

## EXTENDED REPORT

Self-reported quality care for knee  
osteoarthritis: comparisons across  
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**ABSTRACT**

**Objectives:** To assess and compare patient perceived quality of osteoarthritis (OA) management in primary healthcare in Denmark, Norway, Portugal and the UK.

**Methods:** Participants consulting with clinical signs and symptoms of knee OA were identified in 30 general practices and invited to complete a cross-sectional survey including quality indicators (QI) for OA care. A QI was considered as eligible if the participant had checked 'Yes' or 'No', and as achieved if the participant had checked 'Yes' to the indicator. The median percentage (with IQR and range) of eligible QIs achieved by country was determined and compared in negative binominal regression analysis. Achievement of individual QIs by country was determined and compared using logistic regression analyses.

**Results:** A total of 354 participants self-reported QI achievement. The median percentage of eligible QIs achieved (checked 'Yes') was 48% (IQR 28%, 64%; range 0–100%) for the total sample with relatively similar medians across three of four countries. Achievement rates on individual QIs showed a large variation ranging from 11% (referral to services for losing weight) to 67% (information about the importance of exercise) with significant differences in achievement rates between the countries.

**Conclusions:** The results indicated a potential for improvement in OA care in all four countries, but for somewhat different aspects of OA care. By exploring these differences and comparing healthcare services, ideas may be generated on how the quality might be improved across nations. Larger studies are needed to confirm and further explore the findings.

**INTRODUCTION**

Knee osteoarthritis (OA) is a prevalent chronic joint condition that affects the whole joint and may cause pain, stiffness and functional disability.<sup>1</sup> Owing to the increase in the ageing population and the epidemic of obesity, the incidence of OA is increasing.<sup>2</sup> OA is one of the leading causes of global disability<sup>3 4</sup> and is expected to be the fourth

**Key messages****What is already known on this subject?**

► Clinical practice does not always reflect guideline recommendations.

**What does this study add?**

► Patient-reported quality of care shows a large variation on different quality indicators.  
► The differences in achievement rates across four European countries may reflect differences in healthcare priorities.

**How might this impact on clinical practice?**

► By exploring differences in quality of care and healthcare services, ideas for improving healthcare may be developed.

leading cause of disability by the year 2020.<sup>1</sup> Hence, the burden of OA will become a major challenge for health systems globally.<sup>1</sup>

Evidence-based recommendations have the potential to improve the quality of healthcare by promoting interventions of proven benefit and discouraging unnecessary, ineffective or harmful interventions. International and national guidelines for OA treatment, including those made by the European League Against Rheumatism (EULAR), American College of Rheumatology (ACR), Osteoarthritis Research Society International (OARSI) and the UK National Institute for Health and Care Excellence (NICE), have been available for some time.<sup>5–12</sup> The first message that emerges from the guidelines is that there is a range of simple interventions for which there is evidence of clinical effectiveness. However, clinical practice does not always reflect these recommendations.<sup>13 14</sup> Adherence to recommendations for care may be measured using process quality indicators (QI). A QI can be defined as a "measurable [element] of practice performance for which there is evidence or consensus that it can be used to assess the quality, and

hence change in the quality, of care provided".<sup>15</sup> A limited number of QI lists for OA care have been developed.<sup>16–23</sup>

A small number of previous studies have examined the quality of OA care using QIs. The results show patient-reported achievement of OA QIs between 22% and 72%, suggesting that primary healthcare for older adults with OA is suboptimal.<sup>13 14 20 24–28</sup> Although patient self-reported QI measures may have some limitations with regard to accuracy and recall bias, they provide an important perspective of the quality of OA care and mirror the care as perceived by the patient. Further, patient-reported measures can include elements of care that are less reliably captured from the medical records, for example, patient information or functional assessments. The patient perspective of OA QI attainment has so far received limited attention, and differences related to the QI items and study design make it challenging to directly compare study results. This EULAR-funded study is the first study that has applied the same set of QI items in four European countries, which allows a cross-national comparison of OA QI achievement.

This study aimed to determine the self-reported QI achievement for OA care among adults with knee OA and to compare QI achievement cross-nationally between Denmark, Norway, Portugal and the UK.

