Journal of Public Health
DOI: 10.1093/pubmed/fdh162

Vol. 26, No. 3, pp. 277–284
Printed in Great Britain

Opportunities for prevention of 'clinically significant' knee pain: results from a population-based cross sectional survey

Roger Webb, Therese Brammah, Mark Lunt, Michelle Urwin, Tim Allison and Deborah Symmons

Abstract

Background There is little UK-based evidence on the prevalence and predictors of knee pain associated with disability across all adult ages. We aimed to estimate the prevalence of 'clinically significant' knee pain, identify and assess the population impact of independent risk factors, and estimate levels of healthcare need.

Methods A cross-sectional survey of three general practice populations was conducted. Adults (n = 5752) were mailed a screening questionnaire (phase I). Those reporting predominant or isolated knee pain were sent a detailed questionnaire (phase II), with a further sub-sample invited for clinical examination (phase III). Logistic regression was used to identify independent risk factors and population attributable fractions were calculated.

Results The 1 month period prevalence of 'all reported' knee pain was 19 per cent, of which about a third was disabling and a fifth intense and disabling. Obesity, deprivation and South Asian ethnicity were each associated with a 3–4-fold increased risk of knee pain with disability (after age/sex adjustment). The attributable fraction estimate for raised body mass index (BMI) was 36 per cent (27–44 per cent) – the population impact of being overweight was greater than that of being obese. Thirteen per cent of all adults reported a previous primary care consultation, 7 per cent reported previous secondary care referral for knee pain, and 4.5 per cent (2.7–6.2 per cent) of the adult population were currently receiving or in need of specialist treatment.

Conclusions The high population impact of being overweight (BMI 25–29) or obese (BMI 30 or more) has implications for primary prevention. The estimates of previous healthcare usage, and of levels of met and unmet need, are useful for healthcare planning.

Keywords: needs assessment, knee pain, disability, prevalence

Introduction

Knee pain is common in the community, especially in the elderly.[1] However, much of the knee pain reported in population surveys may be mild and have no impact on the individual's activities or ability to participate in society. When planning healthcare services, it is important to focus on 'clinically significant' knee pain – that is knee pain with associated disability. Some UK population surveys of knee pain have incorporated a measure of disability[2–4] but none has spanned the whole adult age range. There has been little work on the predictors of 'clinically significant' knee pain or on the need for referral to secondary care. Tennant *et al.*[4] estimated the level of unmet need for knee replacement surgery but their work did not include an examination phase.

The Tameside Musculoskeletal Project, a three-phase population-based cross-sectional survey, was set up in 1996 in order to establish the healthcare needs of the Tameside population. A phase I screening questionnaire established pain prevalence at seven anatomical sites. A phase II site-specific questionnaire asked about severity and associated disability, and phase III comprised a clinical examination. Some of the phase I results have been published.[5] In adults aged below 65 years the lower back was the most commonly reported site of pain, followed by the knee (16 per cent). The knee was the most common site of pain in men (27 per cent) and women (34 per cent) aged 65 years and over. The overall prevalence of knee pain will inevitably grow as the proportion of older people in the population in developed countries increases.

[1]ARC Epidemiology Unit, University of Manchester Medical School, Oxford Road, Manchester M13 9PT, UK
[2]Department of Rheumatology, Tameside Acute NHS Trust, Ashton-under-Lyne, Greater Manchester, UK
[3]Department of Public Health Medicine, West Pennine Health Authority, Oldham, Greater Manchester, UK

Roger Webb[1]

Therese Brammah[2]

Mark Lunt[1]

Michelle Urwin[1,3]

Tim Allison[3]

Deborah Symmons[1]

Address correspondence to Professor Deborah Symmons, ARC Epidemiology Unit, School of Epidemiology and Health Sciences, Stopford Building, Oxford Road, Manchester M13 9PT, UK.
E-mail: deborah.symmons@man.ac.uk

The first objective of the present study was to estimate the population prevalence of, and to explore the predictors of, knee pain stratified by intensity, disability and chronicity. The second objective, focusing on body mass index (BMI) as a modifiable risk factor, was to estimate the proportion of cases attributable to being overweight or obese. The third objective was to estimate levels of need for secondary healthcare services, including comparison of levels of met versus unmet need.

Participants and methods

Setting

The survey was conducted in three general practice populations in Tameside, a predominantly urban area to the east of Manchester. The Tameside and Glossop Research Ethics Committee approved the study.

Survey methods

These are reported in detail elsewhere.[5] In brief, the practice populations were divided into eight age–sex strata by age groups 16–44, 45–64, 65–74 and 75 years and over. Around 250 subjects per stratum were sampled in each practice. Figure 1 shows the multiphase structure of the survey, the numbers of subjects sampled and the response rate for each phase. Each subject was sent a phase I questionnaire concerning musculoskeletal symptoms, height, weight, employment status and socio-demographics (including self-defined ethnicity according to 1991 census categories). BMI was calculated as weight (kg) divided by height (m^2). Non-responders were sent reminders at 4 and 8 weeks. Subjects were asked whether they had experienced pain lasting for more than a week in the last month in any of seven areas (back, neck, shoulder, elbow, hand, hip, knee), or in multiple joints. They were also asked to indicate their predominant ('most troublesome') pain site.

