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Brief report
Physician diagnosed arthritis, reported arthritis and radiological non-axial osteoarthritis

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Summary

Objective: To determine the question that best predicts radiographic evidence of non-axial osteoarthritis (OA).

Design: The Melbourne Women's Mid-life Health Project (MWMHP), commenced in 1991, is a population-based prospective study of 438 Australian-born. Two hundred and fifty-seven (57%) women remained in longitudinal assessment in 2002 and 224 (87%) women agreed to undergo X-rays of their hands and knees between 2002 and 2003.

Methods: Annually participants were asked about aches and stiff joints and arthritis or rheumatism. In the eleventh year of follow-up X-rays were scored for evidence of OA using a validated scale, by two investigators who were blinded to questionnaire results. Information on hormone therapy use, physical activity, mood, smoking, body mass index (BMI) and age were obtained by both self-administered and face-to-face questionnaires.

Results: Patient reported physician diagnosed arthritis was the best predictor of radiological OA (ROA). The question had a specificity of 64%, a positive predictive value of 57% and a negative predictive value of 71%. Even the most reliable question about arthritis still had a relatively low specificity for radiologically diagnosed OA. Reporting symptoms were significantly more common in participants who were depressed, those who had a higher negative affect and those with a higher BMI.

Conclusion: In large epidemiological studies where questionnaire assessment of OA is required, the greatest accuracy is achieved by asking about physician diagnosed arthritis. Concurrent application of a validated scale for mood is important.
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Key words: Radiological, Osteoarthritis, Mood, Joint symptoms, Menopause, Weight, Physical activity.

Introduction

Osteoarthritis (OA) is the most common musculoskeletal disease[1]. The pain and limitation of function caused by the symptoms of OA affect many aspects of an individual's health and quality of life[2]. Its impact on functional ability imposes a significant burden on the community in the provision of support for those with arthritic disability[3]. The progression of joint degeneration varies considerably between individuals. Current treatment strategies target symptoms and prevention of disability. With no current curative therapy available, treatment at earlier stages of disease may be more effective. Therefore joint symptoms associated with OA are important to study as a possible indicator of early disease[4].

Large population-based studies are required to address these issues as well as for the planning of health services. In these studies, the current gold standard for classification of OA requires assessment of both symptoms and radiographic evidence of disease. However in large epidemiological studies the logistics and the cost of X-ray assessment may not be feasible, and expose study participants to radiation. X-ray measures are also associated with greater participant withdrawal and non-participation compared with simpler measures such as questionnaires. In addition, as investigators have used diverse criteria to determine the presence of symptoms, with a mixture of radiographic views and different definitions of
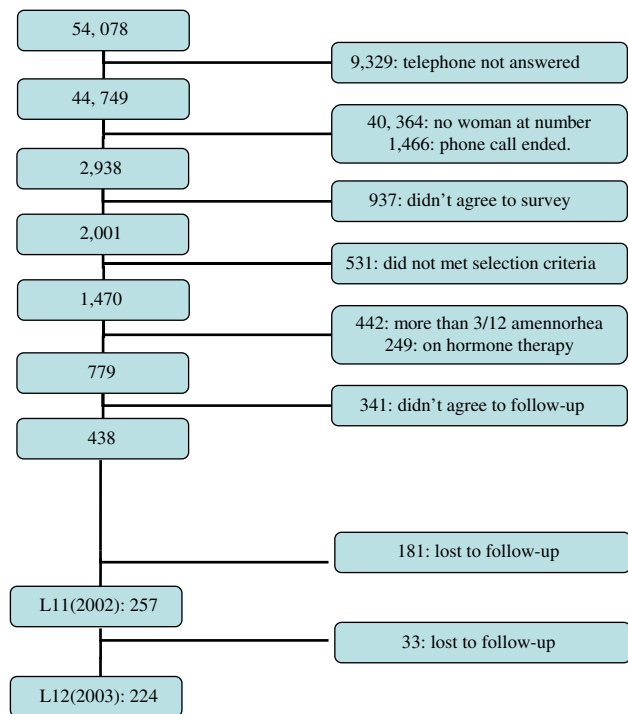
Fig. 1. MWMHP cohort — from baseline to current study.

knee OA, the prevalence of OA varies widely across studies[5]. There is a paucity of recent evidence regarding the prevalence and incidence of OA, with a publication this year based on data obtained between 1990 and 1994[6,7] demonstrating a significant lag time to publication. This highlights the need to revisit self-reported measures as a means to determine those with OA.