## METHODS

### Study design

This study includes data from cross-sectional surveys in primary healthcare in four European countries: Denmark (DK), Norway (NO),<sup>29</sup> Portugal (PT) and the UK (UK).<sup>30</sup> Ethical approvals were granted for all four surveys (see online supplementary file 1). Research partners have been involved in designing the surveys in the four countries, and in this study in the design and writing. This paper is written in concordance with the STROBE guidelines for reporting observational studies.<sup>31</sup>

### Setting and participant recruitment

In all four surveys, the participants were recruited from primary healthcare. Adults aged 45 years and over consulting their general practitioner (GP) with a knee OA diagnosis recorded in the medical records were identified between 2012 and 2014. Participants with inflammatory arthritis, malignant illness or an inability to complete the questionnaire were excluded. There were some minor differences in eligibility criteria between the four surveys, and the details are provided in online supplementary file 1. Written consent was obtained and questionnaires were completed either immediately after the GP consultation on site (DK, NO and PT) or at home (DK, NO and UK) and returned in a prepaid envelope.

### The questionnaire

A set of QI items for OA care was included in all four surveys (see online supplementary file 2). In three

countries (NO, DK and PT), the OsteoArthritis QI (OA-QI) questionnaire was used. The OA-QI questionnaire was developed in 2010 using published QIs, an expert panel and patient interviews.<sup>20</sup> Acceptable validity and moderate test-retest reliability were demonstrated in a Norwegian OA cohort.<sup>20</sup> The OA-QI questionnaire has been subject to a forward and backward translation procedure into English and Danish, and then from English into Portuguese. The OA-QI questionnaire includes 17 items with 'Yes', 'No' response options and a third option if the item was not applicable (eg, 'Not overweight' for items on weight management) or the participant did not remember. The UK survey applied a variation of the QI set: the patient-generated MOSAICS QI questionnaire.<sup>30</sup> Fourteen QI items were measured consistently in all four countries and included in the main analysis (QIs numbers 4, 9 and 12 from the OA-QI were not included). Five items addressed patient education and information about disease development, treatment alternatives, self-management, weight management and physical activity. Regular provider assessments are addressed in two questions. Four questions were related to pharmacological treatment and three addressed referrals.

Age, gender and body height and weight were self-reported or measured (DK), and the body mass index (BMI) was calculated. Comorbidity was self-reported (DK, NO and PT) or obtained from a medical record review for the previous 24 months (UK). Inflammatory arthritis included ankylosing spondylitis, Sjogren's syndrome, psoriasis, psoriatic arthritis, polymyalgia rheumatica, systemic lupus erythematosus and rheumatoid arthritis. Chronic comorbidity included heart disease, lung disease, osteoporosis, cancer and diabetes. Knee function was self-reported in DK, NO and PT using the Knee injury and Osteoarthritis Outcome Score (KOOS),<sup>32</sup> whereas the Western Ontario and McMaster Universities Arthritis Index Short Form 8-item (WOMAC SF-8)<sup>33</sup> function scale score was used in the UK. The WOMAC function scale score can be derived from the KOOS, so the WOMAC SF-8 function scale score was calculated for all countries. The eight items include: descending stairs, ascending stairs, rising from sitting, walking on a flat surface, getting in/out of a car, shopping, putting on a sock and getting on/off the toilet. The scale score ranges from 0 to 100, with 0 indicating no functional problems. The KOOS was not initially included in the questionnaire in PT and only 30% of patients from PT had an SF-8 score determined.

### Statistical analyses

QIs were considered as achieved if the participant had checked 'Yes' to an indicator. Responses were excluded (not eligible) from analysis for that QI if there was a missing/ambiguous response or if the participant had responded 'Don't remember', 'Not overweight', 'No such problems', 'No pain/discomfort' or 'Not severely

troubled'. Hence, the number of eligible items varied from participant to participant.

The median (with IQR and range) number of eligible QIs (ie, checked 'Yes' or 'No') and the median (IQR, range) percentage of eligible QIs achieved in each country were determined on the basis of the 14 QIs measured in all 4 countries. Further, the percentage of people having all eligible QIs achieved (checked solely 'Yes'), and the percentage with no eligible QIs achieved (checked solely 'No') was determined. Differences in the number of QIs achieved between countries, using the number of eligible QIs for each person as the exposure variable, were determined using negative binomial regression, first unadjusted and then adjusted for age, gender, BMI and comorbidity. Results are reported as rate ratios (RR) and 95% CI using NO as the reference country. In sensitivity analyses, we repeated the analysis only in people from NO, DK and the UK for whom a WOMAC function scale score was available, and further adjusted for functional limitation; and then restricted the analysis to those without inflammatory arthritis comorbidity.

Achievement of each QI was compared between countries using logistic regression, again unadjusted and then adjusted for age, gender, BMI and comorbidity.

Analysis was performed using Stata/MP 13.1 for Windows.

