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OSTEOARTHRITIS and CARTILAGE

Clinical validation of self-reported osteoarthritis

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Summary

Objective: To evaluate the use of a postal survey to detect subjects in the community with osteoarthritis (OA) and the ability of metrologists to detect clinical OA.

Methods: Questionnaires were posted to a random sample of residents of the Northern Sydney Health Area, aged 45–64 years old, asking for details of musculoskeletal complaints and diagnoses. A questionnaire definition of OA was made if 'osteoarthritis' was reported or 'degenerative arthritis', 'joints wearing' out together with pain in joints during the previous 6 months. Hands, hips, and knees of 106 subjects were examined by one of two trained metrologists according to ACR clinical criteria for OA. A second subsample was examined by two metrologists and two rheumatologists independently to test for inter-observer variation. Data were analyzed for percentage agreement and concordance using the kappa statistic.

Results: After two mailouts, 59% responded (526 males and 796 females). Definite OA (excluding spine alone) was reported by 52 males (10%), 155 females (19.5%) and possible OA by 62 males (11.8%), 164 females (20.6%). Following examination, 81% of self-reported 'definite' OA was confirmed, while 57% of 'possibles' and one self-reported 'negative' were determined to have clinical OA. Reporting of specific joint OA was less reliable than the highly reliable self-reporting of general OA. Good agreement was demonstrated between rheumatologists and metrologists in the clinical diagnosis.

Conclusion: Postal questionnaires have the potential to detect OA in the community. The clinical diagnosis can be confirmed by a trained metrologist. Further evaluation of this instrument is warranted in other populations.

Key words: Osteoarthritis, Epidemiology, Criteria, Diagnosis.

Introduction

Osteoarthritis (OA) is the most common musculoskeletal disorder and affects at least 10% of the population [1]. The prevalence rises dramatically with age and carries with it significant impact on function, activities of daily living, work and social interaction [1]. Despite the widespread prevalence and significant impact both on the individual and on society, preventable risk factors have not been fully evaluated and effective interventions to halt progression of the disease still need to be developed. Ways of identifying OA sufferers who could help solve these problems are urgently needed. Large scale radiological screening is no longer justifiable on ethical or economic grounds nor do radiological changes necessarily reflect clinical symptoms and loss of function [2–7], and, although OA is one of the most common reasons for presentation to a general practitioner, many OA sufferers never seek medical attention. The aims of this study were to determine whether a self-completed postal questionnaire could detect OA in the community, to describe the performance of the ACR clinical criteria for OA [8] in an Australian population, to measure inter-observer agreement in the clinical diagnosis of OA and to assess the ability of trained metrologists to accurately detect the condition.

Methods

Postal questionnaires were sent to 2250 residents of the Northern Sydney Health Area aged between 45 and 64 years randomly selected from the electoral roll. This was a 1.5% sample of this age group who make up 20% of a base population of approximately 700 000. The area is socioeconomically advantaged with high levels of literacy and low levels of non-English speaking background.

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Non-respondent residents were sent a second mailout. The survey asked for details of musculoskeletal complaints and diagnoses (if known) [see Table 1(a)], general health, family history and any history of bone and joint injury.

A questionnaire diagnosis of 'definite' OA (in any joint) was made if OA was self-reported and respondents reported experiencing joint pain at any time in the previous 6 months and had been given a professional diagnosis. In some cases the diagnosis was less clear and these were classified as 'possible' OA [see Table 1(b) for diagnostic algorithm]. Respondents were grouped according to whether they had 'definite', 'possible' or 'negative' OA. A 'questionnaire diagnosis' of joint specific OA was recorded for hands, hips and knees if they met the above conditions and reported pain in the specific joint at any time in the previous 6 months. Respondents reporting spinal disorders alone were not included. The full description of questionnaire responders and their associated demographics and risk profiles are the subject of another paper (in preparation).

To validate questionnaire responses and to evaluate the accuracy of the definition, a subsample was derived using a list of randomly ordered questionnaire identification numbers of respondents who had indicated their willingness to participate further and who did not report having another musculoskeletal disorder. The first 155 were contacted (100 'definite' OA, 30 'possible' and 25 'negative') and 106 agreed to attend the Rheumatology Department for interview and clinical examination. Despite having previously agreed to further contact, 41 were unwilling or unable to spare the time, seven had moved away, one had died. Of those who agreed to attend, 83 had a questionnaire diagnosis of 'definite' OA (83% response), 14 were 'possible' OA (47% response) and nine were considered 'negative' (36% response). These participants were interviewed and examined by one of two metrologists (J.S., registered nurse and B.C., occupational therapist) who had received standardized training and were blinded to the questionnaire diagnosis.

