication.<sup>174</sup>

From a practical standpoint, with unselective NSAIDs, the wide diversity of action and side-effects of NSAIDs results in considerable variation in patient tolerance and response to different preparations<sup>298</sup> and the prescribing of NSAIDs may therefore involve an element of ‘trial and error’.<sup>138</sup> For the moment, it is recommended that well-established formulations are chosen. These include ibuprofen, which can also be obtained over-the-counter, with diclofenac and piroxicam as other possible structural variants. The reasoning behind this choice is that those which have been in use the longest are least likely to produce idiosyncratic side-effects. They are also likely to be available in generic form and are therefore much cheaper.<sup>138</sup> Ibuprofen has been shown to be the best tolerated of all of the NSAIDs while indomethacin rates as one of the more toxic and should be avoided.<sup>299–302</sup>

Concomitant therapy with H<sub>2</sub> receptor antagonists or antacids is often administered to prevent gastrointestinal side-effects in NSAID users. However, this can prove harmful in the longer term and may simply have the effect of suppressing symptoms, but not necessarily the effects of NSAIDs on the gastric mucosa.<sup>301</sup> New formulations are being researched, with one combination, Arthrotec, appearing to confer increased ambulatory activity, as well as increased analgesia compared with diclofenac alone.<sup>303</sup> Arthrotec is only available as a fixed-dose combination at present, and the dose of diclofenac might be

## 590 Osteoarthritis Affecting the Hip and Knee

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considered too high for many elderly patients, particularly if they are taking drugs known to interact with NSAIDs, such as diuretics, anti-hypertensives, anti-coagulants or lithium. In addition, misoprostal itself may result in diarrhoea.<sup>138</sup>

### **Effectiveness of specialist referral and indications for hip and knee joint replacement surgery**

While increased attention has been given to indications for orthopaedic surgery for OA, no evidence-based guidelines currently exist that can help doctors and surgeons decide who might best benefit from surgery. However, there are consensus criteria which address indications for both referral and surgery.

A multidisciplinary NIH consensus panel was provided with relevant literature and required to reach agreement on a number of questions including 'what are the current indications for total hip replacement?'.<sup>304</sup> They concluded that patients were appropriate for THR who had radiographic evidence of joint damage together with moderate to severe persistent pain or disability, not substantially relieved by non-surgical treatments such as analgesics, NSAIDs and physical therapy. They also referred to contraindications, such as medical conditions, that significantly increased risk of peri-operative complications. The document points out that those aged 60–75 years were once considered ideal candidates for THR but that both younger and older age groups were now increasingly receiving THR. A UK-based workshop similarly emphasised the importance of pain not managed by medical means, followed by loss of movement, increased deformity and progressive disability as the main reasons for surgery for hip and knee OA.<sup>132</sup>

The NIH consensus statement and UK workshop report are both expressed in fairly qualitative terms. A New Zealand consensus panel sought to provide more explicit quantitative guidance in the form of criteria to assess the extent of benefit expected from hip and knee replacement surgery.<sup>56</sup> The literature was summarised and put to groups of health professionals who were required to produce numerical weights of factors that should determine priority for surgery where priority should be judged in turn by extent of expected benefit. Their final weightings for decisions were pain 40%, functional activity 20%, movement and deformity 20%, and other factors such as multiple joint disease 20%. It was felt that this system would be particularly valuable in making decisions about waiting time for elective surgery more transparent. This would, in turn, lead to a system where those with the greatest need and capacity to benefit from surgery would be the greatest priority.

A similar multidisciplinary panel was used in Ontario to agree criteria for appropriateness for referral for possible surgery and also priority in waiting lists for both knee and hip replacement surgery.<sup>305</sup> Their method of developing criteria involved the rating of case scenarios. The panel agreed very substantially on how case scenarios should be assigned following decision algorithms for both appropriateness for referral and urgency and priority in the waiting list. There are striking similarities between NIH, UK and New Zealand guidelines in the dominance of pain and physical function in criteria. To date, there is little evidence regarding the practical feasibility of using such criteria to assist doctors deciding whether to refer or surgeons deciding priorities in waiting lists. There is little evidence of the use of guidelines to address the substantial levels of disagreement about indications for orthopaedic surgery observed among both primary care and specialist doctors.<sup>306,307</sup>

### **Effectiveness of surgical techniques other than total joint replacement**

Arthroscopy can be a valuable tool in the assessment of OA of the knee.<sup>308</sup> It is also a means by which conditions within a joint may be improved during the early stages of symptomatic OA. For example, loose

fragments of cartilage may be removed, regions of articular cartilage may be shaved and subchondral bone may be drilled or abraded to stimulate the formation of a new articular surface.<sup>309</sup> The long-term benefits of arthroscopy are hard to predict, although it is suggested that certain patient-related variables are associated with a better outcome, including a short duration of symptoms.<sup>310,311</sup> There is a need for long-term randomised prospective studies in this area.

Joint lavage may prove beneficial for some patients who have not responded to other therapies and for whom a general anaesthetic is undesirable. Any surgical technique, including arthroscopy, usually involves the removal of debris and perhaps certain inflammatory mediators.

The concept of viscosupplementation (supplementing the fluid components inside the joint) has been studied extensively and products such as modified hyaluronan formulations are continually improving to satisfy the need for tissue and blood compatibility, permeability to metabolites, rheological properties greater than the indigenous synovial fluid (to allow for dilution factors) plus a slow export rate and extended half-life. The procedure is known to relieve the pain of OA and increase mobility in the short term, but it is hoped that it may also delay structural progression of the disease.<sup>172,313</sup>

In a case-series, osteotomy has been shown to produce sustained symptomatic improvement in about 80% of patients treated.<sup>177</sup> In younger active individuals with symptomatic OA of the knee, tibial osteotomy can allow a return to strenuous activities and will frequently delay the need for arthroplasty for up to 12 years – by which time the patient may be more suitable for arthroplasty.<sup>313</sup> Generally, the results of osteotomy depend very much on patient selection, pre-operative planning and surgical technique,<sup>314–317</sup> but the outcome, although very much less predictable than replacement, has the advantage that bone stock is maintained.<sup>177</sup> Generally, this type of surgery is more successful in younger and physically active patients with unilateral knee OA. The outcomes following future arthroplasty of the knee do not appear to be compromised by the prior osteotomy,<sup>318</sup> however, results are not generally so good for patients having THR subsequent to hip osteotomy.<sup>319,320</sup> Nevertheless, in people with acetabular dysplasia, timely operative treatment (e.g. periacetabular osteotomy, which involves moving and refixing the acetabulum) can relieve any symptoms, and although more complex and time-consuming than hip replacement, will prevent or greatly delay deterioration of the hip which would in any case eventually need replacing.

With regard to hemiarthroplasty, rarely and in selected cases this operation may be performed in preference to total joint replacement for OA of the hip in which the disease is limited to one small area of cartilage only. The main advantage is the preservation of bone stock in young people in whom future total joint replacement is likely to be indicated. Outcomes on this form of operation are unclear.<sup>76,321,322</sup>

Somewhat more evidence is available regarding unicompartmental arthroplasty (UCA) of the knee.<sup>323–327</sup> While it is technically a more difficult operation than TKR, UCA is claimed to be a less invasive procedure, while maintaining better range of movement, gait and function than TKR. UCA is also said to be an easier operation to revise – should that subsequently become necessary.<sup>324,328</sup> While limited evidence exists in relation to these claims, one economic analysis from the Swedish registry lends support to the cost-effectiveness of the procedure, compared with TKR, due to shorter associated length of hospital stay, fewer complications and cheaper implants.<sup>329</sup>

## Effectiveness of total arthroplasty, risks, complications and revision surgery

Outcomes following TKR have improved considerably over the last 20 years, such that joint survival estimates are now similar for both hip and knee arthroplasty and it has been estimated that within 10 years of surgery, fewer than 10% of patients should require revision.<sup>198–200,304,330,331</sup> To this extent, both operations are believed to be successful. However, an appraisal of effectiveness that is based purely on revision rates is not entirely satisfactory.

