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Osteoarthritis and Cartilage

Osteoarthritis and the Rule of Halves

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A R T I C L E   I N F O

S U M M A R Y

Background: Symptomatic osteoarthritis poses a major challenge to primary health care but no studies have related accessing primary care ('detection'), receiving recommended treatments ('treatment'), and achieving adequate control ('control').

Objective: To provide estimates of detection, treatment, and control within a single population adapting the approach used to determine a Rule of Halves for other long-term conditions.

Setting: General population.

Participants: 400 adults aged 50+ years with prevalent symptomatic knee osteoarthritis.

Design: Prospective cohort with baseline questionnaire, clinical assessment, and plain radiographs, and questionnaire follow-up at 18 and 36 months and linkage to primary care medical records.

Outcome measures: 'Detection' was defined as at least one musculoskeletal knee-related GP consultation between baseline and 36 months. 'Treatment' was self-reported use of at least one recommended treatment or physiotherapy/hospital specialist referral for their knee problem at all three measurement points. Pain was 'controlled' if characteristic pain intensity <5 out of 10 on at least two occasions.

Results: In 221 cases (55.3%; 95%CI: 50.4, 60.1) there was evidence that the current problem had been detected in general practice. Of those detected, 164 (74.2% (68.4, 80.0)) were receiving one or more of the recommended treatments at all three measurement points. Of those detected and treated, 45 (27.4% (20.5, 34.3)) had symptoms under control on at least two occasions. Using narrower definitions resulted in substantially lower estimates.

Conclusion: Osteoarthritis care does not conform to a Rule of Halves. Symptom control is low among those accessing health care and receiving treatment.

Introduction

Inadequate detection, treatment, and control — "medical science un-applied"[1] — are recurrent concerns in the management of most chronic conditions. An intriguing finding in previous studies of hypertension, hypercholesterolaemia, diabetes, lower respiratory tract infections, asthma, and epilepsy has been a Rule of Halves in which "approximately half of most common chronic disorders are undetected, that half of those detected are not treated, and that half of those treated are not controlled"[2]. Yet this is not a fixed law: incentivising care and aggressive use of effective medication are credited with surpassing the Rule of Halves in managing high blood pressure[3].

Taken together, reports of prolonged non-consultation, underuse of recommended treatments and inadequate control of symptomatic osteoarthritis appear to reflect similar concerns to those behind the Rule of Halves, although it appears not have to been looked at in this way before. We therefore sought to estimate detection, treatment, and control of symptomatic knee osteoarthritis within a defined cohort. Low expectations, lack of incentives for care, and conservative treatments that rely on behavioural change to achieve small-to-moderate benefits, might suggest that current care for osteoarthritis would not exceed the Rule of Halves.

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Methods

Participants

Participants were members of the Knee Clinical Assessment Study (CAS-K), a prospective observational cohort study of knee pain and osteoarthritis in the general population. Ethical approval for the study was obtained from North Staffordshire Research Ethics Committee (References: 1430, 03/94, 05/Q2604/72) and the study protocol has been published[4]. Briefly, all patients aged $\geq$50 years registered with three general practices in North Staffordshire were invited to take part in a two-stage postal survey. Respondents who answered positively to 'knee pain in the last year' were invited to attend a research clinic which included clinical interview, plain X-rays and a self-complete questionnaire. At 18-months research clinic attenders completed a mailed self-complete questionnaire and were contacted again at 3-years with a questionnaire and invitation to research clinic as per baseline. The medical records of consenting participants were searched using an algorithm based on diagnosis/problem code entries and free text entries with all potential hits hand-searched for evidence of musculoskeletal knee-related GP consultations between baseline and 3-year follow-up.

Inclusion criteria for the current analysis were: knee symptoms on few days or more in the past month at baseline and at least definite osteophytes on plain radiographs of the index knee in either tibiofemoral or patellofemoral joint (equivalent to Kellgren & Lawrence grade 2 or more)[5]. Participants with a pre-existing diagnosis of inflammatory arthropathy, a total knee replacement in their most troublesome knee at baseline, or who were lost to follow-up at 3-years were excluded.