To satisfy the ACR criteria [8] (see Table II), participants were asked if they had had any recent joint pain or stiffness and, if positive, how often it had occurred and how long it had lasted. Hands, hips and knees were then examined according to these clinical criteria to establish the presence or absence of OA. Participants were then categorized into three groups: those who satisfied all clinical criteria for OA; those who showed clinical changes but did not satisfy the ACR criterion of pain or stiffness on most days of the month before examination; those who did not have clinical OA. Percentage agreement between self-reported and observed OA was tested for concordance using the kappa statistic [9]. Radiological assessment was not done routinely. Participants were asked to bring to the examination any X-rays that they had

Table I(a)
Questions relating to the self-reporting of osteoarthritis

Q1a.	'Have you experienced any pain and /or swelling in any of your joints at any time in the past six months?'
Q1b.	'If YES, please indicate which joint(s)'. (A checklist of joints was given).
Q1c.	'What do you think was the cause?'
Q2a.	'Has a doctor or other health professional told you that you have any joint problems, rheumatism or arthritis?'
Q2b.	'If YES, what type of arthritis or joint problems do you have?'
Q3.	'List any medical conditions you have that need regular treatment or visits to a doctor'
Q4.	'List any medications that you take regularly'
Q5.	'Have you visited any of the following health professionals in the past 6 months because of problems with your bones, joints or muscles?' [general practitioner, specialist, hospital (inpatient or outpatient), physiotherapist, occupational therapist, naturopath, acupuncturist, chiropractor]

Table I(b)
Diagnostic algorithm

Definite OA	Q1a = yes and	
	Q2a = yes and	
	Q1c or 2b or 3 =	Osteoarthritis
		Degenerative arthritis
		Joint/Cartilage wearing out
Possible OA	Q1a = yes and	
	Q1c or 2b =	Old age
		Old injury
		Arthritis or rheumatism with no evidence of an inflammatory arthritis
	Q2a = Negative or not answered	

Table II
ACR clinical criteria for classification of OA

Hand	1.†	Hand pain, aching or siffness on most days of the past month and
	2.	Hard tissue enlargement of two or more of 10 selected hand joints* and
	3.	MCP swelling in fewer than two joints and
	4a.	Hard tissue enlargement involving two or more DIP (2nd and 3rd DIP may be counted in both 2 and 4a) or
	4b.	Deformity of one or more of 10 selected hand joints* *2nd and 3rd DIP, 2nd and 3rd PIP and 1st CMC of both hands
Hip	1.†	Hip pain on most days of the past month and
	2a.	Internal rotation $<15°$ and
	2b.	Hip flexion $<115°$ or
	3a.	Internal rotation $>15°$ and
	3b.†	Morning stiffness <60 min and
	3c.	>50 years of age and pain on internal rotation
Knee	1.†	Knee pain on most days of the past month and
	2a.	Crepitus and
	2b.†	Morning stiffness knee $\leqslant 30$ min and
	2c.	Age >37 years or
	3a.	Crepitus and
	3b.†	Morning stiffness knee >30 min and
	3c.	Bony enlargement or
	4a.	No crepitus and
	4b.	Bony enlargement

MCP, metacarpophalangeal; DIP, distal interphalangeal; PIP, proximal interphalangeal; CMC, carpometacarpal.
†To determine these criteria, participants were asked whether they had had any pain, aching or stiffness in any of these joints in the past month, how often it had occurred and how long it had lasted.
Other criteria were determined by a standardized clinical examination.

had taken in the previous 3 years. Examiners were not informed of the results until after clinical examination. They were read later by an experienced rheumatologist (L.M.), blinded to the questionnaire and clinical diagnosis, using a standard set of X-rays and a 0–3 grading system for joint space narrowing, osteophytes and sclerosis [10].

To establish whether metrologists could accurately diagnose OA at specific joints, 21 of the 106 participants (20%), were randomly selected for examination by both metrologists and two rheumatologists (L.M. & E.B., each with more than 10 years experience). Participants were examined independently, on the same day, with all examiners blinded to the previous assessments and the questionnaire diagnosis. As before, hands, hips and knees were categorized into three groups. If there was disagreement between examiners, the majority decision was used. Each of the other examiners was tested against each of the others for percentage agreement and concordance using the standard kappa statistic.

