Determining a population’s need for any healthcare intervention is an enormously difficult challenge. Yet, without attempts to quantify healthcare need, health service planning operates in a vacuum. This vacuum has often been filled by reference to past provision, professional judgement, political expediency or, to a limited extent, population preferences.

Needs assessment began to blossom within the UK in the early 1990s largely driven by political and public concern about waiting lists, particularly for surgical interventions. The National Health Service Review ‘Working for Patients’ [1] stated that the assessment of population health needs should be the first step in deciding what local health services are required. This advice came at a time when health authorities began to set contracts with their providers (particularly hospitals) for services.

Need for healthcare should not be confused with a need for better health. The latter may be assessed by measures of mortality and morbidity and will be strongly influenced by a range of social, environmental and genetic factors. In contrast, the former should be defined as the ability to benefit in some way from healthcare [2]. Equally, it should be informed by knowledge of what effective treatments exist, how cost-effective they are, what the population demand is and what can feasibly be provided. An ideal intervention should therefore be cost-effective, demanded and able to be supplied. Crucially, knowledge is then needed of how many people within any population should (and want to) receive this intervention [3].

Often, needs assessment has of necessity relied on potentially misleading data sources. In particular, use is made of waiting list data, hospital activity or other morbidity data. None of these truly indicate a population’s need for a given intervention. Therefore, epidemiologists have been encouraged to undertake population-based studies, where possible, to determine need for healthcare [3]. This has three potential problems: study size, defining a threshold for intervention and accounting for patient preference.

Unless a medical problem is very common, a population-based study to determine, for example, its prevalence is likely to need to be very large. For instance, if one seeks to estimate the prevalence of severe joint disease thought to be present in approximately 2% of a county’s population (of size 500 000), the minimum sample size needed is 18 100 subjects, in order for the estimate to be within ±0.2% of the true value [4]. It is highly likely that a screening technique will need to be applied to identify those whose ability to benefit from the intervention should be assessed in more detail. Ideally this screen should be highly sensitive (i.e. very few patients who could benefit are missed).

Once subjects who appear to suffer from a given condition have been identified, the next step is to identify those who would benefit from the intervention. This step involves developing clear criteria by which patients can be judged to need it. In clinical practice this has tended to involve the subjective professional judgement of a clinician or team of health professionals. However, recently a number of more objective criteria have been developed across a variety of surgical interventions (coronary artery bypass grafting [5], joint replacement [6, 7], cataract surgery [8]) to attempt to prioritize those with proven disease.

Unfortunately, the task does not end there. This initial screen followed by a more detailed assessment will have successfully yielded the current members with disease—some of recent onset, some of longer duration. The next challenge is to follow-up the sample over time to discover the incidence of new disease requiring intervention (a cohort study)—the key parameter in informing evidence-based commissioning. Alternatively, techniques exist to convert the cross-sectional data (i.e. prevalence data) into predicted incidence [9], though this does depend on a number of assumptions.

The last part of the process is to build in patient preference. Some will favour conservative management irrespective of the severity of their problems, whilst others will be unhappy with anything short of surgical intervention. Accurately estimating this is particularly difficult given that a person’s preference is likely to change as their condition deteriorates. It will also depend on how the various choices are presented, and their own knowledge and confidence in challenging authority. None of these are likely to be static [10].

Further problems include the fact that whatever answer is generated is likely to be limited by uncertainties concerning the representativeness of the population studied. Equally, changes in a population’s structure (for example growth or ageing) mean that predicted need will inevitably change [11, 12]. Finally, the appearance of new interventions can change the pattern of supply [13] or even remove the need for certain interventions almost completely (for example the appearance of H2-receptor antagonists in the treatment of peptic ulcer disease...
largely removing the need for its surgical management) [14]. It is not surprising that few researchers have attempted rigorously to estimate population need for a given intervention. Within the domain of surgical interventions there are only a handful of published studies of population needs assessment. These include hip replacements [15–17], knee replacement [17, 18] carotid endarterectomy [19], cataract surgery [20] and prostatectomy [21]. None of these provide data on incident need for surgery by following a cohort.

It is now generally agreed that total knee replacement (TKR) surgery is the treatment of choice for severe pain and disability due to arthritis of the knee. Indeed this operation has been described as the ‘joint of the decade’ [22]. A meta-analysis performed in 1994 concluded that it was a safe and effective procedure [23] and more recent data from the Swedish Knee Arthroplasty Register (1975–1997) show that the results from the procedure continue to improve [24].

The paper by Juni et al. [25] (published in this edition) attempts to quantify the population requirement for primary knee-replacement surgery. Its results are based on a cross-sectional study performed in 1994–1995 [26] (the Somerset and Avon Survey of Health or SASH study). This was a large study based on a questionnaire survey of 28 080 people. The authors report an excellent response rate of 85% [26]. Respondents were then split into two groups. In phase 1 a quasi-random two-thirds of those reporting knee pain were invited for a detailed assessment. In phase 2 all those who reported severe knee pain were invited for the assessment. It is unclear from the results how the varying approaches used in the two phases might have affected the final results. Furthermore, of those invited for assessment approximately 35% did not attend. The prevalence of severe disease in the non-responders is likely to have been lower and a sensitivity analysis to incorporate estimates of this uncertainty would be of interest. Otherwise, this is an excellent attempt to quantify need for an important elective operation. However, two areas need further scrutiny. First, criteria used to assess need, and second, the account taken of patient preference for surgery. Juni et al. [25] use the New Zealand priority scale [6] to determine need for TKR surgery. They applied two cut-off levels, an upper cut-off score of 55 (primary endpoint) out of 100, and a lower score of 43. It is not clear whether UK orthopaedic surgeons would perceive that all those over the threshold score of 55 would be considered in need of surgery. The priority scale has been piloted in New Zealand and, for joint replacement, surgical priority scores appeared to be in close agreement with those generated by the scale. However, this work did not aim to clarify a threshold score above which patients may be considered to need operation. Within the UK a study of waiting list patients [27] found that 60% had New Zealand scores over 55, and 80% scores over 43. This implies that the upper cut-off may perhaps yield too conservative an estimate of need compared with surgical practice. Use of the lower cut-off more than doubles the number in need of surgery (from 27.4 joints per 1000 people aged 35 and over, to 64.3 joints per 1000).

