International Journal of
Rheumatic Diseases

International Journal of Rheumatic Diseases 2011; **14:** 122–129

REVIEW ARTICLE

Osteoarthritis of the knees in the COPCORD world

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Abstract

This paper examines and summarizes data on knee osteoarthritis (AO) in Community Oriented Program For Control Of Rheumatic Disorders (COPCORD) publications. A literature search was made through PubMed, Google, Proceedings of Asia-Pacific League of Associations for Rheumatology (APLAR) congresses, and Abstracts from APLAR congresses. Data were compiled to examine the prevalence of knee OA and knee pain, sex ratio, urban/rural differences and other risk factors. Data on knee pain and OA were available in a total of 36 COPCORD publications. The pooled prevalence of knee OA was 7.9% in adults above the age of 15 years. It was more common in women. Overweight, squatting and cycling appeared to be modifiable risk factors for knee OA. OA of the knee is the commonest rheumatic disease in studied communities. Further research is needed for identification of its modifiable risk factors and development of strategies for reduction of the community burden of this malady.

Key words: COPCORD, epidemiology, knee, osteoarthritis.

INTRODUCTION

The concept of Community Oriented Program For Control Of Rheumatic Disorders (COPCORD) evolved in late 1970s on the background of appreciated need for putting emphasis on crippling diseases compared to that on killer diseases, for data on the burden of rheumatic diseases[1] and for a low-cost approach considering resource constraints prevailing in developing countries.[2,3] The design of the World Health Organization – International League of Associations for Rheumatology (WHO-ILAR) COPCORD includes three stages.

Stage I: collection of epidemiological data. This stage is further subdivided into three phases: phase 1 represented screening for identification of positive respondents; phase 2 more detailed elaboration of the musculoskeletal (MSK) symptoms for selection of respondents for phase 3; and phase 3 represented examination of the identified respondents and randomly selected negative respondents by a rheumatologist or physician trained in rheumatology.[2,3]

Stage II: education of primary healthcare professionals in the management of the most common rheumatic disorders (RD).

Stage III: identification of environmental and genetic risk factors for prevention of RDs and improvement of health care and health status.[4]

Osteoarthritis (OA) is the fourth leading cause of 'years lived with disability' (YLDs), accounting for 3.0% of total global YLDs.[5] As per WHO estimates, the prevalence of knee OA was 1770 and 2693 per 100 000 men and women in 2000, respectively.[6] In the USA, the prevalence of symptomatic knee OA was 4.9% among adults aged ≥ 26 years in the Framingham study,[7] 16.7% among adults aged ≥ 45 in the Johnston County study,[8] and 12.1% among adults aged ≥ 60 in the NHANES III study.[9]

Until the inception of COPCORD, data on knee OA were available predominantly from the developed countries. Over the last three decades, results of descriptive and analytical epidemiological studies have

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been reported from many developing countries. The present communication will summarize data obtained from COPCORD model studies carried out in different parts of the globe.

MATERIALS AND METHODS

COPCORD data were gathered from different sources (PubMed, Google, Proceedings of APLAR congresses, and Abstracts from APLAR congresses). Urban data were separated from rural data, because of differences in daily living habits and work. The number of people surveyed was considered and the 95% confidence intervals (95% CI) were calculated accordingly. When available, differences between men and women and the influence of age were extracted from the data and are reported.

RESULTS

Countries where COPCORD studies were done, the year of the report, the sample size (people interviewed), and prevalence of MSK complaints are shown in Table 1. The data on knee pain were available from 19 COPCORD reports (11 countries). The data on total OA were available from 13 COPCORD reports (10 countries).

Table 1 COPCORD studies, year of study, sample size and prevalence of musculoskeletal (MSK) complaints