## 592 Osteoarthritis Affecting the Hip and Knee

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Despite the overall success rate of hip and knee replacement surgery, an increasing proportion of surgical time is now spent on revising past primary joint replacement operations. There is also considerable variation in the average survival time for different makes of joint prosthesis. Even so, there remains very little reliable evidence on which surgeons may base their choice and recent surveys of all NHS hospitals in England and UK orthopaedic surgeons reported that over 65 different types of hip prosthesis and over 40 different types of knee prosthesis were in use for surgeons to choose between.<sup>192,193</sup> New designs are also continually being introduced.<sup>332,333</sup>

In general, the success of arthroplasty may be affected by a number of factors besides the type of prosthesis used. These include the level of experience and expertise of the surgeon,<sup>334,335</sup> as well as patient characteristics such as the type of arthritis or underlying condition which provokes the need for arthroplasty, patient age, level of physical activity, their weight, general health and expectations.<sup>336-338</sup> The appropriate selection of patients for surgery is extremely important and relies upon an adequate case definition for those most likely to benefit from surgery. This should consider symptoms, function and co-morbidity.

Following arthroplasty, patients are generally at high risk of developing deep venous thrombosis (DVT), less commonly giving rise to a pulmonary embolism (PE) which may rarely prove fatal.<sup>339-342</sup> A significant risk of developing a DVT also persists for some weeks following hospital discharge.<sup>343-345</sup> Many consider that the serious nature of this condition warrants routine prophylaxis with mechanical means (pulsatile stockings or continuous passive motion), anti-inflammatory agents with antiplatelet activity, warfarin – or a combination of these.<sup>346-348</sup> Indeed 75% of hip surgeons have reported using at least one method of thromboprophylaxis routinely for their patients.<sup>349</sup> This was out of 32 different methods mentioned in the same survey, thereby indicating limited consensus.

However, while the development of DVT is relatively common, the precise risk of subsequent symptomatic PE following arthroplasty in patients who receive no prophylaxis has been estimated as around 1% and the risk of death at no more than 0.2%.<sup>339,350,351</sup> These low estimates of PE risk have therefore led others to conclude that the risk of promoting bleeding that is associated with routine prophylactic anticoagulant therapy may not be justified.<sup>345,350</sup>

Peri- and postarthroplasty cardiovascular events become increasingly common with advancing age.<sup>352</sup> Elderly patients are also at risk of cognitive dysfunction following major surgery and in around 5% of cases this is long-lasting.<sup>353,354</sup> While anaesthetic techniques have generally improved in terms of risk, a recent large-scale randomised controlled trial concluded that the risk of cognitive dysfunction or cardiovascular events was not affected by whether the anaesthetic was general or epidural.<sup>354</sup>

Epidural anaesthesia and analgesia are standard techniques in orthopaedic surgery of the lower limbs. Compared with general anaesthesia, the benefits of the epidural technique include excellent analgesia, minimal respiratory depression and a significant reduction in intra- and postoperative blood loss due to induced hypotension.<sup>355,356</sup> Urinary retention is a common complication following any major surgery, particularly in elderly men. However, the risk of retention requiring catheterisation is much increased with the use of epidural anaesthesia.<sup>357</sup> A randomised controlled trial of patients having joint replacement surgery has concluded that the use of an indwelling catheter, inserted during the operation and removed the next day, reduces the short- and long-term risks of urinary retention without increasing the risk of urinary infection.<sup>358</sup> Such practice might well prove more acceptable to patients and more cost-effective than urgent catheterisation with the patient fully conscious.

Bilateral arthroplasty may be performed at the same operation. This inevitably involves a longer period under anaesthetic for the patient and a fairly punishing period of rehabilitation, although length of hospital stay per joint is reduced and the procedure is therefore cheaper. In general, only a minority of surgeons would regularly consider carrying out this operation<sup>359</sup> and even then, younger, fitter individuals tend to be selected.<sup>360</sup> While one study reported that patients who are 80 years of age or above appear to be at an increased risk of cardiovascular and neurological post-operative complications during concomitant bilateral TKR, no such findings have been reported for the equivalent THR procedure.<sup>361,362</sup>

Following arthroplasty, one of the most serious possible complications is deep wound infection. The rate of such infections has been reported as between 0.5 and 2%.<sup>363,364</sup> The more recent use of prophylactic gentamycin-impregnated cement has been shown to reduce the risk of deep infection by comparison with systemic antibiotics in a randomised controlled trial, but the effect did not extend beyond the first year following surgery, which may limit justification for routine use on the grounds of cost.<sup>365</sup>

### *Specific considerations regarding the effectiveness of THR*

A recent structured review of outcomes in primary THR<sup>366</sup> concluded that, given the poor quality of evidence overall, it was not possible to distinguish and recommend any particular prosthesis for use by the NHS in preference to any other. However, the report also concluded that it was hard to justify the use of cementless prostheses at present, and that the more expensive the prosthesis was, the more difficult it was to provide any justification for its selection. One consideration that may make good sense, however, and this consideration applies equally to TKR, is that which takes account of possible trouble in the future, so that prostheses which are conservative of bone stock and which can be removed easily give a better and more successful basis for future revision.<sup>201</sup>

Apart from the many systemic complications that may follow any major surgery, a number of more specific complications may follow THR and the likely positive effects of the operation need to be balanced against the risks concomitant with any major surgical procedure. For example, data for all elective THRs performed in 10 hospitals in the Oxford region during 1976–85 revealed a rate of eight emergency re-admissions per 1000 THRs within 28 days following discharge and 11 deaths per 1000 within the first 90 days following THR – both rates increased with age.<sup>367</sup> Most of the deaths or re-admissions to hospital were associated with thromboembolic or cardiovascular events.

Aseptic loosening of one or more of the components is a particularly serious long-term complication which may affect either or both of the components but which results from a different mechanism in each case.<sup>368</sup> Particular makes of prosthesis are, from time to time, identified with an abnormally early propensity to loosening,<sup>369</sup> otherwise, the incidence of radiographic loosening of cemented femoral components is between 30 and 50% and between 10 and 15% for the acetabular component, 10 years following insertion.<sup>336,370</sup>

An earlier and far more common occurrence following THR is periarticular heterotopic ossification. This may cause severe problems in around 2–3% of patients, but may be treated successfully by surgical excision combined with radiation treatment.<sup>198</sup> Indeed patients at high risk of this condition may be treated prophylactically with radiation therapy<sup>373,374</sup> or indomethacin.<sup>373</sup>

Dislocation or subluxation of the prosthesis is a complication that more commonly occurs following THR than TKR, generally within the first 6 weeks following surgery. It is associated with poor positioning of the prosthesis by the surgeon or with malpositioning of the patient post-operatively and affects between 1 and 3% of cases.<sup>335,374,375</sup> Recurrent dislocation is an indication for revision surgery, although where the position of the implant is satisfactory and the problem caused by weak abductors the condition may be managed conservatively with bracing and training.<sup>375</sup>

Other possible complications of THR include nerve damage (or palsy) from the surgery, occurring in around 1% of cases<sup>376,377</sup> and fracture of an implant component or periprosthetic fracture. Component breakage is now much less common than it used to be and periprosthetic fracture most commonly results from a fall.<sup>378,379</sup>

Despite all the risks associated with major surgery in elderly people there is evidence nevertheless to suggest that THR is more successful and cost-effective for elderly women than for any other group of patients and that advanced age should not be considered a barrier to this type of surgery.<sup>380,381</sup> In addition, there is a suggestion that the – often increased – length of stay for high-risk patients may relate to the timing of rehabilitation and is therefore, potentially modifiable. For example, a recent randomised

## 594 Osteoarthritis Affecting the Hip and Knee

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controlled trial<sup>195</sup> was carried out of third day versus seventh day commencement of intensive inpatient rehabilitation by physiotherapy and occupational therapy for high-risk patients (over 70 years of age with considerable co-morbidity). This study showed that those who were assigned the third day protocol required significantly fewer days in hospital at lower cost. Change scores obtained by patient-based outcome measures before and at 4 months following surgery did not differ. This study would seem to support the early initiation of rehabilitation for THR without the risk of adversely affecting outcomes.