To test for overall inter-observer variation, a summary kappa statistic was calculated using the Fleiss method [9]. Methods are not generally available to obtain kappa for multiple gradings in multiple participants by more than two raters [9], therefore those who did not satisfy all ACR clinical criteria were combined with those showing no evidence of OA.

Results

After two mailouts, there were replies from 526 males (median age 60 years) and 796 females

Table III
Prevalence of self-reported osteoarthritis among males and females aged 45–64 years, living in the Northern Sydney Health Area

	Males ($N = 526$)		Females ($N = 796$)	
OA	Definite	Possible	Definite	Possible
In any joint	52 (10%)	62 (11.8%)	155 (19.5%)	164 (20.6%)
Hand	30 (5.7%)	39 (7.4%)	115 (14.5%)	125 (15.7%)
Hip	19 (3.6%)	17 (3.2%)	51 (6.4%)	46 (5.8%)
Knee	31 (5.9%)	37 (7.0%)	79 (9.9%)	79 (9.9%)

Table IV(a)
Comparison of self-reported and observed OA (all ACR criteria satisfied) in at least one joint in a subsample of 106 respondents

OA	Self-reported	Observed	Accuracy
Definite	83	67	80.7%
Possible	14	8	57.1%
Negative	9	1	88.8%

81.52% agreement; kappa—0.40 (possibles excluded).

Table IV(b)
Comparison of self-reported and observed OA in at least one joint (N = *106) ACR criteria but without pain* '*on most days of the month before examination*'

OA	Self-reported	Observed	Accuracy
Definite	83	83	100%
Possible	14	12	85.7%
Negative	9	3	66.6%

96.4% agreement; kappa—0.78 (possibles excluded).

(median age 58 years) (59% overall response). Self-reported OA in any joint was recorded for 52 males (10%) (median age 61 years) and 155 females (19.5%) (median age 60 years). Table III describes the prevalence of self-reported OA according to the 'questionnaire diagnosis' of respondents. Other rheumatological conditions most frequently reported were: spinal disorders (8.6%), soft tissue disorders (3.3%), gout (2.5%) and rheumatoid arthritis (2.0%).

The 106 respondents who presented for interview and examination comprised 38 males (median age 60 years) and 68 females (median age 57 years). Results of agreement between the questionnaire diagnosis and the clinical examination are shown in Tables IV(a) and (b) and V(a) and (b).

Table V(a)
*Percentage of respondents (*N = *106) with clinical OA (all ACR criteria satisfied) showing agreement with 'questionnaire diagnosis'*

OA	Clinical OA (ACR)	Percentage agreement	kappa
Hand	51 (48.1%)	70%	0.399
Hip	25 (23.6%)	84%	0.609
Knee	48 (40.6%)	67%	0.345

Table V(b)
*Percentage of respondents (*N = *106) with clinical changes of OA but without pain 'on most days of the month before examination' showing agreement with 'questionnaire diagnosis'*

OA	Clinical OA (pain not constant)	Percentage agreement	kappa
Hand	78 (73.6%)	76%	0.451
Hip	30 (28.3%)	83%	0.603
Knee	70 (66.0%)	83%	0.629

Table VI
Interobserver agreement in the diagnosis of hand and knee OA between one metrologist (JS) and three other observers

Hand OA		
Observer	Agreement	kappa
JS/EB	90%	0.74
JS/BC	90%	0.74
JS/LM	90%	0.74
Overall	81%	*
Knee OA		
Observer	Agreement	kappa
JS/EB	80%	0.78
JS/BC	80%	0.78
JS/LM	89%	0.88
Overall	81%	*
OA any site		
Observer	Agreement	kappa
JS/EB	90%	0.84
JS/BC	85%	0.78
JS/LM	93%	0.90
Overall	89.3%	*

*No suitable method is available to generalize kappa to where each subject is rated by the same multiple raters (Fleiss p. 225).

If the ACR criteria were strictly applied following examination, more than 80% of self-reported 'definite' OA in general (i.e. in any joint) was confirmed, as were all but one of the 'negatives'. OA was identified in 57% of the 'possibles' [Table IV(a)]. Following adjustment of the different groups ('definite', 'possible', 'negative') according to the sampling fraction of the total survey population that was examined, tables were reconstructed to calculate expected sensitivity, specificity and predictive value of the questionnaire diagnoses (Table VII). When self-reported 'definites' were compared with combined 'possibles' and 'negatives' as 'no OA', the questionnaire had a sensitivity of 42.3%, specificity of 95.7% and a predictive value of 80.7% for detecting ACR clinical criteria positive OA at any site. If, however, 'definites' and 'possibles' were combined as having OA, then sensitivity increased to 74.9% with a slight decline in specificity to 85.2% and a predictive value of 68.4%. This was in a setting where 30% of the group examined fulfilled the ACR clinical criteria for OA.