## RESULTS

### Participants

In total, 354 patients were included in the analyses (figure 1). The mean age was 67.7 years (SD 10.1), the proportion of females was 67%, and the mean BMI was 28.5 kg/m<sup>2</sup> (SD=4.8; table 1). The WOMAC SF-8 function scale score showed better function among the sub-sample of the Portuguese participants and Danish participants compared with the Norwegian and UK

participants. The presence of inflammatory arthritis was highest in the Danish cohort compared with the other cohorts, and the presence of a chronic disease was higher in the Danish and Portuguese cohorts. The UK had the lowest comorbidity levels, but this was based entirely on medical records rather than self-report.

### Number of QIs achieved in the total sample and by country

The study participants considered most of the 14 QIs to be relevant (eg, checked 'Yes' or 'No'), and the median number of eligible QIs was 12 (IQR=10–14, range 0–14). The median percentage of eligible QIs achieved (checked 'Yes') was 48% (IQR=28%, 64%; range 0–100%). For 5% of the total sample, none of the QIs were achieved, and for 2% all eligible QIs were achieved.

The median percentage of QIs achieved by country was relatively similar across three of the countries, but significantly lower in DK (23%; unadjusted RR compared to NO=0.54; 95% CI 0.43 to 0.68; table 2). DK still had a significantly lower level of achievement after adjustment for age, gender, BMI and comorbidity (RR=0.49; 0.39, 0.62), when further adjusted for the WOMAC function scale score (RR=0.47; 0.38, 0.59), and when restricted to those without inflammatory arthritis comorbidity (RR=0.47; 0.34, 0.66). None of the covariates were associated with the number of QIs achieved in the final models.

### Achievement of individual QIs in the total sample

Achievement of individual QIs ranged from 11% to 67% (table 3). QIs with the lowest percentage achievement were related to referral to services for losing weight (11%), functional assessments (appliances and aids 13%; walking aids 31%), consideration of corticosteroid joint injections (25%) and referral for evaluation for surgery (36%). QIs with the highest percentage achievement were around delivery of information about the

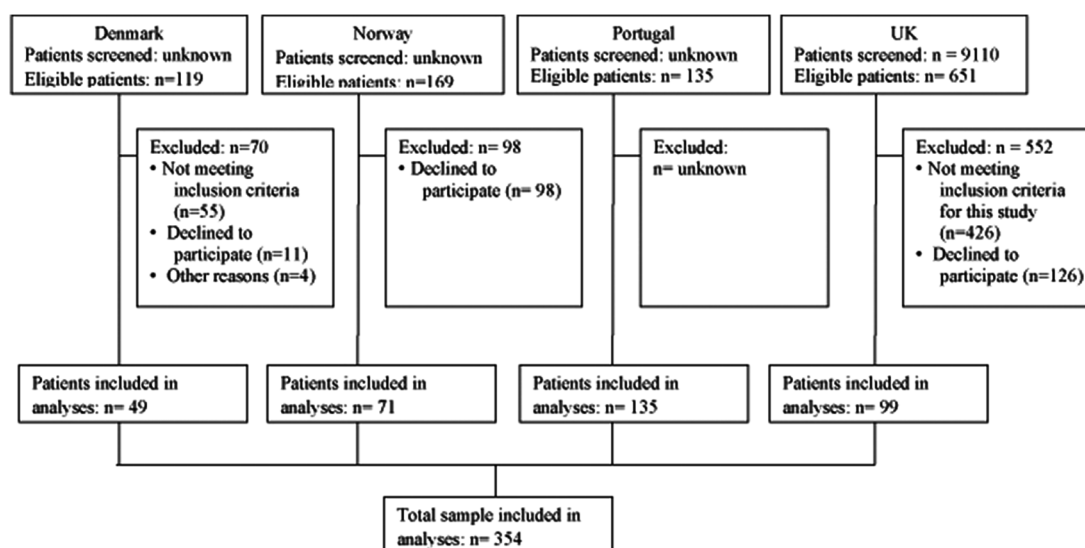


Figure 1 Flow diagram.

**Table 1** Characteristics of participants

	Norway	Denmark	Portugal	UK	Total
Number of responders	71	49	135	99	354
Age, mean (SD)	66.1 (10.18)	57.6 (7.55)	69.2 (8.15)	71.7 (10.07)	67.7 (10.07)
Female, n (%)	48 (68)	26 (53)	104 (77)	59 (60)	237 (67)
BMI, mean (SD)	28.4 (4.22)	27.3 (2.58)	29.5 (5.23)	28.0 (5.20)	28.5 (4.78)
WOMAC SF-8,* mean (SD)	46.4 (19.17)	31.6 (15.65)	28.7 (22.53)†	45.8 (19.58)	40.4 (20.65)
Inflammatory arthritis,‡ n (%)	19 (31)	29 (59)	56 (42)	4 (4)	108 (31)
Chronic disease,§ n (%)	32 (46)	31 (63)	98 (73)	34 (34)	195 (55)

\*Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Short Form 8-item function scale score (0–100, 0=best).