The only previous UK population-based study of need for TKR was carried out in North Yorkshire in 1993 [18]. This study involved a two-stage postal questionnaire. The first questionnaire was sent to 18 827 subjects (86% response rate). Those reporting problems with their knee(s) and difficulties in daily living were followed up with a more detailed 12-page questionnaire including the index of severity of osteoarthritis of hips and knees developed by Lequesne et al. [28]. Use of this index yielded quite different estimates of prevalent population need. In each age-specific band the Yorkshire estimates are less than half those of Juni et al. [25] (women aged 65–74: 19.6/1000 vs 60.1/1000). Thus, it is clear that estimates may be sensitive to both instrument and thresholds chosen.

The second component to be considered is patient preference. As a result of incorporating patient preferences, incident surgical need for knee replacement fell, in Juni et al.’s [25] study, from 55 800 to 35 800 joints, a 36% reduction. In contrast, the equivalent reduction in need for hip replacement when accounting for patient preference was only 9% [15]. The authors question whether the more prevalent negative attitudes amongst patients towards knee, as opposed to hip, replacement surgery may be an inappropriate legacy of the early failings of TKR. Equally, it could be that severe knee disease is painful or disabling in a different way from severe hip disease. Juni et al. [25] assessed willingness for surgery with one question. In Canada, Hawker et al. [17] investigated the effect of patient preferences on their population needs estimates for either hip or knee replacement. Their patient preference interview was based on 10 recorded patient–surgeon discussions, and was designed ‘to emulate such a conversation’. Possible risks associated with arthroplasty were discussed, admittedly in greater detail than is usual. They found that between 44 and 55% (variation by area) of subjects in need of surgery for knee or hip disease were definitely or probably unwilling to undergo surgery.

An adjunct to investigating population need through research is to investigate supply. Table 1 compares provision of TKR surgery in the UK, Sweden and the USA. It shows that provision in the UK per 1000 population over 45 yr [29, 30] is greater than in Sweden [12], but both lag significantly behind the USA [31]. Osteoarthritis of the hip appears to be less common than that of the knee [32] and population estimates of need for surgery from the SASH study suggest a marginally lower need for hip replacement surgery than that for knee surgery [15]. Indeed, within the USA only half as many total hip replacements are carried out as knee replacements [31]. In contrast, in the UK 33% more hip replacement operations occurred in 2000 than did knee replacements. These supply-side data suggest that incident need for knee replacement surgery may not yet have been met within the UK, or indeed within Sweden.
The resulting picture, considering need (as reported by Juni et al. [25]), demand (incorporating patient preference) and supply (as reported by hospital activity) is clearly a complex one. Overall, it appears that current need (circa 56 000 TKR operations) outstrips current supply (circa 40 000 operations) by approximately 40%. If account is taken of patient preference, then these may possibly be in balance at present. This effective procedure is an intervention that ‘adds life to years’ as opposed to ‘years to life’. In Sweden, estimates accounting for the ageing of their population suggest that the number of knee arthroplasties should increase by one-third by 2030 [12]. This is likely to be an underestimate of changing need as at least three further factors are particularly important: the changing population demand for interventions enhancing quality of life; improving anaesthetic and surgical techniques, widening the scope of those able to benefit; and an increasingly obese population [33], likely to result in a greater prevalence of severe osteoarthritis. From a public health perspective, it is clear that extensive efforts should be focused on tackling obesity to improve joint health as much as cardiovascular and diabetic risk. Equally, healthcare commissioners should plan for a substantial growth in the number of orthopaedic surgeons to cope with expected increased needs, not just in joint replacement surgery, but also in the number of fractures as the population ages.

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Table 1. Total knee replacements performed in England, Sweden and USA in 2000 and their population rates

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<td>Total knee replacement operations performed</td>
<td>35,827 NHS 5100 Private sector&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5647</td>
<td>299,000&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>Total knee replacements /10&lt;sup&gt;5&lt;/sup&gt; population</td>
<td>83</td>
<td>63</td>
<td>106</td>
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<tr>
<td>Total knee replacements /10&lt;sup&gt;5&lt;/sup&gt; population aged over 45 yr</td>
<td>210</td>
<td>148</td>
<td>309</td>
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<sup>a</sup>Data are from a survey for 1997–1998 for England and Wales [30]. Only 2.5% of total private activity was conducted in Wales [34]. Thus, this figure overestimates English private knee arthroplasty provision, but this may be balanced by probable growth in private provision up to 2000, if private provision has continued to grow in line with the change observed from 1992–1998 [34].

<sup>b</sup>Data are from the National Hospital Discharge Survey, a representative survey of US private hospital provision. No detailed data are available for federal, military or Veteran Affairs hospitals. Thus, this estimate may underestimate US provision.

References