Some participants were found to have clinical changes of OA and reported having experienced pain in the past 6 months but did not meet the ACR

Table VII
Sensitivity, specificity and predictive values of a postal questionnaire for the diagnosis of osteoarthritis

	Sensitivity (%)	Specificity (%)	Prevalence (%)	Predictive value (%)
1. OA defined as 'all ACR clinical criteria fulfilled'				
'Definite' vs ['possible' + No]	42.3	95.7	29.9	80.7
['Definite' + 'possible'] vs No	74.9	85.2	29.9	68.4
'Definite' vs No	62.8	95.2	24.3	80.7
2. OA defined as ''all clinical ACR criteria met except for 'pain on most days''				
'Definite' vs ['possible' + No]	29.7	100	52.7	100
['Definite' + 'possible'] vs No	57.5	94.9	52.7	92.6
'Definite' vs No	41.2	100	45.9	100

criterion of pain or stiffness on most days of the month before examination. When this group was combined with the positive rather than the negative group for a second analysis, all self-reported 'definite' OA was confirmed, OA was identified in more than 80% of 'possibles' and in three of the nine 'negatives' [Table IV(b)].

When specific joint sites were examined according to the ACR criteria and compared to the 'questionnaire diagnosis', there was only moderate agreement for OA hand and knee but reasonable agreement for OA hips. [Table V(a)]. When this analysis was repeated, including the participants who did not have pain or stiffness on most days of the month before examination (but who had experienced pain at some time in the 6 months before completing the survey questionnaire) in the positive rather than the negative group, there was little difference in agreement between self-reported 'definite' and observed OA in the hips and only slight improvement in hands but there was much improved agreement for OA knees [Table V(b)]. OA hands were under reported in both analyses; hips were well-reported in both; OA knees were under-reported in the first analysis but better reported in the second.

X-rays were available of the hand(s) of 14 participants (17%), hip(s) of 13 participants (16%) and knee(s) of 32 participants (38%). When these were read independent of the clinical examination and questionnaire classification, the clinical diagnosis was confirmed in all cases but one. This participant had radiological signs of OA hip but did not meet the relevant ACR clinical criteria.

Following independent assessment by two metrologists and two rheumatologists, the tests of inter-observer variation showed particularly good agreement between all examiners for identifying OA in general (i.e. any site) and good agreement when classifying OA hands and knees. OA hip was not present in a sufficient number of subjects for statistical analysis. As there was little variation in the combinations, only the results against one observer (J.S.) are presented. (Table VI). These tests also demonstrated that metrologists were capable of accurately making the diagnosis of OA on clinical examination.

Discussion

In this study, it was shown that postal questionnaires have potential to detect OA in the community, with almost all self-reported diagnoses of OA being confirmed on clinical examination. If participants who had definite clinical changes and who had reported experiencing some joint pain in the previous 6 months but who did not have pain or stiffness on most days of the month before examination were included, all self-reported OA was confirmed. This inclusion of participants not fulfiling the pain criteria should have enabled capture of those who had fluctuating symptoms or whose symptoms were controlled by regular medication. Most of those who reported no known arthritis or rheumatism were also confirmed on examination to be free from arthritis. Of those who were classified as 'possible' OA, based on their questionnaire responses, 57% met the clinical criteria for OA at examination. This increased to 86% when those with signs but not constant symptoms were included. This suggests that the questionnaire diagnosis of OA, which required the reporting of a professional diagnosis, may have been too strict and the frequencies of OA obtained were likely to be underestimated. The high prevalence of OA found in the 'possible' group may be explained by participants with symptoms of OA being more likely to attend, particularly as non-response in the 'possible' group was 53%. Modifications to the questionnaire and the classification of responses may be required to utilize self-reported measures for more accurate

prevalence estimates. When the 'possibles' and 'definites' were combined as having OA, the questionnaire had a sensitivity of 75%, a specificity of 85% and a predictive value of 68% for detecting community dwelling respondents who fulfilled the ACR criteria for clinical OA (prevalence 30%). The predictive value will vary depending on the background prevalence of OA in the population being studied. Using these test characteristics, the predictive value would range from 21 to 83.5% if the background prevalence of OA were 5% (younger population) and 50% (older population) respectively. The questionnaire appears to have high specificity, particularly if 'possible' OA participants are excluded from analysis. This would be very useful for identifying groups of definite and non-OA for exploration of risk factors in the community. These results may have been influenced by subjects with symptoms being more willing to participate than those without but the non-response bias is likely to work against the performance of the questionnaire. If the prevalence of OA in the 'possible' group was lower than estimated, in the comparison that was made between 'definite' vs ['possible' + No] OA, both sensitivity and specificity would improve. The comparison between ['definite' + possible] OA vs No OA, however, would yield a reduction in both sensitivity and specificity.