†n=41.

‡Inflammatory arthritis, ankylosing spondylitis, Sjogren's syndrome, psoriasis, psoriatic arthritis, polymyalgia rheumatica, systemic lupus erythematosus and rheumatoid arthritis.

§Chronic disease: heart disease, lung disease, other musculoskeletal disorder, cancer and diabetes.

BMI, body mass index.

importance of exercise (67%), information about their joint problem (55%), information about OA treatment (55%), information about anti-inflammatory (side) effects (59%), and the recommendation of paracetamol as first-line medication (59%).

### Achievement of individual QIs by country

Among the four countries, the UK study showed the highest achievement rates for the information QIs around the joint problem, treatment, and managing OA, and for stronger medication and joint injection QIs (table 4). The Norwegian study had the highest achievement rates for exercise information, referral for physical activity and recommendation of paracetamol. The Portuguese study showed the highest achievement rates for advice to lose weight and referral to services for losing weight. DK had the lowest percentage achievement for 13 of the 14 QIs measured in all four countries.

### DISCUSSION

This study aimed to determine patient self-reported QI achievement for OA care among adults with knee OA

and compare QI achievement across four European countries. The percentage of participants in the total sample who achieved the individual QIs varied widely across QIs, and the number of QIs achieved by patients revealed some differences between the countries. There were similarities and differences between the countries in relation to achievement of the individual QIs.

### QIs achieved in the total sample and by country

In contrast to two previous studies, which showed that age, gender, education and severity of the OA disease were related to QI achievement,<sup>13 14</sup> patient characteristics in the present study were not associated with QI achievement. The median percentage of QIs achieved for the total study sample was similar to the rates in two previous studies of patient-reported OA QI achievement rates in primary healthcare,<sup>24 27 34</sup> higher median than in three studies<sup>14 20 28</sup> and lower median than in one study.<sup>26</sup> It has previously been shown that adherence to QIs in OA care was lower compared to that in gout or other chronic conditions in older adults.<sup>25 28 35</sup> According to Grol,<sup>36</sup> achievement rates of approximately 60–70% have been demonstrated for most chronic diseases, which is higher than the rates in this study.

**Table 2** Number of quality indicators (QI) achieved by country\*

	Norway, n=71	Denmark, n=49	Portugal, n=135	UK, n=99	Total, n=354
Number of eligible QIs, median (IQR)	11 (9, 13)	12 (10, 14)	12 (10, 14)	13 (11, 14)	12 (10, 14)
Number of eligible QIs, range	6, 14	0, 14	0, 14	3, 14	0, 14
No eligible QIs achieved, % (95% CI)	0 (0 to 5)	8 (3 to 20)	10 (6 to 16)	2 (1 to 7)	5 (3 to 8)
All eligible QIs achieved, % (95% CI)	4 (1 to 12)	2 (0 to 11)	1 (0 to 5)	1 (0 to 6)	2 (1 to 4)
Eligible QIs achieved, median % (IQR)	50 (33, 63)	23 (10, 41)	48 (25, 67)	55 (36, 67)	48 (28, 64)
Eligible QIs achieved, range %	7, 100	0, 100	0, 100	0, 100	0, 100
Unadjusted rate ratio for number of eligible QIs achieved (95% CI)	1.00	0.54 (0.43 to 0.68)	0.92 (0.79 to 1.08)	1.06 (0.90 to 1.25)	
Adjusted† rate ratio for number of eligible QIs achieved (95% CI)	1.00	0.49 (0.39 to 0.62)	0.92 (0.77 to 1.09)	1.10 (0.92 to 1.31)	

\*Of the 14 QIs measured in all four countries.

†Adjusted for age, gender, body mass index and comorbidity.

Eligible QIs excludes those stating not applicable/do not remember and those not responding to the QI.



**Table 3** Achievement of individual quality indicators (QI) for the total study sample\*

Indicator	Number of people eligible†	Number of people achieved	Achievement rate, % (95% CI)
Information about joint problem	319	176	55 (50 to 61)
Information about treatment	331	181	55 (49 to 60)
Advice on managing/living with osteoarthritis	323	157	49 (43 to 54)
Information about exercise	330	221	67 (62 to 72)
Referred for physical activity	325	158	49 (43 to 54)
Advised to lose weight	247	114	46 (40 to 52)
Referred to services for losing weight	247	27	11 (8 to 15)
Assessed for walking aid	214	67	31 (25 to 38)
Assessed for daily living appliances and aids	183	23	13 (9 to 18)
Recommended paracetamol	340	202	59 (54 to 64)
Offered stronger painkillers	322	167	52 (46 to 57)
Information about anti-inflammatory medicine (side) effects	311	183	59 (53 to 64)
Considered joint injection	329	81	25 (20 to 30)
Referred for evaluation of surgery	262	94	36 (30 to 42)

\*Including only the 14 QIs measured in all four countries.