Definitions of detection, treatment, and control

The specific definitions used in the current study for detection, treatment, and control are provided in Table I. In the absence of any well-accepted definitions of what constitutes 'detection', adequate 'treatment', and satisfactory symptom 'control' of osteoarthritis we adopted broad definitions of these and then undertook sensitivity analyses to explore the effects on estimates of using narrower definitions for each of these three concepts. The broader definitions are described below: the narrower definitions appear in Table I.

For 'detection' our choice of a 3-year period represented a middle ground between a definition based on lifetime consultation ('ever seen your doctor about your problem'), which may not capture GPs' awareness of their patients' current status, and a definition based on consultation within only 1 year, which, although used as the basis in some quality of care indicators[10] may be too short an interval for monitoring a condition in which dramatic changes are rare. The definition of treatment meant that participants could switch treatments during the 3-year time period. However, at each of the three measurement points they had to be receiving at least one form of recommended treatment (see Table I). Treatments were counted irrespective of dose and source of supply. The inclusion of referral to physiotherapy or hospital specialist was intended to capture other potential recommended treatments that participants had received or may be taking but which had not been included as individual items in the treatment checklist of the questionnaires (e.g., bracing, TENS, manual therapy). Information on treatment was by participant self-report due to the absence or incomplete recording in the routine medical record of many recommended treatments. A participant's pain was considered 'controlled' if on at least two of the three measurement points they reported characteristic pain intensity in the past 6 months[7] of <5 out of 10[8]. If this criterion was not met, then the pain was classed as 'uncontrolled'.

Data analysis

The estimated rates of detection, treatment (among detected cases), and control (among detected and treated cases) were expressed as simple proportions with 95% confidence intervals (95%CI). Sensitivity analyses were run, repeating the above analyses but using the narrow definitions (Table I) in isolation and then in combination. We also investigated the effect of raising the symptom threshold for case definition at baseline to symptoms on most or all days in the past month. All data were analysed using Stata 11.0 (StataCorp. 2009. Stata Statistical Software: Release 11. College Station, TX: StataCorp LP).

Results

400 participants were included in the analysis (48% female; mean age 66.9 years (SD 8.6; range 50–93); mean average pain intensity in past 6 months 4.6 (SD 2.4)). Reasons for exclusion were: patient declined radiography ($n = 2$), TKR index knee ($n = 15$),

Table I
Definitions of cases, detection, treatment, and control

	Broad definition	Narrow definition
Case definition	Knee symptoms on few days or more in the past month at time of research assessment clinic visit at baseline and evidence of at least definite osteophytes on plain radiographs of the index knee in either tibiofemoral or patellofemoral joint (equivalent to Kellgren & Lawrence grade 2 or more)	Knee symptoms on **most or all days** in the past month at time of research assessment clinic visit at baseline and evidence of at least definite osteophytes on plain radiographs of the index knee in either tibiofemoral or patellofemoral joint (equivalent to Kellgren & Lawrence grade 2 or more)
Detection	At least one recorded knee-related musculoskeletal general practice consultations in the 3-year period following baseline OR self-reported recall of knee-related general practice consultation in the 3-year period following baseline	At least one recorded knee-related musculoskeletal general practice consultation, **specifically coded as osteoarthritis** (Read codes N05 or N06), in the 3-year period following baseline
Treatment	Self-report of having been seen by a physiotherapist or hospital specialist for their knee problem, received a TKR, or receiving at least one of the following recommended[6] treatments at baseline AND 18-months AND 3-years: dieting to lose weight (if body mass index $\geq$ 25 kg/m^2), specific knee exercises, paracetamol, oral NSAID (including COX2 inhibitor), oral opioid analgesia, topical analgesics/NSAID, or intra-articular injection)	Self-report of receiving at least one of the following **recommended core nonpharmacological treatments** at baseline AND 18-months AND 3-years: dieting to lose weight (if body mass index $\geq$ 25 kg/m^2), specific knee exercises
Control	Self-reported characteristic pain intensity in the past 6 months[7] of <5 out of 10[8] at two out of the three measurement points (baseline, 18-months, 3-years)	Self-reported characteristic pain intensity in the past 6 months of **<4 out of 10**[9] at two out of the three measurement points (baseline, 18-months, 3-years)

missing/spoilt knee X-rays ($n = 9$), existing diagnosis of inflammatory disease ($n = 16$), no knee symptoms in past month reported at baseline clinic ($n = 56$), no radiographic osteoarthritis in index knee ($n = 215$), died between baseline and 3-year follow-up ($n = 12$), lost to follow-up at 3-years ($n = 59$), and missing data ($n = 35$).