### *Specific considerations regarding the effectiveness of TKR*

A recent UK survey of surgical techniques in TKR<sup>191</sup> revealed that there were 41 different knee implants in use of which five constituted 61% of the total and while the majority of prostheses now used are of the total condylar resurfacing type, a few surgeons nevertheless continue to use hinged varieties associated with poorer outcomes.<sup>191,382,383</sup>

The type of prosthesis used is only one of a number of technical elements which may influence the ultimate outcome following TKR. One important factor, on which there appears to be no consensus, is whether or not the patella undergoes resurfacing.<sup>384,385</sup> A badly arthritic patella will not track well in the femoral groove and this can lead to complications, however, complications may also arise following resurfacing. Management of the patella and balancing the patellofemoral joint space to avoid maltracking and subluxation is considered to be one of the more difficult aspects of primary TKR surgery which becomes even more difficult in the revision situation.<sup>386</sup> At present, 32% of surgeons report that they always resurface the patella, while 19% say that they never do.<sup>191</sup>

Another issue has to do with the timing of an operation in relation to the stage of the disease. For example, most cases of knee OA begin in the medial compartment only,<sup>387</sup> which suggests that UCA, which may be performed at an earlier stage than TKR, before the anterior cruciate ligament becomes destroyed, might be the most appropriate choice of operation. An additional technical consideration concerns whether the prosthesis is fixed in place with cement or left uncemented. In the UK, 95% of TKRs are cemented. This practice appears to be associated with good results<sup>331,398</sup> and is the cheaper option.<sup>191</sup>

Age is just one of a number of relative contraindications which apply to TKR to a greater extent than to THR and the decision to proceed with TKR in younger individuals should certainly be weighed against all possible alternatives, e.g. tibial osteotomy.<sup>200</sup> Overweight patients are generally considered to be poor candidates for TKR. However, evidence in support of this stance is fairly mixed and, on balance, suggests that while the results achieved by obese versus non-obese patients are not as good, early to medium-term outcomes are not significantly compromised by the patient's weight.<sup>388-392</sup>

Following TKR, complications involving the patella are the most common.<sup>393,394</sup> The main problems include patellar dislocation,<sup>395</sup> stress fractures,<sup>396</sup> avascular necrosis,<sup>397</sup> progressive erosion of the articular cartilage in the unresurfaced patella<sup>204</sup> and loosening of the patellar prosthesis.<sup>398</sup> The likelihood of patellofemoral complications may be increased with the use of some types of implant, although evidence for this is sparse.<sup>399</sup> Overall, the majority of such problems are, in any case, very often self-limiting and may simply be managed with medication, exercises and bracing.<sup>393</sup>

As with THR, aseptic prosthetic loosening is the most common serious long-term complication following TKR. This almost never affects the femoral component, but occurs at the junction between the tibial component and the underlying tibial bone.<sup>199</sup> While tibial component loosening has been related to poor surgical technique,<sup>400</sup> the trabecular bone of the proximal tibia is often abnormally weak in people with OA. It has been suggested that metal-backed tibial components offer the best results with regard to this problem.<sup>199,400</sup>

As with THR, other complications include occasional, usually transient, nerve damage<sup>401</sup> and, more importantly, deep infection. This latter complication affects between 0.5 and 2% of knee arthroplasties.<sup>363,364</sup>

In a large prospective study carried out in Sweden, the probability of revision due to infection was reported to be 2% within 6 years, for patients with OA.<sup>402</sup>

## Models of care/recommendations

This section considers a number of scenarios for the management of hip and knee OA and explores the possible consequences of these models. The models are intended to complement one another and are not intended as alternative approaches.

### *The public health emphasis*

Current evidence would suggest that the prevalence of OA is likely to increase over the next 30 years.<sup>9–11,403</sup> The lack of mobility that results from moderately severe OA symptoms of a lower limb joint can propel individuals towards a rapid deterioration in general health and cardiovascular fitness. This is often further potentiated by other co-morbidity.<sup>7,404</sup> Such indirect effects and costs of OA represent some of the many important variables that are exceedingly difficult to evaluate and quantify.

It is clearly more desirable to prevent or at least delay symptomatic OA in whatever ways are feasible, rather than concentrating all efforts on expensive treatments and technologies for the minority of patients who are in the end-stage of the disease. By addressing known modifiable risk factors, primary prevention interventions could theoretically delay or, in some cases, prevent the development of OA in a significant number of people. The high prevalence of hip and knee OA among elderly people, together with evidence of a number of known risk factors, means that this area is an ideal target for future public health interventions. The following areas deserve particular attention:

- 1 Exercise. Increasingly sedentary lifestyles with low levels of fitness contribute substantially to the major chronic diseases prevalent in industrial societies.<sup>405</sup> Regular moderate (but not excessive) levels of low-impact exercise may assist in delaying the onset of symptomatic hip and knee OA and the associated loss of mobility.<sup>257–259</sup> Exercise can certainly alleviate the symptoms of established OA in some people.<sup>257–260</sup> Indirect effects of exercise that are relevant to OA include the favourable influence on body fat distribution and maintenance of weight loss.<sup>406</sup> Public health initiatives should aim to increase general awareness of the benefits of exercise for this and other conditions.
- 2 Obesity. Obesity is an important modifiable risk factor for both hip and knee OA, but has particular relevance for women and OA of the knee.<sup>85,127</sup> The avoidance of obesity should be a primary target for prevention in both men and women.<sup>63</sup>
- 3 Occupational factors. OA of the hip is, in many cases, an occupational disease. There is a need for increased education and raised awareness among employers and workers, particularly men, whose work involves regular lifting. Where appropriate, lifting aids and machinery should increasingly be provided and working conditions modified.
- 4 Screening is particularly relevant to the hip. Congenitally abnormal joints have an increased likelihood of developing OA of early onset.<sup>240,241,407</sup> Screening programmes require high sensitivity to be cost-effective and neonatal screening does not meet this requirement currently. The evaluation of alternative or additional methods of screening such as ultrasound or routine examination once children begin to walk is strongly recommended, but overall, it is suggested that such efforts should be concentrated on babies that are of increased risk. Risk factors for congenital dysplasia appear to include family history, breech presentation, female sex, oligohydramnios and primiparity.<sup>408–412</sup>

There is little evidence to support the use of other large-scale screening programmes at present. In particular, the use of biological markers of OA (currently being developed) to identify people with

asymptomatic disease could not be recommended before effective disease-modifying technologies are available.

### *The service emphasis*

Here changes in existing services are considered. Evidence that relates to the availability of effective treatments and their associated risks as well as the appropriateness of health care setting and personnel will be addressed.

### **Medical training**

In view of the large and increasing prevalence of OA, all doctors require training in the management of musculoskeletal problems. Primary care physicians also need continuing training to include this emphasis because many will have received inadequate training at medical school, but also because guidelines in the prevention and management of OA will continue to change with improving therapies. Current recommendations on the use of medications to manage OA of hip or knee are summarised below.