The phase I questionnaire included the modified Health Assessment Questionnaire (mHAQ), which comprises eight questions on physical function, with scores ranging from zero (no disability) to three.[6] The mHAQ is a shortened version of the Stanford Health Assessment Questionnaire, which was developed for use with rheumatoid arthritis sufferers,[7] but has

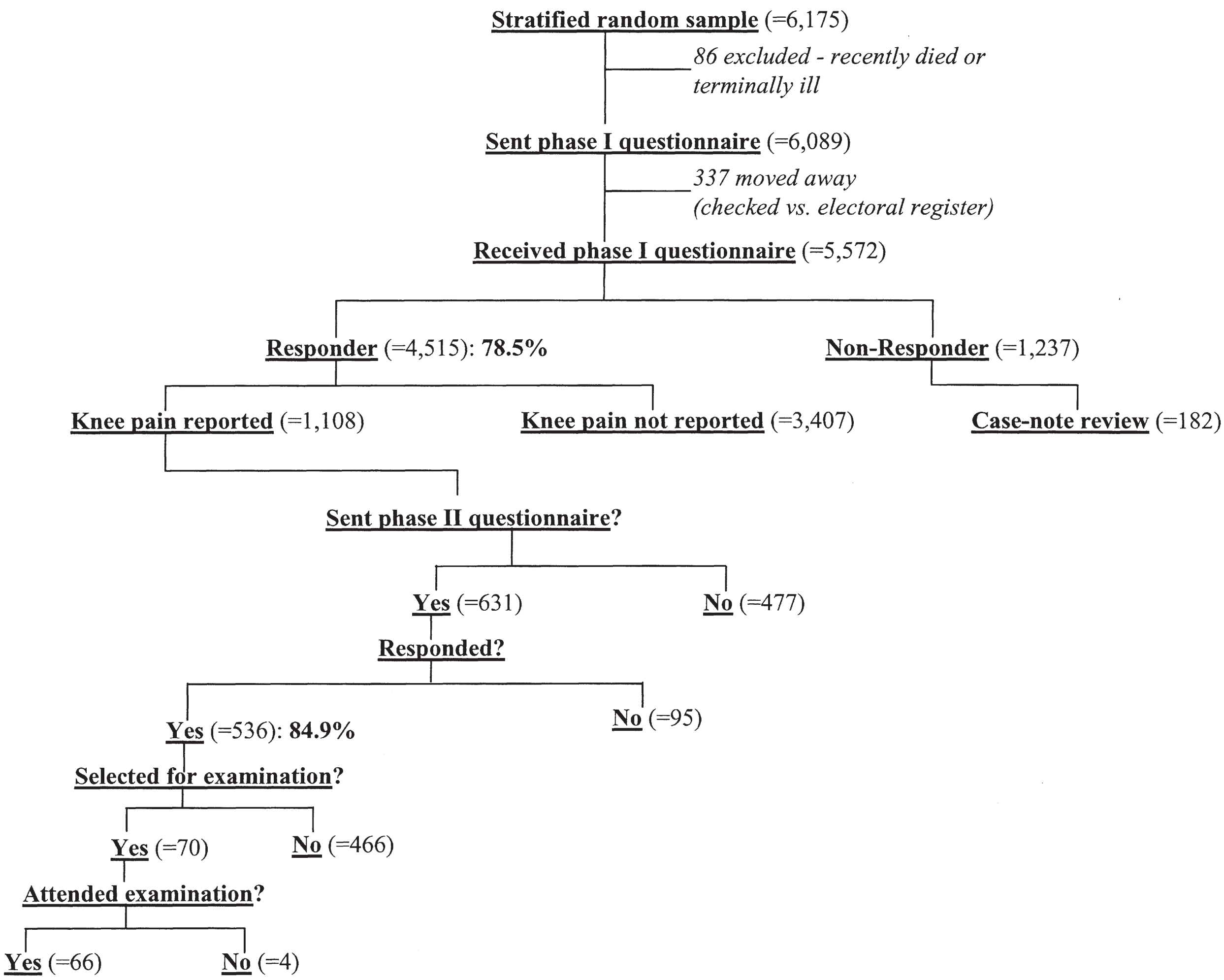

Fig. 1 Study design flowchart.

also been validated for osteoarthritis patients.[8] We used two definitions of disability: a cut-off score of ≥0.5 in the mHAQ and, in those aged under 65, the employment status category 'not working due to ill-health or disability'.