COPCORD study	Year	Sample size	MSK pain (%)
Australia – urban[10]	1992	1437	34
Australian Aborigines[11]	2004	847	33
Bangladesh (BD) – rural[12]	2005	2635	26.9
BD – urban slum[12]	2005	1371	24.9
BD – urban affluent[12]	2005	1259	27.9
Brazil[13]	2004	3038	7.2
China – Beijing[14]	1994	4192	
China – Shantou[14]	1994	5057	
China – Shanghai[15]	2003	6584	
China – Chenghai[16]	2004	2040	
Cuba[17]	2009	300	58
Egypt[18]		5120	16.7
India – rural[19,20]	2001	4092	18.2
India – urban[21]	2009	8145	14.1
Iran – urban[22]	2008	10 291	41.9
Iran – rural[23]	2009	1565	66.6
Malaysia[24]	2007	2594	21.1
Mexico[25]	2002	2500	17
Pakistan[26]	1998	2090	14.8
Philippines – rural[27,28]	1985	846	14.5
Philippines – urban[29]	1997	3006	
Thailand[30]	1998	2463	17.6
Vietnam[31]	2003	2119	

Knee as the site of MSK pain

Table 2 shows prevalence of knee pain and knee OA in different COPCORD studies. Earlier COPCORD surveys focused more on pain sites, disability and help seeking rather than on exact clinical diagnosis. Knee was the commonest site of current MSK pain in Bangladesh,[12] Shanghai,[15] Egypt,[18] rural India,[19] urban Iran,[22] Mexico,[25] Thailand[30] and Vietnam.[31] On the other hand, it was second to low back pain (LBP) in Australian urban communities,[10] Aboriginals,[11] Beijing and Shantou,[14] Cuba,[17] rural Iran[23] and rural Philippines.[27] In all communities, the prevalence of knee pain was higher in women than in men. Although in all these studies the prevalence of MSK pain in general showed a trend of rise with age, such an upward trend specifically in case of knee pain has been described in the studies in Australian Aboriginals[11], Shanghai communities[15] and in Filipino villages.[26] In the Chinese rural study, the prevalence of knee pain showed no progressive increase with age. The investigators explained this by causation of knee pain from conditions other than OA.[14]

Prevalence of knee OA

Prevalence rates of OA in general varied from 3.7% in Pakistan[26] to 20.4% in Cuba.[17] Knee OA was possibly the commonest of all specific RDs in most of the communities. The prevalence of knee OA ranged from 1.4% in urban Filipinos[28] to 19.3% in = rural communities in Iran.[22] Eleven COPCORD reports show knee OA data: there were 3328 knee OA patients out of a total surveyed pooled sample of 41 884. The pooled prevalence of knee OA thus becomes 7.9% (95% CI: 7.6–8.2%). The difference between the prevalence of knee pain and knee OA probably reflected non-OA knee pain in the majority of these studies. Many of such cases might have represented peri-articular knee pathology or non-OA articular disorders of the knee joint itself. The majority of the COPCORD investigators did not elaborate other causes of knee pain. Many might have put a part of them in the category of soft tissue rheumatism, while clinching a specific diagnosis. In the Bhigwan population in India, 5.9% of the respondents had chronic knee pain without clinical evidence of OA. Chopra *et al.*[19] classified them as 'symptom-related disorders' (SRD). The difference between prevalence rates of OA in general and knee OA

Table 2 Prevalence of knee OA in COPCORD studies

COPCORD study	% LBP	% Knee pain	% Total OA (95% CI)	% Knee OA (95% CI)
Australia – urban[10]	22	15	8.2 (6.9–9.7%)	
Australian Aborigines[11]	12.5	11.2	5.5 (4.2–7.3%)	3.1 (2.1–4.5%)
Bangladesh (BD) – rural[12]	6.6	14		7.5% (6.6–8.6%)
BD – urban slum[12]	9.9	14.2		9.2% (7.8–10.8%)
BD – urban affluent[12]	9.2	15.8		11.5% (9.9–13.4%)
Brazil[13]			4.1 (3.5–4.9%)	
China – Beijing[14]	35	30		
China – Shantou[14]	13.1	2.6		
China – Shanghai[15]	5.6	7		4.1% (3.6–4.6%)
China – Chenghai[16]	10.2	6.5		
Cuba[17]	14.2	11.7	20.4 (16.2–25.3%)	
Egypt[18]	5.1	9.3	8.5 (7.8–9.3%)	
India – rural[19,20]	11.4	13.0	5.6 (4.9–6.3%)	3.9 (3.4–4.5%)
India – urban[21]	5.5	8.1	6.5 (6–7%)	5.5 (5.0–6.0%)
Iran – urban[22]	21.7	25.5	16.6 (15.9–17.3%)	15.3 (14.6–16%)
Iran – rural[23]	41.9	39.2	20.5 (18.6–22.6%)	19.3 (17.4–21.3%)
Malaysia[24]	11.6			
Mexico[25]	6	12.3		
Pakistan[26]	1.9		3.7 (3.0–4.6%)	1.8 (1.3–2.5%)
Philippines – rural[27,28]	11.3	7		3.0 (2–4.4%)
Philippines – urban[29]	2.1		4.1 (3.4–4.9%)	1.4 (1.0–1.9%)
Thailand[30]	4	5.7	11.3 (10.1–12.6%)	
Vietnam[31]	11.2	18.2	4.1 (3.3–5.0%)	