### **Summary of recommendations on the use of medications in the management of hip and knee OA**

It is vital that practitioners obtain complete information on any over-the-counter preparations that patients already use before systemic preparations are prescribed. This may also facilitate discussion and guidance about the potential for serious side-effects from NSAIDs which are becoming increasingly available to people without prescription.

A moderate level of pain requires effective pain management and this usually requires analgesia to be given in anticipation of, rather than in response to, pain. The initial choice should be paracetamol 0.5–1 g given 4–6 hourly, up to a maximum of 4 g/day.<sup>132</sup> Paracetamol is available in soluble form for patients who do not like taking tablets. Alternatively, or for those who find paracetamol inadequate, topical NSAIDs may help, e.g. ibuprofen, and capsaicin cream may prove even more effective. However, this latter preparation can produce a localised burning sensation which some people will not tolerate. Topical forms of treatment may nevertheless appeal to those who already take a number of regular oral forms of medication, they also encourage massaging the affected joint – which many find additionally helpful.

Codeine phosphate, nefopam hydrochloride or combined preparations such as co-proxamol are often preferred by patients although there is little evidence that they work better than paracetamol and they can be associated with side-effects.<sup>414,415</sup> The use of stronger opioid analgesics should be avoided as they are likely to increase the risk of falls and accidents.

NSAIDs, including aspirin, should only be considered when simple analgesics are found to be inadequate for pain control or during inflammatory stages of the disease. The chief consideration at present is the high cost of the side-effects – particularly in those with any prior history of indigestion or gastrointestinal ulceration or those with renal insufficiency. In addition, other drugs are known to interact with NSAIDs, such as diuretics, anti-hypertensives, anti-coagulants or lithium.

While the newer highly selective COX-2 inhibitors, such as celecoxib, are associated with fewer gastrointestinal events,<sup>175</sup> the renal side-effects may remain even when used at a relatively low therapeutic dose<sup>415</sup> and their long-term evaluation has not yet occurred. They are also relatively expensive. With older varieties of unselective NSAIDs, the wide diversity of action and side-effects results in considerable variation in patient tolerance and response to different preparations, and the prescribing of NSAIDs may



therefore involve an element of 'trial and error'. For the moment, it is recommended that well-established formulations are chosen. These include ibuprofen – which can also be obtained over-the-counter. Those that have been in use the longest are the least likely to produce idiosyncratic side-effects, they are available in generic form and are therefore much cheaper. Ibuprofen is one of the best tolerated of all NSAIDs, while indomethacin should be avoided.

Concomitant therapy with H<sub>2</sub> is not recommended as it can prove harmful in the longer term – suppressing symptoms, but not necessarily the effects of NSAIDs.

### **Improvements in dissemination of information and advice to GPs**

Many GPs would welcome guidelines based on best current evidence and expert consensus regarding appropriate management and referral practices for patients with OA. There is a need for guidelines that are evidence-based, but a number of specialist consensus guidelines does exist. However, such information is frequently published in specialist journals – rather than the more general medical journals that GPs are most likely to read. Consensus guidelines might also be made available to GPs via the Internet and this would seem to represent a relatively inexpensive initiative.

A *BMJ* editorial concluded that most protocols raise standards of care and most do more good than harm for patients.<sup>416</sup> The ability to telephone hospital consultants for advice is also considered to be extremely helpful by the proportion of GPs who already have this arrangement. The Internet may, in time, also make possible consultations that avoid the need for some patients to attend outpatient appointments. An increase in such communication channels is to be encouraged. The expansion of rheumatology and orthopaedic specialist outreach clinics might also increase GPs' skills and expertise,<sup>235</sup> although this would obviously need to be weighed in terms of resource allocation and would require a thorough evaluation.

Comprehensive information needs to be provided for GPs concerning the local availability (and costs) of services – physiotherapy, day centres, occupational therapists, health visitors, social workers and so on, in one source book (or Internet site) that is updated regularly. This seems an obvious requirement and there is certainly much room for improvement in this area, particularly as GPs are very keen to refer their patients directly to physiotherapy and other services without the need to involve hospital outpatient clinics. The responsibility for providing this service also needs to be decided, perhaps centrally. At present, no one carries this responsibility. Inadequate information results in inappropriate referrals to specialists in some circumstances and, on other occasions, presumably results in no referral being made where one might have been appropriate. This is most certainly an area of unmet need.

### **Improvements in access to PAMs by GPs and expansion of these services and roles**

Assessment by a physiotherapist with orthopaedic experience (either community or hospital based) is recommended for many patients when they first present with signs of OA of the hip or knee. Practical treatment can then be initiated promptly with the potential to reduce symptoms and the associated need for medications. Physiotherapy can also halt the progression of physical decline – or reduce the speed of decline – into disability and dependency. This strategy has the potential to reduce the pressure on outpatient departments, as it would encourage more appropriate referral practices – particularly if referral and triage were to be influenced by physiotherapists. Waiting times could also be reduced in this way. An increased role for physiotherapists and an expansion of this and other services provided by PAMs nevertheless carries major resource implications.<sup>226</sup>

In addition, the regular monitoring of patients with established OA – perhaps with the assistance of nurse practitioners – could improve patients' sense of social support, check their understanding of exercise and drug regimens and assist their compliance with medication. This could reduce GPs' workload. Regular

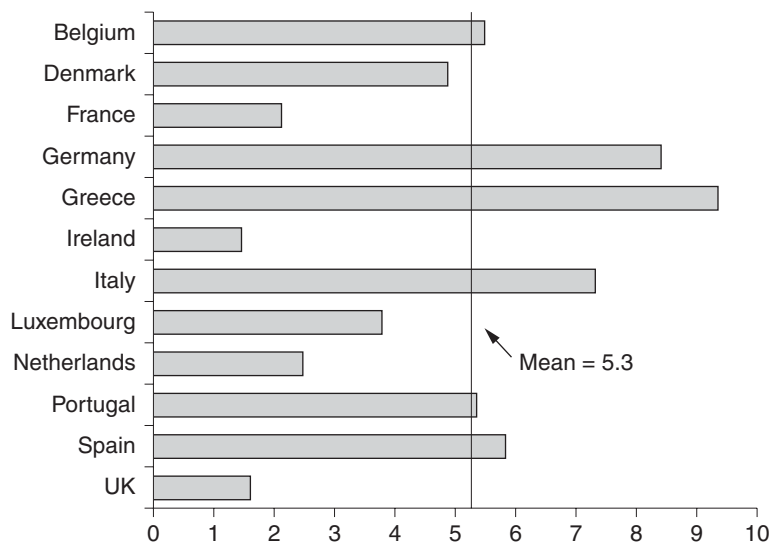
## 598 Osteoarthritis Affecting the Hip and Knee

appointments would mean that any adverse effects of drugs might also be detected sooner. An extension of the roles of specialist PAMs and nurses would need to find acceptance with medical personnel and be assessed on the basis of cost-effectiveness.

### *Improving the availability of specialist services*

The likely increase in the prevalence of hip and knee OA suggests that demand for specialist services will increase over the next 30 years. This has serious implications given that rheumatology has always been undermanned in England and Wales, with many districts having grossly inadequate rheumatology cover during 1983–90. During this period it was also shown that 25% of rheumatology doctors at senior registrar level had had little prior experience in rheumatology.<sup>112</sup>

A report published in 1995 by the British Orthopaedic Association (BOA)<sup>417</sup> was no more reassuring. The report stated that, in 1992, the delay experienced by patients in Britain between referral and being seen by a specialist was ‘at the extreme end of the European spectrum’. Furthermore, that there was only one orthopaedic consultant for every 62 000 people in England and Wales and that if the number of consultants were to be doubled, this would still represent a ratio below the average for most other European countries (Figure 18) and would still make no allowance for unmet need and the projected increasing numbers of patients requiring more time-consuming treatment in the future (e.g. patients with complex injuries resulting from sports and high-speed travel and the higher rate of survival of premature babies).