In addition to the requirement for a non-procedural diagnosis of OA in the research field, a validated questionnaire may provide important information for the clinical management of this disease. The earlier the diagnosis of disease, the more chance preventative measures can be employed to reduce the enormous burden of disability. A community-based questionnaire, if effective, would provide a better tool to identify those people who may benefit from preventive programmes and earlier treatment.

Previous literature has shown that joint symptom reports are poor predictors of radiological OA (ROA) as they may be caused by more than one pathology[8]. It has been well documented that ROA is not necessarily symptomatic. The American College of Rheumatology (ACR) criteria[9] have also been examined and whilst shown to identify severe OA they do not have the sensitivity required to identify most cases of disease[10,11]. The doubling of the number of cases identified when the criteria were expanded to include "any pain in the last month" indicate just how dependent such criteria are, highlighting the need to determine the best questions[11]. In this study we examined the sensitivity and specificity of a number of survey questions to detect subjects in the Melbourne Women's Mid-Life Health Project (MWMHP) with ROA.

The analysis accounts for important confounders of reporting, as outlined above, in addition to confounders for the presence of OA. The effect of increased weight associated with OA has been well documented[12–14] and obesity

has been associated with disease progression[15]. Menopause has been implicated in the development of OA by several epidemiological studies[16]. Further support for an influence of menopause is the finding that women who have surgical menopause have significantly higher rates of clinical signs of knee OA and first carpo-metacarpal (first CMC) OA than control women without a hysterectomy and oophorectomy[17,18]. Furthermore, an inverse association between premenopausal status and patello-femoral (PF) OA has also been observed[19,20].

Methods

Participants for this study were recruited from the MWMHP which is a population-based prospective study of Australian-born women. Ethics approval was obtained from the Melbourne Health Research Directorate and the University of Melbourne. The study began in 1991 (baseline) with the use of random digit dialling to interview 2001 Australian-born women aged between 45 and 55 years and residing in Melbourne. The response rate was 71%. Seven hundred and seventy-nine of these women were eligible for longitudinal assessment (they had menses in the prior 3 months and were not taking oral contraceptives or hormone therapy)[21]. Of these 779 women, 438 (56%) were recruited for longitudinal assessment with 257 participants remaining in follow-up in 2001 and of these 224 (87%) had X-rays of their hands and knees (see Fig. 1).

Analysis was conducted on these 224 participants. All participants answered the questions on joint symptoms and disease from the annual MWMHP. The questions were "Do you have Arthritis or Rheumatism" (self-reported arthritis) and "Have you experienced Aches or Stiff joints" (self-reported aches). In addition a further questionnaire was designed with the use of a skeleton picture and asked two questions: (1) "Have you ever been told by a doctor that you have arthritis?" please colour in the circles over the joints where you have been told by a doctor that you have arthritis (physician diagnosed arthritis) and (2) "Do you have arthritis or rheumatism?" (self-perceived arthritis) "please colour in the circles over the joints where you have arthritis pain".

X-rays were taken of the knees both in a weight bearing antero-posterior view in full extension and in skyline view in 45° flexion using a perspex positioning wedge. Both knees were X-rayed in each participant. PF joint disease was based on the radiological findings on the skyline view. All radiographs were assessed independently by two trained observers who were blind to the subject details. Using a published atlas of individual features[22], the presence of definite osteophytes or narrowing were used to classify disease in the hands and knees. The radiological features of knee OA in both the tibio-femoral (TF) and PF joints were graded on a four-point scale (0–3) for individual features, which included osteophytes and joint space. Classification of hand OA including the distal interphalangeal (DIP), proximal interphalangeal (PIP) and first CMC joints of the thumb were based on a previously validated and similar four-point scoring system devised by Kallman et al.[22].

'OA' was defined as any hand or knee OA where hand or knee OA was defined as significant (score ≥ 2) osteophytes or joint space narrowing at any one of the joint compartments. Symptomatic OA was determined by those participants reporting aches and joint pains who had radiological evidence of OA as defined above.