Townsend deprivation scores were calculated for the enumeration district (the smallest unit of census geography) of residence of each subject.[9] The scores were allocated to quintiles using reference data for England and Wales

Phase I responders reporting pain at one or two sites were sent site-specific phase II questionnaires for these sites. Subjects reporting pain in three or more areas (or 'pain in most joints') received the questionnaire on multiple joint symptoms plus the site-specific questionnaire for their predominant pain site. Thus, by design, not all phase I respondents with knee pain were sent a phase II knee-pain questionnaire. The phase II knee questionnaire asked about pain intensity ('none', 'mild', 'moderate', 'severe'), chronicity (number of years since pain commenced), and whether the subjects had ever consulted their GPs or been referred to hospital for knee pain.

The final phase (III) included a standardized clinical examination by a consultant rheumatologist (T.B.). Subjects were selected from the phase II responders using quota sampling. Approximately 20 subjects in total in each knee-pain intensity category ('mild'/'moderate'/'severe') were invited for examination. Clinic attendees were asked about current specialist treatment for their knee pain. The rheumatologist judged the need for additional referral to orthopaedics, rheumatology or physiotherapy. 'Need for secondary healthcare' was defined as either currently receiving, or judged to require, specialist referral.

Summary of definitions

'Knee pain with disability' is defined as knee pain plus mHAQ ≥ 0.5. 'Knee pain with work disability' is defined as knee pain plus not working due to ill health (aged below 65 years only). 'Intense knee pain' is defined as knee pain of moderate or severe intensity. 'Chronic knee pain' is defined as knee pain that first occurred 5 or more years ago.

Statistical methods

Statistical analyses were performed using Stata version 6.0 unless otherwise stated.[10] Survey estimation commands were used to take account of the unequal age–sex-specific stratified sampling.[11,12]

Phase I

Prevalence rates were extrapolated to the Tameside population using direct age–sex standardization. Tameside has a demographic structure that is very similar to England as a whole and so the results are widely generalizable. Ninety-five per cent confidence intervals (CIs) were calculated using the Confidence Interval Analysis package.[13] Multivariate logistic regression was used to model the independent predictors of 'all reported knee pain' and 'knee pain with disability'.

The independent predictors considered were age, sex, BMI, Townsend quintile and 'South Asian' ethnicity (i.e. people of Indian, Pakistani or Bangladeshi origin). These categories were aggregated as the proportion of people in the sample that were of South Asian was very low (1.6 per cent: $n = 71$) and the study was not powered to investigate outcomes by specific minority subgroup. The BMI was categorized as: <20, 'underweight'; 20–24.99, 'normal'; 25–29.99, 'overweight'; ≥30, 'obese'.[14] Univariate logistic regression models were created and then multivariate adjustment was performed at three levels: age and sex ('level 1'); age, sex, BMI and Townsend quintile ('level 2'); age, sex, BMI, Townsend quintile and additional pain sites ('level 3').

Population attributable fractions (PAF) for the effect of BMI category (overweight or obese versus 'normal') were estimated using the 'aflogit' command following logistic regression. This estimates the proportion of cases in the population that can be attributed to a predictor following covariate adjustment.[15,16]

Phase II

Prevalence estimates for intense, disabling and chronic knee pain were generated from the phase II data in several stages. As the phase II data represented a skewed sub-set of the phase I data, prevalence in the phase I subjects was estimated from the logistic regression equation derived from the phase II subjects. Direct standardization was then used to estimate the prevalence in the Tameside population.

Phase III

Comparison of the demographic and pain severity characteristics of the clinic attendees versus the phase II responders not sampled for phase III was made to assess the representativeness of the phase III data. Pain intensity stratum-specific proportions were extrapolated from phase III to the Tameside population by multiplying: the proportion of subjects in each pain intensity stratum 'needing secondary care' (based on phase III data) by the proportion of the adult population with knee pain of that intensity (i.e. the prevalence – previously extrapolated from phase II to the general population). The proportion of the total population 'needing secondary care' for knee pain was estimated by adding the proportions for each pain intensity category.

Results

Phase I

Prevalence of all reported knee pain and knee pain with disability; proportion of subjects with knee pain who also reported pain at other sites

The phase I response rate was 78.5 per cent. One thousand, one hundred and eight of the 4515 responders reported knee pain (Fig. 1), and the age-standardized prevalence of knee pain was almost the same in women (19.0 per cent) and men (18.8 per cent) (Table 1). However, in those aged over 45 years, knee pain

Table 1 One month period prevalence (%) of knee pain stratified using various definitions of severity – data from phases I and II extrapolated to the adult population of Tameside