**Figure 18:** Orthopaedic surgeons to 100,000 population in various European countries (reproduced from British Orthopaedic Association. *Consultant Staffing Requirements for an Orthopaedic Service in the National Health Service*. London: BOA, 1995, pp. 1–27).<sup>417</sup>

The report recommended that no patients should wait longer than 16 weeks for an outpatient appointment, but conceded that, at that time, the average wait was 24 weeks with only nine of 161 units able to report waits of 6 weeks or less for a new outpatient appointment.

In response to the BOA report, the Chairman of the BMA’s Central Consultants and Specialists Committee stated that an extra 1000 consultants a year were needed for at least 5 years on top of the

standard 2% expansion, and that, if all else failed, there would have to be a massive expansion of subconsultant grades instead.<sup>418</sup>

An obvious recommendation is that this situation should be taken extremely seriously by the government of the day, with more resources targeted towards the expansion of rheumatology and orthopaedic provision. However, even if this were to occur, a medium-term shortfall is inevitable.

Frankel *et al.*'s west of England study<sup>16</sup> generated incidence rates from which a population annual requirement for THR was derived. This requirement was put at 46 600 operations. They calculated that 'actual provision' in England for the same period was 43 500 operations and concluded that current provision of THR surgery is '... of the same order as the incidence of new cases meriting surgery' and that '... demand for the intervention, given agreement on indications, is [therefore] a realistic objective'. These conclusions nevertheless included both NHS and independent sector operations as representing 'provision' and some might question whether surgery carried out in the independent sector should be considered as equivalent to NHS provision, since it is clearly not equally available to all.<sup>419</sup>

No equivalent data are available for TKR surgery. However, given that symptomatic knee OA is more prevalent than hip OA, the lower numbers of TKR operations relative to THR would appear to represent a substantial unmet need at present. A national prevalence rate is far less useful than an incidence rate (which cannot be calculated with any confidence) and each is, in any case, constructed against a background of considerable variation in surgical activity at district level (Figure 16). It is therefore important that purchasers make assessments of the amount of demand that is met for joint replacement surgery based on their resident population. It is important that such analyses are performed taking account of evidence of unexplained variations in the volume of and access to specialist services within the NHS.

It is necessary to use rates standardised for age and sex for determining a district THR or TKR requirement. Reasonable estimates of what constitutes 'appropriate levels of surgery' might be forthcoming if the variation in standardised rates for THR and TKR could be explained fully. However, surgical activity at the district level results from the complex interrelationships of need, supply, demand and the influence of clinical decision-making. It also encompasses both NHS and private activity.

## Quantified need for services

### *Severe symptomatic hip disease*

Frankel *et al.*<sup>16</sup> estimated that, among a large cross-section of people aged 35–85, 143/1000 people reported symptomatic hip disease and 15.2/1000 people had disease severe enough to require surgery – although the annual incidence of hip disease severe enough to require surgery was estimated at 2.23/1000 population. These estimates used population figures taken from the 1991 census. Other findings from the same study were that, within a 12-month period, approximately one-third had consulted a GP about hip pain, around 7% were currently awaiting an outpatient appointment and 2% were awaiting surgery.

A different study<sup>115</sup> reported that of those referred to a specialist for symptomatic OA, specialist referral will likely occur in a 4:1 ratio between orthopaedic surgeons and rheumatologists respectively. Using this information, together with HES figures on actual hospital activity (which includes people of all ages) and reference costs (Table 6), we calculated cost estimates for a hypothetical population of 100 000 people (Table 8, *see overleaf*). An alternative calculation is then presented which assumes that 25% of those currently treated by surgery will instead be treated conservatively (Table 9, *see p. 603*). This somewhat arbitrary percentage has been adopted purely to illustrate the extent to which costs might be affected by such a change. The second calculation assumes that GP visits would increase by 50% and that the number of physiotherapy referrals would double. It also assumes a 100% shift (increase) towards the use of COX-2 selective NSAIDS (taking one example), as well as a doubling in the length of course for all medications for people with severe hip OA.

## 600 Osteoarthritis Affecting the Hip and Knee

**Table 8:** Illustrative annual costings for OA of the hip based on a population of 100,000.

Service/procedure		Unit cost	Total cost
Consulted GP about hip pain – 4,767 cases			
<i>Of whom:</i>			
9% referred to consultant – 429 cases	{ 1 GP visit, incl. 2% home visits (h/v)	{ 420 @ £10 in GP surgery 9 @ £30 h/v	
5% referred for physiotherapy, remainder not referred altogether – 4,338 cases	{ 2 GP visits, incl. 2% home visits (h/v)	{ 4,251 × 2 @ £10 in GP surgery 87 × 2 @ £30 h/v	£94,710.00
Prescribed medicines (40%):		1998 prices: <sup>470</sup>	
Co-codamol 8/500 (48 mg/3 g daily) – 477 cases (10%)		20 × 8/500 mg = 23p = £4	
Ibuprofen (1.2 g daily) – 477 cases (10%)	56 day course:	20 × 400 mg = 32p = £3	
Diclofenac Sodium (100 mg daily) – 477 cases (10%)		20 × 50 mg = £1.29 = £7	
Meloxicam (7.5 mg daily) – 477 cases (10%)		30 × 7.5 mg = £10 = £20	£16,218.00
Direct referral to NHS physiotherapist 238 – cases (5%)	1 hour per person	@ £30 per hour	£7,140.00
NHS specialist referral – 334 cases (7%)	Rheumatology Orthopaedics	86 @ £68.57 248 @ £53.87	£19,256.78
No surgery/2 NHS O/P visits – 253 cases	Rheumatology Orthopaedics	63 × 2 @ £68.57 190 × 2 @ £53.87	£29,110.42
Private specialist referral – 95 cases (2%)		95 @ £80	£7,600.00
No surgery/2 private O/P visits – 71 cases		71 × 2 @ £80	£11,360.00
NHS surgical rates (all ages/all diagnoses) based on 1995–96 HES data:			
Primary THR NHS – 71 cases	33,320/47,055,204 × 100,000	71 @ £3,737.00	£265,327.00
Outpatient visits × 3 – 71 cases		71 × 3 @ £53.87	£11,474.31
Primary THR private – 22 cases	10,400/47,055,204 × 100,000	22 @ £7,500	£165,000.00
Outpatient visits × 3 – 22 cases		22 × 3 @ £80	£5,280.00
Revision THR NHS – 10 cases	4,637/47,055,204 × 100,000	10 @ £4,613.00	£46,130.00
Outpatient visits × 3 – 10 cases		10 × 3 @ £53.87	£1,616.10
Revision THR private – 2 cases	1,000/47,055,204 × 100,000	2 @ £9,500	£19,000.00
Outpatient visits × 3 – 2 cases		2 × 3 @ £80	£480.00
		TOTAL	£562,377.83

**Table 9:** Illustrative annual costings for OA of the hip based on a population of 100,000 assuming a 25% decrease in the numbers of NHS patients treated surgically