†Eligible excludes those stating not applicable/do not remember and those not responding to the QI.

Although the median percentage of QIs achieved was relatively similar for three of the countries, the median for the Danish cohort in this study was significantly lower even after adjustments for patient characteristics. Although a real difference cannot be ruled out, it might be due to a selection bias as the Danish data were extracted from baseline data among a small number of participants recruited to a randomised controlled trial of pharmacological versus exercise treatment.

### Achievement of individual QIs in the total sample and by country

There was substantial variation in the achievement of individual QIs across the countries. Differences in healthcare systems (ie, access to dietitians, physiotherapists, occupational therapists and orthopaedic surgeons; or the healthcare economy and patient payment) may explain a substantial proportion of the variation in individual QI achievement rates seen in this study. The observed variation could also be related to differences in patient expectations or attitudes towards OA, and in knowledge about OA and recommended treatment. There may also be variation in the timing of when people choose to consult a healthcare professional for their OA symptoms. Hence, the patients' disease severity and burden of disease may vary at the time of consultation.

The UK data showed the highest achievement rates among the four countries regarding information about the joint problem, treatment alternatives and self-management as compared to the other three countries. Compared to two previous UK studies,<sup>13 28</sup> the achievement rates in this study were substantially greater (76% vs 30/18%). This may have been related to the recruitment procedures in the MOSAICS study where eligible participants were identified via electronic pop-up screens in general practices, which could have reminded

GPs about treatment recommendations for OA and led to higher achievement rates.

The total study sample showed substantially higher achievement rates for advice to exercise compared to a Canadian study (69% vs 25%),<sup>14</sup> and much higher referral rates to supervised exercise (physical therapy) compared to a recent Australian study (52% vs 4%).<sup>37</sup> The Norwegian cohort had the highest achievement rates regarding advice to exercise and referrals to supervised exercise. Whether this is due to differences in the healthcare system and organisation, gross domestic product and healthcare economy, national health authority strategies, or due to differences in GPs' knowledge or attitude towards exercises and physical therapy could not be investigated in this study.

In the total study sample, the low rate for referrals to services (ie, dietitians) for support on losing weight is in line with the results in a recent Australian study.<sup>37</sup> However, the low rates are in contrast to the evidence showing that obesity is a risk factor for OA progression and that even modest weight reductions may reduce symptoms.<sup>38</sup> A UK survey showed that BMI monitoring and adherence to exercise were less frequently monitored by GPs as compared to pain, function and analgesia. The authors suggest that lack of time, lack of confidence in providing advice and effectiveness of interventions, lack of reimbursements, and lack of patient adherence and motivation represent major barriers to GPs discussing lifestyle interventions (eg, exercise and losing weight) with their patients.<sup>39</sup> In this study, the Portuguese cohort had the highest achievement rate for advice on losing weight. Although the Portuguese GPs' referral rate to weight loss services was only 21%, this was much higher compared to the achievement rates in the other three countries. This finding most likely reflects a priority in the Portuguese healthcare services since most healthcare centres in the region of Algarve have been staffed with a dietician or

**Table 4** Individual quality indicator achievement by country

Indicator	Norway Total n=71		Denmark Total n=49		Portugal Total n=135		UK Total n=99	
	Eligible n*	Achieved n (%)	Eligible n*	Achieved n (%)	Eligible n*	Achieved n (%)	Eligible n*	Achieved n (%)
Information about joint problem	62	36 (58)	42	10 (24)†	121	59 (49)	94	71 (76)‡
Information about treatment	63	32 (51)	47	18 (38)†	127	59 (46)	94	72 (77)‡
Advice on managing/living with OA	60	26 (43)	44	7 (16)†	127	56 (44)	92	68 (74)‡
Information about changing lifestyle§	55	18 (33)	47	8 (17)†	127	56 (44)		
Information about exercise	63	52 (83)	47	25 (53)†	129	84 (65)	91	60 (66)
Referred for physical activity	67	53 (79)	47	10 (21)†	124	53 (43)†	87	42 (48)†
Advised to lose weight	42	17 (40)	33	8 (24)†	98	59 (60)	74	30 (41)
Referred to services for losing weight	38	4 (11)	35	0 (0)†	97	19 (20)	77	4 (5)
Assessment of problems in daily activities§	48	22 (46)	38	14 (37)	93	36 (39)†		
Assessed for walking aid	42	11 (26)	28	0 (0)†	69	27 (39)	75	29 (39)
Assessed for daily living appliances/aids	33	6 (18)	29	0 (0)†	68	11 (16)	53	6 (11)
Assessment of pain§	66	48 (73)	47	22 (47)†	126	74 (59)†		
Recommended paracetamol	66	48 (73)	48	29 (60)	129	67 (52)†	97	58 (60)
Offered stronger painkillers	61	27 (44)	47	17 (36)	122	62 (51)	92	61 (66)‡
Information about anti-inflammatory medicine (side) effects	60	36 (60)	45	19 (42)†	119	79 (66)	87	49 (56)
Considered joint injection	68	11 (16)	44	3 (7)	126	32 (25)	91	35 (38)‡
Referred for surgery	54	23 (43)	33	5 (15)†	101	39 (39)	74	27 (36)