The Centre for Epidemiologic Studies Depression Scale (CES-D, 10-item) was used to determine mood status in the eleventh year of follow-up. This

Table I

Demographics of the cohort at time of X-rays and questionnaire

Variable	Mean, range (SD) or N (%)
Age (years)	59.9, 55.9–66.8 (2.5)
Self-reported arthritis	83 (37.1%)
Self-reported aches	140 (62.5%)
Self-reported physician diagnosed arthritis	94 (48.7%)
Self-perceived arthritis	118 (63.7%)
Any OA	129 (58.6%)
Knee OA	49 (21.9%)
Hand OA	101 (45.1%)
Depression scale (CES-D)	6.6, 0–22 (4.1)
BMI (kg/m^2)	27.7, 17.5–56.1 (3.5)
Current smoker	17 (7.6%)
Drinker of alcohol	173 (77.2%)

Table II

Sensitivity, specificity, positive and negative predictive values of self-reported arthritis and joint pain for determining the presence of ROA

Question	Odds ratio	Positive predictive value (%)	Negative predictive value (%)	Sensitivity (%)	Specificity (%)	Cohen's kappa	% Efficiency
Self-reported physician diagnosed arthritis	1.6	73.4	53.5	60.0	68.0	0.64	0.28
Self-perceived arthritis	1.5	66.1	53.7	71.6	47.4	0.54	0.11
Self-reported aches	1.2	63.7	48.4	70.5	40.8	0.54	0.12
Self-reported arthritis	1.7	79.0	53.6	53.6	79.0	0.57	0.12

was derived from the 20-item version of the CES-D, which was originally developed for the National Institute of Mental Health (NIMH)[23]. It is a validated screening instrument for symptoms of depressed mood in older adults. It has high reliability and validity to detect both clinical and non-clinical symptoms of depression[24,25] and was shown to have good predictive accuracy compared to the full-length 20-item version[25,26].

The sensitivity, specificity, odds ratio, negative and positive predictive values were calculated for each of these questions for the presence of ROA. Cohen's kappa coefficient was used as a statistical measure of inter-tool agreement as it is more robust than a simple percent agreement calculation. Computation of efficiency is defined on the basis of assumed distributions of errors. Questions with low specificity for OA were examined for their correlation with other factors. *t* test comparison of means was used for continuous variables and chi-square analysis used for categorical variables, with the SPSS 13.1 statistical package used for all analyses.

Results

This study examined the cohort of 257 women who were in follow-up at the eleventh year of the MWMHP. Two hundred and twenty-four women underwent X-rays of their hands and knees. The arthritis questionnaire was completed by 196 of these women: a response rate of 87.5%. X-ray defined OA (defined as any hand or knee OA where hand or knee OA was defined as significant (score $\geq$ 2) osteophytes or joint space narrowing at any one of the joint compartments) was found in 95 (42.2%) women. Table I shows the demographics of the cohort and prevalence of OA.

The Table II demonstrates the comparison of question results with the gold standard of OA diagnosis (ROA).

All questions were tailored to ask about any joint arthritis rather than specific joint arthritis. The highest positive predictive values were for any OA. The highest odds ratio for a positive answer were the questions of self-reported arthritis and physician diagnosed arthritis correlating with OA with a high sensitivity and negative predictive value but low specificity. Comparison testing was conducted, with physician diagnosed arthritis having the greatest efficiency, highest correlation (Cohen's kappa) and best odds ratio to measure ROA.

This analysis was then repeated for those participants with "symptomatic OA" defined as those participants with X-ray evidence of OA and joint pain. In this analysis we examined which question (physician diagnosed arthritis or

self-reported arthritis) was more predictive of those with symptomatic OA and again physician diagnosed arthritis was the best question. Selecting for symptomatic OA gave higher positive predictive value and correlation with higher specificity and positive predictive value of self-reported arthritis also (see Table III).

Given that joint symptoms and perceived arthritis correlate so poorly with ROA, we examined the factors associated with reported symptoms. Table IV displays the factors which were found to be significantly different in simple analysis between those participants who reported symptoms of aches and joint pains and those that did not. Self-perceived arthritis reports were related to being more depressed and there being less time since participants had their final menstrual period (see Table IV).

Reporting aches and stiff joints were significantly more common in participants who were depressed, those who had higher negative affect and those with higher body mass index (BMI). As the CES-D score and negative mood are highly correlated they were not analysed in a model together (see Table V).

Discussion

In this study we found that reported joint symptoms and arthritis correlate with radiological arthritis, but are not specific for it. Self-reported physician diagnosed arthritis was most predictive of ROA. The question has a specificity of 68%, a positive predictive value of 73% and a negative predictive value of 54%. Even selecting for symptomatic OA which improved these values the most reliable question about arthritis still had a relatively low specificity for radiologically diagnosed OA.

Questions about symptoms and participant-perceived arthritis had very poor specificity. The lack of association of symptoms with ROA has been demonstrated in previous studies[27]. When the responses to these questions were examined against other factors, symptom reports were related to depressed mood scores and increased BMI. The cohort examined in this study was derived from a larger sized longitudinal study therefore results may not be applicable to the general population.