The Rule of Halves

Using the broad definitions, the estimated rates of 'detection', 'treatment' and 'control' were 55.3% (95%CI: 50.4, 60.1), 74.2% (68.4, 80.0), and 27.4% (20.5, 34.3) respectively (Table II).

Rates of 'detection' and 'treatment' were slightly higher and 'control' substantially lower when the analysis was restricted to patients with frequent symptoms at baseline (67.2%, 81.7% and 15.9% respectively). The requirement of having received a GP recorded diagnosis of osteoarthritis halved the 'detection' estimate (from 55.3% to 23.3%) but made little difference to the estimated rates of 'treatment' or 'control'. Using the narrow definition for treatment, which insisted on core nonpharmacological treatment (dieting or knee exercises) at all three time points substantially reduced the 'treatment' estimate (from 74.2% to 17.2%) but with little effect on 'control'. Choosing the more stringent Patient Acceptable Symptom State (PASS) criterion[9] (Table I) reduced the 'control' estimate from 27.4% to 18.3%. Of 195 persons with symptomatic radiographic knee osteoarthritis and frequent symptoms at baseline, we found only one who had evidence of an osteoarthritis-coded GP consultation over the 3-year period, consistent use of core nonpharmacological treatment, and symptoms that were classed as 'controlled' using the PASS cut-off.

Discussion

Our findings suggest that the management of symptomatic knee osteoarthritis does not conform to a Rule of Halves. Our sensitivity analyses, using more stringent definitions that were still consistent with current recommendations, suggest that rates of detection, treatment, and control are, if anything, likely to be lower.

Our estimate of 55% detection is at the slightly higher end compared with previous studies[11]. The inclusion of both self-reported recall and electronic health record as sources for consultation in the present study could partially explain the higher estimate. More fundamentally, 'detection' was defined simply as evidence of a general practitioner consultation and rates of treatment and control differed little depending on whether knee-related consultations were recorded under the diagnosis of knee osteoarthritis or under non-specific symptom codes. Prioritising higher consultation rates and disease diagnosis may be less important than implementing timely, accurate 'detection' of patients' pain severity and functional limitation. These are currently poorly recorded[12] but consistently proposed quality of care indicators[10,13]. Our unit is currently evaluating simple computer prompts and intensive training and support of practitioners to improve implementation.

On treatment and control, again our findings are broadly consistent with previous studies showing fairly high rates of use of recommended pharmacological treatments, relatively low levels of use of recommended nonpharmacological treatments, and often a lack of adequate symptom control in spite of these[12,14–19]. Our study cannot determine the respective contributions of mismatching existing treatments to patients, inadequate dosage and duration[20], and reduced effectiveness of treatments when applied to the broader spectrum of patients in routine practice than typically included in clinical trials[21]. Improving access to allied health professionals in primary care[22] and the long-term maintenance of effective nonpharmacological treatments warrant continued research and service development.

Our sample was drawn from prevalent symptomatic individuals recruited to an existing population cohort with linked medical record review. This approach enabled us to define cases based on the combination of symptoms and evidence of structural changes rather than by symptoms alone, and to use prospectively collected data thereby reducing inaccurate recall. However, although our sample was derived from a census survey of the entire population aged 50 years and over registered with participating practices, non-response and attrition may potentially bias estimates. We previously investigated patterns of selective participation and loss to follow-up in this cohort and found that aged 80 years and over, lower socioeconomic group, currently in employment, experiencing anxiety or depression, and brief episode of knee pain within the previous year were associated with non-participation at baseline[23]. The net effect of this on our estimates is difficult to judge. While our study gathered a large amount of data, it was on a relatively small sample from a single geographical region. Estimates