\*Excluding missing, not applicable, do not remember.

†Lower achievement than in Norway ( $p < 0.05$ ), adjusting for age, gender, body mass index (BMI) (except for items relating to weight), comorbidity.

‡Better achievement than in Norway ( $p < 0.05$ ), adjusting for age, gender, BMI (except for items relating to weight), comorbidity.

§Not measured in the UK.

nutritionist, which is in contrast to that in the other three countries.

Apart from QIs related to weight, the QIs for functional assessments, corticosteroid injections and referrals for surgery represented the lowest achievement rates in this study. This could reflect a lower priority among health professionals for these aspects of OA care or limited access to or availability of such assessments and treatment. The UK and Portuguese cohorts had (non-significantly) higher achievement rates for assessment for walking aids, whereas the Norwegian cohort had the highest rates for daily living appliances/aids. There was a higher achievement rate for recommendation of paracetamol in the Norwegian cohort, and of stronger painkillers in the UK cohort. This may reflect differences in national pharmacological guidelines or differences in the medical practice between the countries.

### Strengths and limitations

The application of the same set of QIs across primary healthcare in the same time period and in similar settings in four different European countries allowed for cross-national comparisons and represents a major strength of this study. However, there were some minor differences in the phrasing of the UK QI items compared to the QIs in the other three countries, which may possibly have influenced the patient-reported achievement. Some GPs may have been aware of the items in the questionnaire. If they changed their behaviour due to this, it may have resulted in somewhat higher achievement rates. The populations in the four countries might have been somewhat different due to differences in the inclusion criteria and the target population, which may have influenced the characteristics of participants and the achievement rates. Comorbidity was self-reported in most countries, but extracted from medical records in the UK, so this may have induced some differences between the study populations. However, none of these variables were associated with the number of QIs achieved in the final models. The unknown number of people screened in three countries and the somewhat limited number of participants recruited in each country implies that some caution should be applied in generalising the study results to the general populations in the four countries. However, the results from the Norwegian cohort were similar to the results from a recent nationwide survey, which strengthen the generalisability. It is also a limitation that we had no data on psychological distress or depression, expectations, knowledge on OA treatment and healthcare utilisation and that we were not able to adjust analyses for the differences in healthcare systems and access to OA care across the countries.

### Implications

Quality improvement initiatives targeting OA care are becoming increasingly important as the prevalence of OA is expected to further increase, and implementation

of evidence-based OA treatment is likely to reduce the associated burden of disability.<sup>9–12</sup> Carefully designed QIs have the potential to quantify and address gaps in clinical care,<sup>40</sup> and can improve delivery of provided care through an appropriate measurement of healthcare system performance across providers, system levels and regions.<sup>41</sup> This study represents a novel attempt to implement the same set of QIs and compare QI achievement rates across populations from four different countries. Adherence to process QIs in rheumatology has recently been shown to be associated with improved patients' outcomes,<sup>42</sup> and a recent study demonstrated that by implementing core recommendations for OA treatment, the need for total joint replacements may be postponed.<sup>43</sup> Hence, health professionals should aim for higher adherence to standards of care and guideline recommendations. However, multifaceted approaches, including system-level interventions and patient-focused interventions among others, may be needed to improve the quality of OA care.<sup>44</sup> Joint initiatives and cross-country collaborations to improve OA care and implementation of international guidelines could be explored as one of several potential ways to meet this healthcare challenge.

In conclusion, the results of this study indicate that there exists a potential for improvement in OA care in all four countries, but for somewhat different aspects of OA care. QIs may be used to assess and monitor the quality of OA care, and larger studies with more countries and larger sample sizes may allow for further explorations of differences in QI achievement between countries. By exploring such differences and comparing healthcare services across countries, ideas may be generated on how the quality of OA care might be improved internationally.