Service/procedure		Unit cost	Total cost
Consulted GP about hip pain – 4,767 cases			
<i>Of whom:</i>			
9% referred to consultant – 429 cases	{ 1 GP visit, incl. 2% home visits (h/v)	{ 420 @ £10 in GP surgery 9 @ £30 h/v	
10% referred for physiotherapy, remainder not referred altogether – 4,338 cases	{ 3 GP visits, incl. 2% home visits (h/v)	{ 4,251 × 3 @ £10 in GP surgery 87 × 3 @ £30 h/v	£136,050.00
Prescribed medicines (40%):		1998 prices <sup>a</sup>	
Co-codamol 8/500 (48 mg/3 g daily) – 238 cases (5%)		20 × 8/500 mg = 23p = £8	
Ibuprofen (1.2 g daily) – 238 cases (5%)	112 day course:	20 × 400 mg = 32p = £6	
Diclofenac Sodium (100 mg daily) – 477 cases (10%)		20 × 50 mg = £1.29 = £14	
Meloxicam (7.5 mg daily) – 954 cases (20%)		30 × 7.5 mg = £10 = £40	£48,170.00
Direct referral to NHS physiotherapist – 476 cases (10%)	1 hour per person	@ £30 per hour	£14,280.00
NHS specialist referral – 334 cases (7%)	Rheumatology Orthopaedics	86 @ £68.57 248 @ £53.87	£19,256.78
No surgery/2 NHS O/P visits – 278 cases	Rheumatology Orthopaedics	69 × 2 @ £68.57 209 × 2 @ £53.87	£31,980.32
Private specialist referral – 95 cases (2%)		95 @ £80	£7,600.00
No surgery/2 private O/P visits – 71 cases		71 × 2 @ £80	£11,360.00
NHS surgical rates (all ages/all diagnoses) based on 1995/96 HES data:			
Primary THR NHS – 53 cases	33,320/47,055,204 × 100,000	53 @ £3,737.00	£19,8061.00
Outpatient visits × 3 – 53 cases		53 × 3 @ £53.87	£8,565.33
Primary THR private – 22 cases	10,400/47,055,204 × 100,000	22 @ £7,500	£165,000.00
Outpatient visits × 3 – 22 cases		22 × 3 @ £80	£5,280.00
Revision THR NHS – 7 cases	4,637/47,055,204 × 100,000	7 @ £4,613.00	£32,291.00
Outpatient visits × 3 – 7 cases		7 × 3 @ £53.87	£1,131.27
Revision THR private – 2 cases	1,000/47,055,204 × 100,000	2 @ £9,500	£19,000.00
Outpatient visits × 3 – 2 cases		2 × 3 @ £80	£480.00
		<b>TOTAL</b>	<b>£480,748.92</b>

## 602 Osteoarthritis Affecting the Hip and Knee

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In each case, our estimates for services/procedures other than joint surgery do not take account of people aged 85 and above, although costs relating to surgical procedures do. People aged 85+ account for around 2% of THR surgery and – presuming that those unfit for surgery are most likely to be among the very elderly – it may make sense to add around 4% to the cost estimates for services/procedures other than joint surgery to take account of these individuals. The figures presented here are in many cases rough approximations and should only be used or interpreted with extreme caution. There are many hidden costs and large areas of uncertainty. Changes in any of these areas will directly affect any estimates.

### *Particular points of uncertainty*

The use of over-the-counter medicines as well as GP prescribing practices for OA of the hip and knee.

- The proportion of GP consultations that are home visits – we have assumed 2% – but the proportion is likely to increase in line with the advancing age of patients.
- The proportion of patients that GPs refer directly for physiotherapy before considering (or while awaiting) specialist referral.
- The proportion of patients with moderate to severe symptoms who do not seek, or who refuse, treatment.
- The extent to which partners, family and other informal carers provide nursing and other services for people relatively disabled by hip or knee OA.
- Additional treatment/hospitalisation required due to side-effects of medication and whether these will be reduced with next generation NSAIDS.
- Regional variation in referral practices of GPs and hospital specialist provision.
- The proportion of patients who require hospital transport for outpatient appointments.
- The number of arthroscopies, osteotomies and other operations – apart from total joint replacement – that are carried out for OA hip or knee.
- Variations in length of stay due to post-operative complications and number/cost of post-operative re-admissions.
- Availability, uptake and costs of residential convalescence facilities.

Comparison of the two models implies a reduction in costs of around 15% to the NHS by adopting the second model. It cannot be stressed too strongly that this model says nothing about the change in benefit to the patient and that no conclusions may be made regarding cost-effectiveness. Also, it is perfectly possible that the patients who were denied surgery would seek private treatment. While this cost would not fall upon the NHS directly it would represent an indirect cost – since some resources are shared – as well as a cost to individuals, insurance companies and ultimately, to society as a whole.

### **Severe symptomatic knee disease**

Cost estimates for OA of the knee are even more problematic than for the hip due to the lack of population prevalence and incidence data which reliably takes account of symptoms. Based on study figures reported earlier (summarised in the sections on prevalence of OA of the hip and knee), it would be safe to assume that 50% more people are affected by severe symptomatic OA of the knee than the hip with around 22/1000 having disease severe enough to require surgery. Using these assumptions it would be possible to adjust the tables on illustrative costings accordingly. Particular points of uncertainty are identical – although the lower level of surgery relative to the apparent scale of the problem requires explanation.

## 7 Outcome measures

Until relatively recently, a fundamental reason for the lack of adequate outcome studies in OA and OA-related orthopaedic surgery, has been to do with the lack of standard acceptable outcome measures.<sup>222,368,422,423</sup> For example, the sensitivity and interpretation of methods used to measure and assess outcomes for OA has often been fairly crude and it has become increasingly clear that clinical assessments of key aspects of outcome (e.g. pain, physical function, range of joint movement) are often inaccurate and not reproducible.<sup>422</sup> Clinical assessments may also overly represent concerns of the clinician, rather than those of the patient.

An alternative method is to use patient-based outcome measures of pain, function, health-related quality of life and satisfaction. Such measures (questionnaires) – which are generally used as an adjunct to, rather than a replacement for clinical assessments – may provide data that are standardised, reliable, valid, sensitive to change and assess matters of immediate concern to patients.<sup>423–427</sup> An additional merit of these measures is that they render large clinical trials more feasible than is the case where all outcomes are to be assessed by a clinician,<sup>220,428</sup> because following up large numbers of people for a reasonable period is both problematic and costly – particularly if hospital visits and clinical examinations are involved. This partly explains why few high-quality studies have been carried out in the past.

A number of patient-based general health and condition-specific measures has now been developed for application in clinical trials of treatments for OA, e.g. the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Lequesne Index,<sup>134,220</sup> and more specifically for the evaluation of THR and TKR, e.g. The Oxford hip and knee scores.<sup>426,427</sup> Such measures are designed to compare outcomes between different study populations and treatment groups and are not generally appropriate for the assessment and monitoring of symptoms in individuals.

Outcomes that are considered following treatment for OA, and in particular, outcomes following surgical treatment, are usually long-term. For example, measurable differences in the relative effectiveness of different joint prostheses may not become evident for 8–10 years and for this reason, many studies of outcomes are retrospective. In the absence of acceptable patient-based measures, a large number of studies to evaluate different joint prostheses tended to focus on rates (and timing) of revision surgery as the main outcome of comparison, frequently using a method called survival analysis.<sup>429</sup> Using the event of revision surgery in this way is problematic because it ignores the fact that there are people who have had an unsatisfactory outcome but who do not have revision surgery. Also, the timing of revision surgery may be related to the availability of health services rather than patients' need and will almost certainly involve a lag. The 'survival' and success of joint prostheses is necessarily exaggerated by this method therefore, and it may be that patient-based measures are able to reveal important symptom-based differences in outcomes at an earlier stage following treatment and thereby reduce the period of follow-up that is needed. However, because the more highly condition-specific measures have only been in use for a relatively short time, evidence concerning the full extent of their usefulness (as well as any shortcomings) in detecting such differences is only starting to become available.<sup>108,430,431</sup>

## 8 Information and research requirements

This section signals priorities important to the accumulation of evidence which would allow for informed judgements to be made by purchasers and providers. A number of these priorities relates to primary care and the primary/secondary care interface. For example, GPs have unfortunately only been obliged to provide any numbers or details regarding hospital referrals since April 1990 and such figures which are now available may be difficult to interpret.<sup>115</sup> An example concerns the lack of available statistics on the

## 604 Osteoarthritis Affecting the Hip and Knee

conditions most commonly referred to outpatient clinics, reasons for referral or characteristics of those patients who are referred.