Table III

Sensitivity, specificity, positive and negative predictive values of self-reported arthritis and self-reported physician diagnosed arthritis for determining the presence of symptomatic OA

Question	Odds ratio	Positive predictive value (%)	Negative predictive value (%)	Sensitivity (%)	Specificity (%)	Cohen's kappa
Self-reported physician diagnosed arthritis	1.7	78.3	54.7	69.2	65.9	0.73
Self-perceived arthritis	1.5	68.2	53.1	79.5	38.6	0.52
Self-reported arthritis	2.1	85.9	60.0	69.6	80.0	0.56

Table IV
Factors associated with self-perceived arthritis

Variable	Self-perceived arthritis N (%) or value (SD)	Self-perceived no arthritis N (%) or value (SD)	P-Value
Depressed	20 (55.6%)	14 (38.9%)	
Not depressed	69 (46.6%)	78 (52.7%)	0.056
Depression score (CES-D)	7.08 (4.3)	5.7 (3.5)	0.046
Time from final menstrual period	3.29 (4)	4.5 (3.9)	0.05

These results are consistent with findings in the literature that joint symptoms and self-reported disease have been documented to be poorly predictive of ROA[27,28] and are likely to be surrogate markers for psychological symptoms[29].

Of course symptoms of joint pain may be caused by more than one pathology[8] and this will influence the reporting of symptoms associated with OA. The likelihood of reporting symptoms at all is also influenced by factors other than OA. In women, exercise and physical activity were not predictors of reporting but past obesity and higher levels of neuroticism were associated with increased reporting of joint pain[30]. Review of the literature in this area revealed that psychiatric factors, radiological severity of OA and lower educational level are associated with symptom reports[29,31].

The paradox found in the investigation of OA is that whilst the most significant issue for patients, and therefore health provision, is the presence and severity of symptoms, these do not relate reliably to radiographic measures of OA[27]. The majority of older adults have radiographic evidence of OA without symptoms[32–34]. As only 40–50% of patients with radiographic OA report pain, it is postulated that there are determinants of 'symptomatic OA' which are not present in asymptomatic patients with radiological evidence of OA[35,36].

The presence of radiological disease may not be the most important factor to identify in terms of population-based reduction of disease burden. A key focus of improved health is to minimise reported loss of function, which has important implications for treatment, rehabilitation and patient independence and quality of life. We know that women especially report diminishing hand function with ageing[37] and reported "loss of function" has been shown to correlate with the presence of OA[38]. Therefore patient perceived symptoms which have a strong impact on function are of great importance in examining the impact of this highly prevalent disease. The strong correlations observed between mood and symptom reports suggest that in the development of questionnaires on self-reported arthritis, a validated mood scale asked concurrently will provide benefit in increasing

Table V
Factors associated with reports of aches and stiff joints

Variable	Reported aches and stiff joints N (%) or value (SD)	No reported aches and stiff joints N (%) or value (SD)	P-Value
BMI	28.3 (5.4)	25.7 (4.6)	0.001
Depression score (CES-D)	7.2 (4.2)	5.3 (3.4)	0.002
Reported depression	29 (80.6%)	7 (19.4%)	0.03

the specificity of the questionnaire for identifying those with radiological disease. Furthermore these mood questions may unmask a psychological pathology which could benefit from treatment. The importance of including a validated measure of mood in these studies should be emphasised.

A potential limitation of this study is the high attrition from the original cohort. It is possible that this study was biased to those more likely to have OA. However, the prevalence of OA was comparable to other population-based studies[39,40]. This population was also similar to the original cohort in terms of education level, which may effect response to questionnaires[21].

Given that the focus of healthcare should be on improved quality of life and maintained function, it is important to examine reported symptoms and their correlates. The literature shows that depression and other mood disorders are prevalent and often unrecognised[41,42]. If mood is a primary cause for these symptoms then appropriate treatment (support, counselling or antidepressants) may lead to significant improvement in quality of life and function. This is an association study and therefore causation cannot be determined. Therefore the potential that symptoms are in fact causing lowered mood should be examined in further work.

Conclusion

In large epidemiological studies where questionnaire assessment of OA is required, the most appropriate question is to ask participants if a doctor has diagnosed them with arthritis. The inclusion of a mood scale in all questionnaires of reported symptoms is recommended.

Conflict of interest

Professor Lorraine Dennerstein has received grants and/or research support from Organon and Wyeth; is a consultant to Pfizer and Boehringer-Ingelheim and has been a consultant to Procter & Gamble. There are no declared conflicts of interest for Professor Flavia Cicuttini, Dr Cassandra Szoeke, Anita Wluka, Janet Guthrie, Margaret Clarke or John Taffe.

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