Age/sex strata	(Phase I) No. of observed cases	(Phase I) All reported knee pain	(Phase I) Pain + disability (mHAQ ≥0.5)	(Phase I) Pain + work disability (<65 years)	(Phase II) Intense pain (moderate or severe)	(Phase II) Chronic pain (+5 years)	(Phase II) Intense pain + disability
F 16–44	52	10.0	2.5	1.7	5.0	4.2	0.7
F 45–64	148	23.4	7.6	4.7	16.9	11.6	6.3
F 65–74	201	32.1	12.6	–	25.1	17.7	8.0
F 75+	198	35.8	18.3	–	29.5	21.1	13.9
Women	599	19.0	6.8	2.8	11.8	9.0	3.4
(95% CI)		(17.1–20.9)	(5.7–7.8)	(1.8–3.8)	(9.7–13.9)	(7.5–10.5)	(1.0–5.8)
M 16–44	64	15.2	2.4	1.2	7.4	7.2	1.0
M 45–64	122	21.3	8.4	5.9	16.2	12.0	7.3
M 65–74	167	27.1	7.6	–	21.3	16.1	7.0
M 75+	156	27.2	12.7	–	21.3	17.0	11.0
Men	509	18.8	5.2	2.8	11.5	9.8	3.5
(95% CI)		(16.4–21.2)	(4.1–6.3)	(1.9–3.8)	(9.1–13.9)	(8.0–11.6)	(1.1–5.9)
Persons	1108	18.9	6.0	2.8	11.7	9.4	3.4
(95% CI)		(17.4–20.4)	(5.2–6.8)	(2.1–3.5)	(10.1–13.2)	(8.2–10.5)	(1.7–5.1)

F, female; M, male.

prevalence was higher in women than men. The prevalence of knee pain continued to rise into old age (75 years and above) in both men and women. The prevalence of knee pain with disability (mHAQ ≥0.5) rose sharply with increasing age in both genders.

Following age–sex standardization, we estimated that 68.8 per cent (95 per cent CI 60.5–77.1 per cent) of the adult Tameside population who report knee pain also report pain at additional sites. More women (74.1 per cent) than men (63.2 per cent) report pain in additional sites ($p = 0.001$). An estimated 43.4 per cent (36.5–50.2 per cent) of adults with knee pain also report low back pain and an estimated 28.2 per cent (23.2–33.3 per cent) also report shoulder pain.

Predictors of knee pain with disability

Increasing BMI and increasing deprivation were weakly associated with all reported knee pain.[5] These predictors were much more strongly associated with knee pain with disability (mHAQ ≥0.5) and knee pain with work disability (Table 2). Obese subjects were nearly four times more likely to report knee pain with disability than those with a normal BMI (after adjusting for age and sex) ($OR_{adj} = 3.63$, 2.48–5.30). Subjects in the most deprived Townsend quintile were nearly three times more likely to report knee pain with disability than those in the least deprived quintile (after adjusting for age and sex) ($OR_{adj} = 2.98$, 1.82–4.86). Men were less likely to report knee pain with disability than women, although this association was lost with adjustment. South Asians were more likely to report knee pain with disability, even following adjustment for additional pain sites ($OR_{adj} = 3.56$, 1.56–8.14).

Phase II

Prevalence estimates and predictors of 'clinically significant' pain

The phase II response rate was 84.9 per cent. Extrapolation to the general adult population indicated that 11.7 per cent (10.1–13.2 per cent) of adults report intense knee pain, 9.4 per cent (8.2–10.5 per cent) report knee pain of at least 5 years duration, and 3.4 per cent (1.7–5.1 per cent) report intense knee pain with disability (Table 1). Furthermore, 13.3 per cent (12.1–14.5 per cent) report consulting a GP for knee pain, and 6.8 per cent (6.0–7.6 per cent) report being referred for specialist treatment. The only significant predictors of previous primary care attendance were increasing mHAQ score (0.5–0.99 versus zero: OR = 5.09, 2.64–9.81; ≥1 versus zero: OR = 6.80, 2.56–18.06) and two or more other pain sites (OR = 2.04, 1.17–3.55). The only significant predictors of previous secondary care referral were increasing mHAQ score (0.5–0.99 versus zero: OR = 2.93, 1.69–5.10; ≥1 versus zero: OR = 2.61, 1.29–5.25) and male gender (OR = 1.56, 1.08–2.27). Disability was, therefore, a stronger predictor of a history of primary care consultation than of secondary care referral.

Population attributable fraction estimates for BMI

The PAF estimates suggest that a considerable proportion of knee pain cases may be attributable to being overweight or obese (Table 3). For the phase I models the outcome was the proportion of the adult population and for the phase II models it was the proportion of all reported knee pain cases. BMI was a strong independent predictor of all reported knee pain,

Table 2 Independent predictors of knee pain with disability: (1) mHAQ ≥0.5 or (2) unemployed sick – phase I data: ORs with 95% CIs