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**Competing interests** KD was a member of the NICE Guideline Development Group and the NICE quality standards group for osteoarthritis.

**Patient consent** Obtained.

**Ethics approval** Danish Data Protection Agency, on the 22nd of June 2012 + the Norwegian Regional Committee for Medical and Health Research Ethics on the 19th of October 2011 (REK South-East B 2011/1963 + the Regional Health Administration (ARS-Argave) on the 27th of July 2012 (077/12 DSPP) + the North West 1 Research Ethics Committee, Cheshire (REC reference: 10/H101776) on 26th October 2010 and was monitored by an Independent Trial Steering Committee and Data Monitoring Committee (Trial registration number ISRCTN06984617).

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** No additional data are available.

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## REFERENCES

- Cross M, Smith E, Hoy D, *et al*. The global burden of hip and knee osteoarthritis: estimates from the Global Burden of Disease 2010 study. *Ann Rheum Dis* 2014;73:1323–30.
- Bijlsma JW, Berenbaum F, Lefeber FP. Osteoarthritis: an update with relevance for clinical practice. *Lancet* 2011;377:2115–26.
- Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. *Bull World Health Organ* 2003;81:646–56.
- Vos T, Flaxman AD, Naghavi M, *et al*. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2163–96.
- Jordan KM, Arden NK, Doherty M, *et al*. EULAR Recommendations 2003: an evidence based approach to the management of knee osteoarthritis: report of a Task Force of the Standing Committee for International Clinical Studies Including Therapeutic Trials (ESCISIT). *Ann Rheum Dis* 2003;62:1145–55.
- Zhang W, Doherty M, Arden N, *et al*. EULAR evidence based recommendations for the management of hip osteoarthritis: report of a task force of the EULAR Standing Committee for International Clinical Studies Including Therapeutics (ESCISIT). *Ann Rheum Dis* 2005;64:669–81.
- Zhang W, Doherty M, Leeb BF, *et al*. EULAR evidence based recommendations for the management of hand osteoarthritis: report of a Task Force of the EULAR Standing Committee for International Clinical Studies Including Therapeutics (ESCISIT). *Ann Rheum Dis* 2007;66:377–88.
- Zhang W, Moskowitz RW, Nuki G, *et al*. OARSI recommendations for the management of hip and knee osteoarthritis, part I: critical appraisal of existing treatment guidelines and systematic review of current research evidence. *Osteoarthritis Cartilage* 2007;15:981–1000.
- National Collaborating Centre for Chronic C. *Osteoarthritis: national clinical guidelines for care and management in adults*. London: Royal College of Physicians, 2008.
- Hochberg MC, Altman RD, April KT, *et al*. American College of Rheumatology. American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care Res (Hoboken)* 2012;64:455–74.
- Fernandes L, Hagen KB, Bijlsma JW, *et al*. EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Ann Rheum Dis* 2013;72:1125–35.
- McAlindon TE, Bannuru RR, Sullivan MC, *et al*. OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis Cartilage* 2014;22:363–88.
- Broadbent J, Maisey S, Holland R, *et al*. Recorded quality of primary care for osteoarthritis: an observational study. *Br J Gen Pract* 2008;58:839–43.
- Li LC, Sayre EC, Kopec JA, *et al*. Quality of nonpharmacological care in the community for people with knee and hip osteoarthritis. *J Rheumatol* 2011;38:2230–7.
- Lawrence M, Olesen F. Indicators of quality in health care. *Eur J Gen Pract* 1997;3:103–8.
- Hochberg MC. Quality measures in osteoarthritis. *Clin Exp Rheumatol* 2007;25:102–6.
- MacLean CH. Quality indicators for the management of osteoarthritis in vulnerable elders. *Ann Intern Med* 2001;135:711–21.
- Pencharz JN, MacLean CH. Measuring quality in arthritis care: the Arthritis Foundation's Quality Indicator set for osteoarthritis. *Arthritis Rheum* 2004;51:538–48.
- eumusc.net. Health Care Quality Indicators for OA. 2012. [http://www.eumusc.net/workpackages\\_wp6.cfm](http://www.eumusc.net/workpackages_wp6.cfm) (accessed Apr 2015).
- Østeras N, Garratt A, Grotle M, *et al*. Patient-reported quality of care for osteoarthritis: development and testing of the osteoarthritis quality indicator questionnaire. *Arthritis Care Res (Hoboken)* 2013;65:1043–51.
- Edwards JJ, Khanna M, Jordan KP, *et al*. Quality indicators for the primary care of osteoarthritis: a systematic review. *Ann Rheum Dis* 2015;74:490–8.
- Grypdonck L, Aertgeerts B, Luyten F, *et al*. Development of quality indicators for an integrated approach of knee osteoarthritis. *J Rheumatol* 2014;41:1155–62.
- Peter WF, van der Wees PJ, Hendriks EJ, *et al*. Quality indicators for physiotherapy care in hip and knee osteoarthritis: development and clinimetric properties. *Musculoskeletal care* 2013;11:193–202.
- McGlynn EA, Asch SM, Adams J, *et al*. The quality of health care delivered to adults in the United States. *N Engl J Med* 2003;348:2635–45.
- Wenger NS, Solomon DH, Roth CP, *et al*. The quality of medical care provided to vulnerable community-dwelling older patients. *Ann Intern Med* 2003;139:740–7.
- Glazier RH, Badley EM, Wright JG, *et al*. Patient and provider factors related to comprehensive arthritis care in a community setting in Ontario, Canada. *J Rheumatol* 2003;30:1846–50.
- Ganz DA, Chang JT, Roth CP, *et al*. Quality of osteoarthritis care for community-dwelling older adults. *Arthritis Rheum* 2006;55:241–7.
- Steel N, Bachmann M, Maisey S, *et al*. Self reported receipt of care consistent with 32 quality indicators: national population survey of adults aged 50 or more in England. *BMJ* 2008;337:a957.
- Gronhaug G, Østeras N, Hagen K. Quality of hip and knee osteoarthritis management in primary health care in a Norwegian county: a cross-sectional survey. *BMC Health Serv Res* 2014;14:598.
- Dziedzic KS, Healey EL, Porcheret M, *et al*. Implementing the NICE osteoarthritis guidelines: a mixed methods study and cluster randomised trial of a model osteoarthritis consultation in primary care—the Management of OsteoArthritis In Consultations (MOSAICS) study protocol. *Implement Sci* 2014;9:95.
- von Elm E, Altman DG, Egger M, *et al*. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *BMJ* 2007;335:806–8.
- Roos EM, Roos HP, Lohmander LS, *et al*. Knee Injury and Osteoarthritis Outcome Score (KOOS)—development of a self-administered outcome measure. *J Orthop Sports Phys Ther* 1998;28:88–96.
- Whitehouse SL, Lingard EA, Katz JN, *et al*. Development and testing of a reduced WOMAC function scale. *J Bone Joint Surg Br* 2003;85:706–11.
- Grønhaug G, Hagfors J, Borch I, *et al*. Perceived quality of health care services among people with osteoarthritis—results from a nationwide survey. *Patient Prefer Adherence* 2015;9:1255–61.
- Kerr GS, Richards JS, Nunziato CA, *et al*. Measuring physician adherence with gout quality indicators: a role for natural language processing. *Arthritis Care Res (Hoboken)* 2015;67:273–9.