When hands, hips and knees were examined according to the ACR clinical criteria, self reporting of OA in specific joints was less reliable. OA of the hands and knees was under-reported. Specific joint OA was determined by a combination of self-reported arthritis together with pain and/or swelling in that joint at any time in the previous 6 months and a professional diagnosis. More explicit questions relating to the joints, such as specific activity related pain or disability questions, should improve the accuracy of the diagnosis.

The questionnaire used in this study would tend to underestimate OA hands and knees but in clinical practice many patients have OA at multiple sites as was evident in 60% of our examined patients, thus they will be detected.

Clinicians often disagree over the diagnosis of a patient they have examined but they are likely to agree with each other more often than would be expected by chance. When this percentage agreement is tested for concordance using the kappa statistic, a value between 0.40 and 0.75 represents fair to good agreement beyond chance. In this study, agreement and concordance is consistent with or better than other studies of agreement in clinical examination [11]. Moreover, our study confirmed that trained metrologists can reliably detect clinical OA. Percentage agreement between examiners on the presence of OA reached high levels overall and the kappa levels are acceptable. This is in keeping with other work showing reproducibility of clinical signs of OA among trained metrologists and rheumatologists [7, 12, 13].

Traditionally, radiological changes have been considered the 'gold standard' for the diagnosis of OA. However, widespread radiological surveillance of the population is no longer ethically or economically appropriate. There is a growing body of literature that supports the use of clinical examination [7] and history of joint pain for the diagnosis of OA in population surveys. This study used the ACR clinical criteria for OA as the reference standard. X-rays were available for 20% of participants. When these were examined, blinded to disease status, a very high correlation was demonstrated between the clinical diagnosis and radiological changes. However, firm conclusions cannot be drawn since X-rays were not routinely performed and the 'negative' group was small.

A substantial number of participants showed clinical changes of OA without satisfying the ACR criterion of pain experienced on most days of the month before examination. It is well-recognized that pain in OA tends to fluctuate and may not relate to the degree of periarticular enlargement, crepitus or deformity. In this questionnaire, respondents were asked whether they had experienced joint pain at any time in the prior 6 months. This might be a more reasonable time frame for a chronic condition such as OA.

When participants from this study who had experienced pain in the previous 6 months and who showed clinical changes of OA were included in the positive group for analysis, self-reporting of OA hand improved but was still under-reported, however agreement between reported and observed OA of the knees was much improved.

The usefulness of criteria such as the ACR clinical criteria for OA depends on the purpose for which they are required. The ACR criteria were developed to differentiate OA from other painful rheumatological conditions [8]. For the development and testing of disease modifying agents, other methods might be needed to identify people with early OA. These people are more likely to have fluctuating symptoms and, in this case, the ACR criteria may not be sufficiently sensitive. Any trials of new agents should include patients with early disease and will need to be over a longer time

frame which makes it more reasonable to include those with less constant symptoms.

The ACR criteria were not developed for use in population studies although this is how they are frequently used. Their use in epidemiological studies of OA has the potential to underestimate disease prevalence. This in turn would lead to underestimation of the disease burden on the community and of the impact of potential risk factors.

This study has several limitations relating, predominantly, to issues of generalizability. It was performed among a restricted age group, in a socioeconomically advantaged area with a high level of literacy and those negative for self-reported OA were under-represented in the sub-sample who attended for clinical examination. However, the self-reported arthritis prevalence was similar to the published National figures for this age group [14]. In a recently published study [15], it was suggested that self-reported diagnosis for rheumatoid arthritis is inaccurate but the same study identified better self-reporting of the more prevalent OA. Despite the limitations of our study, we would postulate that questionnaires of this nature are useful for initial screening of the population for OA for community based studies and healthcare utilization reviews. It has also been shown that trained metrologists can reliably confirm OA status. With more joint specific questions, further evaluation of this instrument in other populations is warranted.

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