	(1) Knee pain with disability (mHAQ 0.5+)				(2) Knee pain with work disability: (unemployed sick, <65 years)			
Independent variable	**(a) Unadjusted**	**(b) Adjusted (Level 1)***	**(c) Adjusted (Level 2)****	**(d) Adjusted (Level 3)*****	**(a) Unadjusted**	**(b) Adjusted (Level 1)***	**(c) Adjusted (Level 2)****	**(d) Adjusted (Level 3)*****
Sex								
Women	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Men	0.75 (0.58–0.98)	0.89 (0.68–1.16)	0.91 (0.69–1.19)	1.19 (0.87–1.62)	1.03 (0.64–1.67)	1.04 (0.64–1.70)	1.06 (0.64–1.77)	1.36 (0.79–2.34)
BMI								
<20	0.98 (0.53–1.79)	1.06 (0.56–2.02)	0.98 (0.51–1.87)	0.98 (0.46–2.09)	0.21 (0.03–1.62)	0.31 (0.04–2.40)	0.25 (0.03–2.00)	0.18 (0.02–1.77)
20–24.99 (reference)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25–29.99	2.27 (1.67–3.09)	2.02 (1.47–2.78)	1.98 (1.44–2.73)	2.07 (1.43–2.99)	2.48 (1.41–4.39)	2.03 (1.14–3.62)	2.04 (1.14–3.68)	1.96 (1.02–3.76)
≥30	4.12 (2.84–5.98)	3.63 (2.48–5.30)	3.25 (2.21–4.77)	2.51 (1.59–3.95)	3.94 (1.97–7.87)	2.91 (1.43–5.92)	2.36 (1.15–4.85)	1.49 (0.69–3.25)
	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.006$	$p = 0.013$	$p = 0.058$
Townsend								
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.26 (0.74–2.13)	1.30 (0.76–2.21)	1.27 (0.74–2.17)	1.27 (0.71–2.30)	1.23 (0.39–3.86)	1.31 (0.42–4.09)	1.30 (0.42–4.07)	1.26 (0.38–4.16)
3	1.91 (1.15–3.19)	1.80 (1.07–3.01)	1.77 (1.06–2.97)	1.61 (0.90–2.91)	1.29 (0.35–4.81)	1.33 (0.35–4.99)	1.29 (0.34–4.87)	1.24 (0.34–4.57)
4	2.75 (1.69–4.47)	2.77 (1.69–4.54)	2.56 (1.56–4.22)	1.85 (1.05–3.25)	6.76 (2.58–17.72)	7.94 (3.01–20.94)	7.71 (2.93–20.29)	5.80 (2.14–15.73)
5 (most deprived)	2.73 (1.67–4.46)	2.98 (1.82–4.86)	2.80 (1.71–4.61)	2.11 (1.20–3.71)	5.66 (2.12–15.07)	7.06 (2.64–18.88)	7.11 (2.66–19.05)	5.68 (2.07–15.55)
	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.053$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
South Asian								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	2.63 (1.29–5.35)	5.20 (2.41–11.22)	4.18 (1.86–9.40)	3.56 (1.56–8.14)	4.26 (1.81–10.00)	6.07 (2.52–14.64)	3.84 (1.53–9.63)	2.63 (0.94–7.35)

*'Level 1' adjustment (for age and sex). **'Level 2' adjustment (for age, sex, Townsend and BMI). ***'Level 3' adjustment (for age, sex, Townsend, BMI and additional pain sites). At each of the above levels, sex not adjusted for sex, BMI not adjusted for BMI, Townsend not adjusted for Townsend.

Table 3 PAF estimates for BMI as a predictor of all reported knee pain and knee pain stratified by disability, intensity and chronicity

	(a) All reported pain*		(b) Pain with disability† (mHAQ 0.5+)		(c) Intense pain† (moderate/severe)		(d) Chronic pain† (5+ years)		(e) Intense pain + disability† (mHAQ 0.5+)	
BMI category	**OR (95% CI)**	**PAF (95% CI)**	**OR (95% CI)**	**PAF (95% CI)**	**OR (95% CI)**	**PAF (95% CI)**	**OR (95% CI)**	**PAF (95% CI)**	**OR (95% CI)**	**PAF (95% CI)**
Unadjusted										
<20(underweight)	0.69 (0.45–1.06)	–	0.98 (0.53–1.79)	–	1.99 (0.68–5.81)	–	4.20 (1.13–15.61)	–	2.92 (0.95–8.98)	–
20–24.99 (baseline)	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
25–29.99(overweight)	1.64 (1.35–2.01)	14% (10–18)	2.27 (1.67–3.09)	22% (15–29)	1.44 (0.97–2.15)	6% (0–12)	1.05 (0.69–1.58)	1% (0–9)	2.11 (1.22–3.65)	22% (6–36)
30+(obese)	2.35 (1.79–3.09)	8% (6–10)	4.12 (2.84–5.98)	15% (11–19)	1.95 (1.10–3.45)	4% (1–7)	1.55 (0.87–2.77)	3% (0–8)	3.37 (1.75–6.49)	15% (6–24)
Combined effect of overweight + obesity	($p < 0.001$)	22% (17–27)	($p < 0.001$)	37% (28–45)	($p = 0.068$)	10% (1–18)	($p = 0.057$)	5% (0–15)	($p = 0.002$)	38% (15–54)
Adjusted‡										
<20 (underweight)	0.68 (0.44–1.04)	–	0.98 (0.46–2.09)	–	1.60 (0.52–4.94)	–	3.91 (1.01–15.06)	–	2.04 (0.63–6.56)	–
20–24.99 (baseline)	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
25–29.99 (overweight)	1.51 (1.23–1.86)	13% (9–17)	1.98 (1.44–2.73)	21% (14–28)	1.39 (0.92–2.10)	5% (0–11)	1.05 (0.69–1.59)	1% (0–9)	2.11 (1.20–3.70)	21% (5–35)
30+(obese)	2.06 (1.56–2.73)	8% (6–10)	3.25 (2.21–4.77)	15% (11–19)	1.98 (1.09–3.59)	4% (1–7)	1.66 (0.92–3.01)	4% (0–8)	3.74 (1.88–7.44)	16% (7–24)
Combined effect of overweight + obesity	($p < 0.001$)	21% (16–26)	($p < 0.001$)	36% (27–44)	($p = 0.113$)	9% (0–16)	($p = 0.062$)	5% (0–16)	($p = 0.002$)	37% (15–54)