36. Grol R. Successes and failures in the implementation of evidence-based guidelines for clinical practice. *Medical care* 2001;39:1146–54.
37. Brand CA, Harrison C, Tropea J, *et al.* Management of osteoarthritis in general practice in Australia. *Arthritis Care Res (Hoboken)* 2014;66:551–8.
38. Christensen R, Bartels EM, Astrup A, *et al.* Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: a systematic review and meta-analysis. *Ann Rheum Dis* 2007;66:433–9.
39. Clarson LE, Nicholl BI, Bishop A, *et al.* Monitoring Osteoarthritis: A Cross-sectional Survey in General Practice. *Clin Med Insights Arthritis Musculoskelet Disord* 2013;6:85–91.
40. Barber CE, Smith A, Esdaile JM, *et al.* Best practices for cardiovascular disease prevention in rheumatoid arthritis: a systematic review of guideline recommendations and quality indicators. *Arthritis Care Res (Hoboken)* 2015;67:169–79.
41. Bombardier C, Mian S. Quality indicators in rheumatoid arthritis care: using measurement to promote quality improvement. *Ann Rheum Dis* 2013;72(Suppl 2):ii128–31.
42. Yazdany J, Trupin L, Schmajuk G, *et al.* Quality of care in systemic lupus erythematosus: the association between process and outcome measures in the Lupus Outcomes Study. *BMJ Qual Saf* 2014;23:659–66.
43. Svege I, Nordsletten L, Fernandes L, *et al.* Exercise therapy may postpone total hip replacement surgery in patients with hip osteoarthritis: a long-term follow-up of a randomised trial. *Ann Rheum Dis* 2015;74:164–9.
44. Grol R. *Improving patient care: the implementation of change in health care*. 2nd edn. Chichester, West Sussex: Wiley Blackwell, 2013.