In addition, the quality and consistency of coding categories and detail of routinely collected data which relate to primary care and hospital outpatient activity are generally poor. This severely hampers any attempt to provide a clear picture of overall care and provision for people with OA (let alone OA which specifically affects the hip or knee). Thus, data gathered from different sources will report on groups with 'arthritis and related conditions', 'joint pain' or 'conditions of the musculo-skeletal system' – all somewhat vague terms that are overly inclusive.

Another problem for GPs concerns the dissemination of relevant information about the availability of services that are accessible to them. At present, GPs acquire knowledge of local services in an unsystematic and haphazard fashion. Some information is acquired as a part of continuing medical education (R Walton, personal communication) otherwise very little information comes directly from health authorities and the dissemination of guidelines and details of available local services is currently the responsibility of individual institutions and service providers and – perhaps surprisingly – such information is not generally available to GPs in one local source book, although some variation is likely across different health care regions in this regard. (GPs used to receive a directory of relevant people and services, all in one booklet, from HAS/FHSAs. However, the last one was produced in 1993 and since then, with changes in health care funding, this was felt to be a 'provider' responsibility; T Jones, personal communication.) It is hoped that Internet websites may go some way towards fulfilling this function, becoming routine over the next few years. (For example, OXWAX, a software package providing a comprehensive library of medical news updates and available local services, is soon to be used in GP practices throughout the Oxford Region.) Although this would require someone to take responsibility for regularly updating the information, which would obviously have cost implications. For the moment, information on services is not widely available in any useful format, in the NHS (T Lancaster, personal communication; J Bradlow, personal communication).

At the level of secondary care, organisational changes in the NHS have led to the hasty development of 'performance indicators', league table comparisons between hospital trusts and suchlike. Many believe that these kinds of measures are currently too simplistic or ill thought-out.<sup>433</sup> Certainly, comparisons between different institutions may, at times, prove misleading. This is because data obtained from different institutions are likely to be of variable quality. However, comparisons between institutions based on such data are also unlikely to involve adequate adjustment for differences in case-mix that will almost certainly exist between trusts.<sup>434</sup>

Overall we have identified the following information priorities which relate to OA of the hip and knee:

- improvements in recording and accuracy of diagnostic and treatment details in computerised primary care databases and hospital information systems
- the accurate recording and availability of data on private THR and TKR surgery for district residents, to include demographic data
- the establishment of terse, acceptable and standard methods of adjusting outcomes data for differences in case-mix. This represents a formidable challenge to the research community<sup>435,436</sup>
- the availability of inpatient and medium-term morbidity and mortality data for the 90 days following joint replacement surgery providing absolute figures and figures adjusted for case-mix
- the establishment of clear criteria for specialist referral (to include the consideration of rheumatologist vs. surgeon) and for surgical intervention for clinicians in primary and secondary care, with the aim of better defining and identifying those most likely to benefit
- audit of the outcomes of THR and TKR surgery to include standard measures, providing failure rates – unadjusted and adjusted for case-mix – for the benefit of purchasers and providers alike



- the development of protocols for auditing methods and outcomes measures
- to obtain estimates of the prevalence of local met demand in terms of successful and unsuccessful primary THR and TKR surgery in the district resident population. These estimates should include the use of standard patient-based measures of outcome
- an assessment of the costs and benefits of THR and TKR for varying severity of OA, to assist in setting priorities for health care provision.

With some considerable planning and adequate resources, the establishment of national THR and TKR registers could theoretically help to bring about many of these suggestions within one efficient framework.

## Appendix I The analysis of routine health service data

### Diagnostic and operation codes

A tenth edition of the *International Classification of Diseases* (ICD-10) was published in 1993 and was used for all Hospital Episode Statistics (HES) data from 1995–96 onwards.

The NHS Centre for Coding and Classification counsels that, owing to changes in medical knowledge and the requirements of classification itself, there will have been significant changes between the ninth and tenth revisions of the ICD and state that: ‘absolute continuity in all, or even most areas of data is not possible and should not be sought’. Such changes are likely to affect the HES data presented in this chapter and their interpretation.

The International League against rheumatism is also currently working on a revision of the *Application of the International Classification of Diseases to Rheumatology and Orthopaedics* (ICD–R&O), including the *International Classification of Musculoskeletal Disorders* (ICMSD), to be compatible with ICD-10. This is designed to clarify and standardise the use of terms such as those which apply to the inflammatory polyarthropathies.<sup>465</sup>

### The International Classification of Diseases diagnostic codes

The most common diagnostic codes relating to OA and used in this chapter are shown in Table A1.

**Table A1:** Common ICD codes relating to OA.

ICD-IX code (in use prior to 1995)	ICD-X code <sup>a</sup> (in use since 1995)	Diagnosis
715	M15.0–M19.9	Osteoarthritis

<sup>a</sup>These codes are listed in much more detail below.

#### *Details of ICD-X codes which relate to OA*

Codes were kindly supplied by the NHS Centre for Coding and Classification, Leicester.

- M15 Polyarthrosis
- M15.0 Primary generalized (osteo)arthrosis
- M15.1 Heberden’s nodes (with arthropathy)
- M15.2 Bouchard’s nodes (with arthropathy)
- M15.3 Secondary multiple arthrosis
- M15.4 Erosive (osteo)arthrosis
- M15.8 Other polyarthrosis
- M15.9 Polyarthrosis, unspecified
- M16 Coxarthrosis [arthrosis of hip]
- M16.0 Primary coxarthrosis, bilateral
- M16.1 Other primary coxarthrosis
- M16.2 Coxarthrosis resulting from dysplasia, bilateral
- M16.3 Other dysplastic coxarthrosis
- M16.4 Post-traumatic coxarthrosis, bilateral

- M16.5 Other post-traumatic coxarthrosis
- M16.6 Other secondary coxarthrosis, bilateral
- M16.7 Other secondary coxarthrosis
- M16.9 Coxarthrosis, unspecified
- M17 Gonarthrosis [arthrosis of knee]
- M17.0 Primary gonarthrosis, bilateral
- M17.1 Other primary gonarthrosis
- M17.2 Post-traumatic gonarthrosis, bilateral
- M17.3 Other post-traumatic gonarthrosis
- M17.4 Other secondary gonarthrosis, bilateral
- M17.5 Other secondary gonarthrosis
- M17.9 Gonarthrosis, unspecified
- M18 Arthrosis of first carpometacarpal joint
- M18.0 Primary arthrosis of first carpometacarpal joints, bilateral
- M18.1 Other primary arthrosis of first carpometacarpal joint
- M18.2 Post-traumatic arthrosis of first carpometacarpal jt bilat
- M18.3 Other post-traumatic arthrosis of first carpometacarpal jt
- M18.4 Oth sec arthrosis of first carpometacarpal joints bilateral
- M18.5 Other secondary arthrosis of first carpometacarpal joint
- M18.9 Arthrosis of first carpometacarpal joint, unspecified
- M19 Other arthrosis
- M19.0 Primary arthrosis of other joints
- M19.1 Post-traumatic arthrosis of other joints
- M19.2 Secondary arthrosis of other joints
- M19.8 Other specified arthrosis
- M19.9 Arthrosis, unspecified

### ***Total hip replacement operation codes and definitions***

THRs may be primary or revision/conversion procedures. The strict definition of a primary THR is the replacement of the femoral head and the acetabulum. Should this primary operation fail, a repeat procedure, termed a revision, may be performed. This may necessitate replacement of the acetabular or femoral components, or both. It is occasionally necessary to convert to a THR following previous non-THR surgery of the hip.