*Estimates generated using phase I data (outcome = proportion of the adult population).
†Estimates generated using phase II data (outcome = proportion of all reported knee pain cases).
‡Adjusted for age, sex and deprivation (Townsend).

knee pain with disability, and intense knee pain with disability. The highest estimates (after adjustment for age, sex and deprivation) were for knee pain with disability (phase I: PAF_{adj} = 36 per cent, 27–44 per cent) and intense knee pain with disability (phase II: PAF_{adj} = 37 per cent, 15–54 per cent). Although the relative risk estimates (expressed as odds ratios) were consistently higher for the obese than the overweight category, the PAF estimates were consistently higher for the overweight than the obese, indicating that a higher proportion of cases at the population level is attributable to being overweight than being obese.

Comparison of people who reported knee pain as the dominant or isolated site of pain with those who reported knee pain as part of more generalized musculoskeletal pain

A multivariate logistic regression model was used to compare the characteristics of people sent a phase II knee questionnaire (the 'dominant or isolated' sub-group, $n = 631$) with those not sent one (the 'generalized' sub-group, $n = 477$). After age and mutual covariate adjustment, the 'generalized' knee pain cases were more likely than the 'dominant/isolated' group to be female (OR_{adj} = 1.57, 1.10–2.23) and to report disability (mHAQ score ≥1: OR_{adj} = 14.16, 8.07–24.83).

Phase III

The phase III subjects were generally younger, less likely to be female, to have an mHAQ score >0.5, or to report two or more additional pain sites, than other phase II respondents, although none of these differences was significant. There were no consistent differences in BMI categories between the groups of subjects.

Among the phase III clinic attendees ($n = 66$), 17 subjects were found to be currently receiving specialist treatment for knee pain, and a further 13 were indicated as requiring referral (eight of which were for orthopaedic services). In a multivariate logistic regression model, disability (mHAQ ≥0.5 versus <0.5: OR_{adj} = 4.11, 1.07–15.79) independently predicted the need for secondary healthcare. There was also some suggestion that people below the age of 45 years were more likely to require secondary healthcare, although this effect was non-significant in the multivariate model. Overall, it was estimated that 4.5 per cent (2.7–6.2 per cent) of the adult population needed specialist treatment. Most of this healthcare need was for orthopaedics (2.8 per cent, 1.4–4.2 per cent). For all specialities combined and for orthopaedics alone, the level of currently unmet need was approximately twice the level of currently met need (3.2 per cent receiving specialist treatment versus 1.3 per cent requiring specialist treatment, for all specialities; 1.9 per cent versus 0.9 per cent, for orthopaedics alone). Figure 2 summarizes the population estimates for primary and secondary health care utilization, presented as a 'prevalence staircase' as used by Peat *et al.*[17]