Table II
Estimated rates of detection, treatment and control in community-dwelling individuals with symptomatic knee osteoarthritis, North Staffordshire, 2002–2006

	N	Detection	Treatment	Control
Broad definitions	400	221	164	45
		55.3% (50.4, 60.1)	74.2% (68.4, 80.0)	27.4% (20.5, 34.3)
Sensitivity analyses:				
[A] Narrow case definition	195	131	107	17
		67.2% (60.5, 73.8)	81.7% (75.0, 88.4)	15.9% (8.8, 22.9)
[B] Narrow definition of detection	400	93	69	15
		23.3% (19.1, 27.4)	74.2% (65.1, 83.3)	21.7% (11.8, 31.7)
[C] Narrow definition of treatment	400	221	38	8
		55.3% (50.4, 60.1)	17.2 % (12.2, 22.2)	21.1% (7.5, 34.6)
[D] Narrow definition of control	400	221	164	30
		55.3% (50.4, 60.1)	74.2% (68.4, 80.0)	18.3% (12.3, 24.3)
[A]+[B]	195	58	47	7
		29.7% (23.3, 36.2)	81.0% (70.6, 91.4)	14.9% (4.3, 25.5)
[A]+[B]+[C]	195	58	12	1
		29.7% (23.3, 36.2)	20.7% (9.9, 31.4)	8.3% (0.0, 26.7)
[A]+[C]+[D]	195	131	26	2
		67.2% (60.5, 73.8)	19.8% (12.9, 26.8)	7.7% (0.0, 18.7)
[A]+[B]+[C]+[D]	195	58	12	1
		29.7% (23.3, 36.2)	20.7% (9.9, 31.4)	8.3% (0.0, 26.7)

NB Numbers and percentages are within those with complete data for each calculation.
See Table I for definitions.

would be expected to be particular to time and place, at least to some extent. The period of observation preceded the publication of NICE guidelines for the management of osteoarthritis in 2008 and patterns of treatment may have changed. However, many systematic reviews and guidelines with overlapping content to the NICE guidelines existed at the time of the study[24] and we have previously shown that rates of prescribed analgesia in this population (with the possible exception of topical NSAIDs) are unlikely to have changed markedly[25].

Applying the concepts underpinning the Rule of Halves to symptomatic osteoarthritis raises many questions. Unlike asymptomatic conditions, symptomatic osteoarthritis is in practice a clinical syndrome and the main consequences — pain and functional limitation — are manifest to the patient; therefore rates of detection, treatment, and control in general practice will reflect, in part at least, the values and informed choices of patients, including making an informed decision to self-manage or to live with pain without treatment. The two cutoffs we used to define 'control' have broad support from previous studies[26] but some patients may be satisfied with their function in spite of pain levels above those defined on average as "unacceptable". We suspect, though, that even our narrow definition of 'control', requiring only two time points over 3-years where pain was at 'acceptable' levels, results in an optimistic estimate of symptom control. Intermittent treatment taken during episodes of worse pain would tend to bias estimates of 'control' towards zero but cross-sectional estimates will still predominantly comprise long-term patterns and our choice of average pain intensity over the past 6 months would be expected to reduce such bias. Nevertheless, it is clear that even assuming one can apply the Rule of Halves to symptomatic osteoarthritis, operationalizing each step involves contentious decisions which can strongly influence the resultant estimates. We have justified our choices and explored them through sensitivity analyses and hope to have provoked critical discussion on these concepts and their definitions.

In acknowledging the challenges in applying the Rule of Halves to symptomatic osteoarthritis, the importance of individual patient values and needs should perhaps be emphasised. Improving patient care is not simply a case of 'more medicine'[27,28].

Author contributions

BN, GP conceived the study. BN, LS obtained funding. LS, DG, GP undertook the statistical analysis. LS, GP produced the initial draft manuscript. All authors contributed to the interpretation of the analysis, critical revision of the manuscript and all read and approved the final manuscript.

Competing interest statement

The authors have no conflicts of interest to declare.

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