For the purpose of estimating primary THR requirements the crucial distinction is between elective procedures and those emergency procedures carried out for hip fracture.

Owing to the uncertainties surrounding current coding practices,<sup>466</sup> the operational definition of primary elective THR in the analyses of HES data in this chapter is main procedures coded as THRs only where undertaken for conditions other than fracture (OPCS Operation Codes W37.0–W39).

We have not included operations coded as hemiarthroplasty which is invariably carried out for fractured femur. In addition, we have counted admissions rather than episodes. The latter can lead to double-counting. These are likely to represent differences in the way that HES data have been analysed by comparison with Williams *et al.*<sup>67</sup>

## 608 Osteoarthritis Affecting the Hip and Knee

### OPCS Operation Codes for hip replacement (Table A2)

Operations were considered to be primary where the third digit is .1, .8 or .9, and a revision/conversion procedure where the third digit is .2, .3, or .0.

**Table A2:** OPCS Operation Codes, 4th revision (1988 to present).

Code	Operation
W37–W39	Total hip replacements
W46–W48	Hemiarthroplasty <sup>a</sup>

<sup>a</sup> Replacement of the femoral head only which we have not included.

### The knee

TKRs include both femoral and tibial components and are performed almost exclusively as elective procedures. Surgery relating solely to the patellofemoral joint is not considered in our analysis.

#### OPCS operation codes

The OPCS operation codes for knee replacement are shown in Table A3. As with the hip and THR, there is diversity in coding practice.<sup>466</sup> Operations were considered to be primary where the third digit is .1, .8 or .9, and a revision/conversion procedure where the third digit is .2, .3, or .0.

**Table A3:** OPCS Operation Codes for knee replacement, 4th revision (1988 to date).

Code	Operation
W40–W42	Total knee replacements

The coding of TKRs does not suffer from the level of confusion evident with THRs, in which distinction between a true elective THR and a hemiarthroplasty can be particularly problematic. Comparison of the TKR cases recorded for the HES system with information from theatre records revealed 98% accuracy in a 1989–90 survey from six hospitals.<sup>67</sup> This may not be representative of the country as a whole.

### Data sources

The following data sources were used to examine aspects of activity levels that may relate to the need for total hip or knee replacement (THR/TKR) surgery:

- Hospital Episode System (HES) Data, England, 1989–90
- data on surgical activity in independent hospitals and NHS pay-beds from local and national surveys, and preliminary data from a current Nottingham-based study of independent sector surgical activity covering all of England and Wales (B Williams, personal communication).

### *National Health Service data*

NHS utilization data are fundamentally flawed as a measure of population requirements for surgery for the reasons given below.

- Problems of data quality and comparability over time. Trends are difficult to establish accurately when using data collected from any two different sources, e.g. the Hospital Inpatient Enquiry System (HIPE) and the Hospital Episode System (HES). In addition, the incompleteness and inaccuracy of data coding is a problem. Coding systems also change periodically, as was noted above.
- There is an uncertain relationship between supply, demand, professional decision-making and requirements.<sup>467</sup> These are clearly interdependent in that patients have no direct access to hospital treatment. It is impossible to distinguish the effects of limits on supply from those of satisfied demand. Public expectations, as well as decisions concerning referral and admission, are influenced by the accuracy of diagnosis by GPs, the perceptions of potential benefit of referral by the GPs and the availability of treatment facilities.
- This data source excludes activity in independent hospitals and NHS pay-beds. The limited current data have been utilized.

The deficiencies of Hospital Activity Analysis (HAA)<sup>466,468</sup> are now compounded by those that have followed the introduction of Körner data since 1987–88. Cross-validation of HAA coding by manual inspection of theatre registers revealed (in 1988) that discrepancies can affect as many as 16% of operations<sup>469</sup> and KP70 ascertainment data suggest that there are wide variations in the proportion of hospital activity data reported to HES from each district health authority. In addition, ICD-10 has been implemented since 1995 as noted above. The errors inherent in routine data sources must be considered carefully when drawing any conclusions from their analysis. The interpretation of time trends is particularly problematic. It is therefore inappropriate to attempt to derive precise estimates of appropriate operation rates from these data sources.

### *Private surgery*

It is essential to incorporate the level of activity in independent hospitals and NHS pay-beds when attempting to reflect current population levels of THR and TKR surgery. Unfortunately, the record systems of independent hospitals include the underlying diagnosis in only a minority of cases, and not consistently.<sup>470</sup> Until very recently, the only available national data concerning private sector activity were estimates derived from surveys conducted by the Medical Care Research Unit, University of Sheffield and based on a small sample. These data suggested a 30% increase in THR surgery in independent hospitals and NHS pay-beds in England and Wales took place between 1981 (6200 operations) and 1986 (8091 operations).<sup>68</sup> The proportion of THR surgery undertaken by the private sector in the respective years was an estimated 26.2% and 27.7%. The Sheffield study estimated that 320 TKRs were undertaken in NHS pay-beds in 1981 and 790 in 1986.<sup>67</sup> Preliminary data from a Nottingham-based study of independent sector surgical activity have now been made available and are more detailed than the Sheffield study and cover hospitals in the independent sector throughout England and Wales (B Williams, personal communication). These data are presented for hip and knee replacement surgical rates in Tables A4–A7 (*see overleaf*).

**610** Osteoarthritis Affecting the Hip and Knee**Table A4:** Estimated numbers of all total hip-joint and knee-joint replacement operations in independent hospitals in England and Wales, 1997–98. Residents of England and Wales.

Age group	Hip joint	Knee joint	Total
15–44	101	32	133
45–64	2,897	1,204	4,101
65–74	4,625	2,750	7,375
75–98	3,709	1,979	5,688
All ages	11,332	5,965	17,297

**Table A5:** Estimated numbers of *primary* total hip-joint and knee-joint replacement operations in independent hospitals in England and Wales. 1997–98. Residents of England and Wales.

Age group	Hip joint	Knee joint	Total
15–44	83	32	115
45–64	2,851	1,151	4,002
65–74	4,267	2,718	6,985
75–98	3,292	1,885	5,177
All ages	10,493	5,786	16,279

**Table A6:** Estimated numbers of all total hip-joint and knee joint replacement operations in independent hospitals in England and Wales, 1997–98, by region of residence.

Region of residence	Hip joint	Knee joint	Total
Wales	338	335	673
Northern & Yorkshire	930	369	1,299
Trent	897	400	1,297
Anglia & Oxford	1,462	747	2,209
North Thames	1,538	835	2,373
South Thames	1,906	1,151	3,057
South & West	2,016	1,050	3,066
West Midlands	776	389	1,165
North West	743	490	1,233
London NEC	5		5
England nec/other	722	200	922
Totals	11,333	5,966	17,299

**Table A7:** Estimated numbers of *primary* total hip-joint and knee-joint replacement operations in independent hospitals in England and Wales, 1997–98, by region of residence.

<b>Region of residence</b>	<b>Hip joint</b>	<b>Knee joint</b>	<b>Total</b>
Wales	321	335	656
Northern & Yorkshire	862	346	1,208
Trent	897	400	1,297
Anglia & Oxford	1,381	724	2,105
North Thames	1,448	803	2,251
South Thames	1,590	1,134	2,724
South & West	1,876	1,033	2,909
West Midlands	776	349	1,125
North West	713	462	1,175
London NEC	5		5
England nec/other	625	200	825
<b>Totals</b>	<b>10,494</b>	<b>5,786</b>	<b>16,280</b>

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**630** Osteoarthritis Affecting the Hip and Knee

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