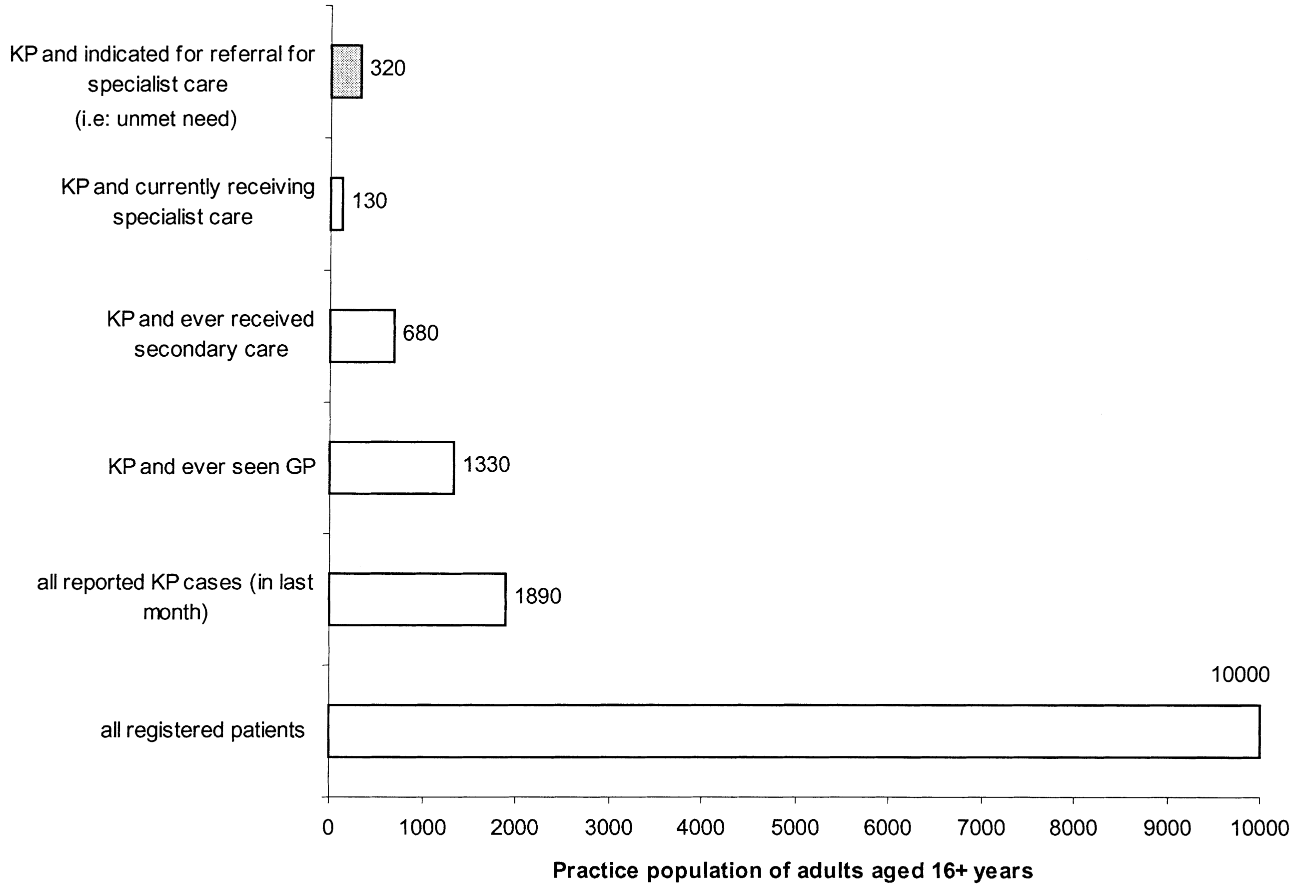

Fig. 2 Prevalence staircase for healthcare service utilisation estimates.

Discussion

This was a large community-based survey with high response rates. Extrapolated to the general population, the prevalence of all reported knee pain was ~19 per cent for men and women. Almost two-thirds of those reporting knee pain reported intense pain, around a half reported pain duration of at least 5 years, around a third had moderate levels of disability, and almost a fifth reported intense pain with disability. Increasing BMI, increasing deprivation and South Asian ethnicity were strong independent predictors of knee pain with disability. Previous studies of predictors of knee pain have not adjusted for pain reported at other musculoskeletal sites. Such adjustment enabled us to assess whether these predictors were truly independently associated with knee pain. The independent associations between BMI, deprivation, South Asian ethnicity and knee pain with disability were stronger than those previously found for back and neck pain with disability.[18]

Almost three-quarters of adults reporting knee pain reported a primary care consultation for this symptom. Peat *et al.*[17] estimated the annual primary care attendance for knee osteoarthritis among older adults as 4 per cent, but their estimate is not comparable with our study, which calculated a lifetime cumulative proportion using a different case definition (i.e. knee pain as opposed to diagnosed osteoarthritis). A degree of reporting bias may have occurred in our study with some subjects perhaps reporting consultations that were primarily related to complaints other than knee pain. Over a third of all knee pain cases gave a history of secondary care treatment. Based on the 66 subjects examined, around a quarter of all knee pain cases were estimated as 'needing' secondary treatment (i.e. currently treated or indicated for referral). The ratio of unmet to met need was approximately two, for orthopaedics and for all specialities combined.

The secondary sampling of subjects at phases II and III introduced selection biases. The decision to sample only the 'isolated' or 'predominant' knee pain cases at phase II was partly pragmatic (i.e. to avoid overwhelming subjects with too many questionnaires). The decision will also have minimized the amount of 'double counting' of demand for primary and secondary care (i.e. if a subject had hip and knee pain, a single secondary care referral, rather than two separate ones would suffice). Due to sampling error, the phase III subjects were somewhat unrepresentative (in terms of age, gender, disability and number of musculoskeletal pain sites) of the phase II sampling frame, and this may have resulted in some underestimation of levels of need.

Almost 3 per cent of the whole adult population was estimated to 'need' specialist orthopaedic treatment, whereas Tennant *et al.*[4] estimated that 2 per cent of the population aged 55 years and over should be considered for knee arthroplasty,[4] using a cut-off of 14 ('extremely severe') on the Lequesne index.[19] The age range and outcome definition used in the two studies are different and so the two estimates of need are not comparable. In a separate analysis of these data, the unmet need for knee replacement surgery in the Tameside population was estimated.[20] Although the estimates were not robust because of the small size of the clinic sample, they were lower than those proposed by Tennant *et al.*[4]

Around a fifth of all reported knee pain cases, over a third of cases of pain with disability, and over a third of cases of intense pain with disability were estimated as being attributable to having an overweight or obese BMI. Although causality cannot be proven with a cross-sectional design, there is prospective evidence from the Framingham cohort that obesity is indeed a causal factor for knee osteoarthritis,[21] and obesity has been identified as the key preventable risk factor for that condition.[22] The PAF estimates therefore indicate that the contribution made by raised BMI to knee pain prevalence (and associated disability) is substantial. The estimates were consistently greater for the overweight than the obese category, which demonstrates the usefulness of this population impact approach compared with using measures of relative risk. Our study data indicate that 35 per cent of the adult Tameside population are overweight and a further 10 per cent are obese, and so the public health implications of these estimates are clear. They also indicate huge potential cost savings for the NHS in reducing BMI across the whole population, as opposed to focusing solely on the high-risk obese group.

Acknowledgements

The authors acknowledge the contribution of Professor Gareth Williams (formerly at the University of Salford Public Health Research and Resource Centre). West Pennine Health Authority and The Arthritis Research Campaign provided joint funding for the project.

References

1 Symmons DPM. Knee pain in older adults: the latest musculoskeletal 'epidemic'. *Ann Rheum Dis* 2001; **60:** 89–90.

2 McAlindon TE, Cooper C, Kirwan JR, Dieppe PA. Knee pain and disability in community. *Br J Rheum* 1992; **31:** 189–192.

3 O'Reilly SC, Muir KR, Doherty M. Knee pain and disability in the Nottingham community: association with poor health status and psychological distress. *Br J Rheum* 1998; **37:** 870–873.

4 Tennant A, Fear J, Pickering A, Hillman M, Cutts A, Chamberlain MA. Prevalence of knee problems in the population aged 55 years and over: identifying the need for knee arthroscopy. *Brit Med J* 1995; **310:** 1291–1293.

5 Urwin M, Symmons D, Allison T, *et al.* Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 1998; **57:** 649–655.

6 Pincus T, Summey JA, Soraci SA Jr, Wallston KA, Humman NP. Assessment of patient satisfaction in activities of daily living using a modified Stanford Health Assessment Questionnaire. *Arthritis Rheum* 1983; **26:** 1346–1353.

7 Fries JF, Spitz P, Kraines RG, Holman HR. Measurement of patient outcome in arthritis. *Arthritis Rheum* 1980; **23:** 137–145.

8 Brazier JE, Harper R, Munro J, Walters SJ, Snaith ML. Generic and condition-specific outcome measures for people with osteoarthritis of the knee. *Rheumatology* 1999; **38:** 870–877.

9 Townsend P, Phillimore P, Beattie A. *Health and deprivation and the North*. London: Croom Helm, 1988.

10 StataCorp. *Stata statistical software: release 6.0*. College Station, TX: Stata Corporation, 1999.

11 Pfeffermann D. The use of sampling weights for survey data analysis. *Stat Methods Med Res* 1996; **5:** 239–261.

12 StataCorp. *Stata user guide: release 6.0*. College Station, TX: Stata Corporation, 1999.

13 Gardner MJ, Gardner SB, Winter PD, *et al. Confidence interval analysis (CIA), version 2.0.0*. London: BMJ Publishing Group, 2000.

14 World Health Organization. *Measuring obesity. Classification and description of anthropometric data*. Report on a WHO consultation on the epidemiology of obesity. Copenhagen, Denmark: WHO Regional Office for Europe, Nutrition Unit, 1988.

15 Greenland S, Drescher K. Maximum likelihood estimation of the attributable fraction from logistic models. *Biometrics* 1993; **49:** 865–872.

16 Benichou J. A review of adjusted estimators of attributable risk. *Stat Methods Med Res* 2001; **10:** 195–216.

17 Peat G, McCarney R, Croft P. Knee pain and osteoarthritis in older adults: a review of community burden and current use of primary health care. *Ann Rheum Dis* 2001; **60:** 91–97.

18 Webb R, Brammah T, Urwin M, Allison T, Lunt M, Symmons D. The prevalence and predictors of intense, chronic and disabling neck and back pain in the UK general population. *Spine* 2003; **28:** 1195–1202.

19 Lequesne MG, Merry C, Samson M, Gerard P. Indexes of severity for osteoarthritis of the hip and knee. *Scand J Rheum* 1987; **Suppl 65:** 85–89.

20 Allison TR. *Knee pain in Tameside and Glossop*. MFPHM Part II submission, 1997.

21 Felson DT, Anderson JJ, Naimark A, Walker AM, Meenan RF. Obesity and knee osteoarthritis. The Framingham Study. *Ann Intern Med* 1988; **109:** 18–24.

22 Hart DJ. Spector TD. The relationship of obesity, fat distribution and osteoarthritis in women in the general population: the Chingford Study. *J Rheumatol* 1993; **20:** 331–335.

Date Accepted 16.4.04.