definitely represented OA at other sites, including cervical and lumbar spine, hands and hips. As stated earlier, many COPCORD stage I studies concentrated on pain sites and not on specific diagnostic entities.[14–16,24–26] In others, specific diagnoses were made rather grossly and as a result, data of OA is available, but not specifically that of knee OA.[13,17–23,26–31] However, many investigators did not group OA at all these sites together and mentioned them separately.[12] OA of hips and hands were rare in most COPCORD studies. For example, in the rural and urban communities of Iran, the prevalence rates of knee OA, hand OA, cervical spondylosis and hip OA were: 19.3% and 15.3%; 2.6% and 2.9%; 2.2% and 1.8%; and 0.13% and 0.32%, respectively.[21,22] Two exceptions were Egyptian rural[18] and Filipino urban communities.[29] In the latter, the prevalence of generalized OA (2.4%) was higher than that of knee OA (1.4%).[29] In a follow-up (phase

III) study in Filipino villages, the prevalence of Heberden's nodes was equal to that of knee OA.[26] Some investigators attempted to classify knee OA into primary and secondary on the basis of age, history of trauma and sport injury, presence of hand OA, and so on. Among knee OA patients in the Queensland Aboriginal communities, 88% of women had primary OA, whereas 82% of men had secondary OA.[11] It appears that knee OA is more often secondary in men and may be more amenable to preventive interventions.

It is quite plausible that as with other degenerative conditions, the prevalence of knee OA would increase with age. In COPCORD studies, the prevalence of MSK pain and RDs increased with age, but age-related data on knee OA were extractable from only a few general prevalence reports. Although the percentage was not extractable, the follow-up report of the Filipino rural study shows eight and 50 patients with any knee abnormality in the age groups 35–40 and ≥ 65 years, respectively.[28] In a few countries, the COPCORD investigators have carried out surveys dedicated to knee OA using the COPCORD protocol or have detailed their knee OA data in separate reports. In such reports from an urban[32] and a rural[33] community in Bangladesh and from Taiyuan, China,[34] prevalence of knee OA increased steadily with age. In another COPCORD model knee OA study carried out in Shanghai, China, prevalence estimates of radiological knee OA combining both symptomatic and asymptomatic cases, were 13.5%, 41.9%, 64.1% and 71.4% in 40-, 50-, 60- and 70-year age groups, respectively.[35] In China, knee OA data are available from five COPCORD studies.[15,16,35–37] The lowest prevalence (1.3%) was reported from that carried out in a Shantou school population.[36] Sex distribution of knee OA was reported by investigators from Bangladesh,[12] urban Indian,[21] urban Iran,[22] Shanghai,[15] Pakistan[26] and rural Philippines.[28] A general female preponderance was noted in all these reports (Table 3). In the study of Du *et al.*[35] in Shanghai, the prevalence rates of radiological, symptomatic and asymptomatic knee OA were higher in women, and the difference was largest in cases of symptomatic knee OA.

Incidence

In a Bangladeshi rural community, the annual incidence of knee pain was 6.5%: 4.6% in men and 8.4% in women, the knee being the second commonest site of new MSK pain after the spine. The incidence of symptomatic knee OA was 0.9%: 0.8% in men and 1.1% in women.[38] In a Kuwati community, the incidence of knee pain among non-complainers was 1.8%, and the incidence of knee OA was 0.3%.[39]

Table 3 Sex ratio of knee OA in COPCORD studies

COPCORD study	Sample size	% Knee OA	% Male	% Female
Bangladesh (BD) – rural[12]	2635	7.5	6.4	8.5
BD – urban slum[12]	1371	9.2	10.4	7.8
BD – urban affluent[12]	1259	11.5	6.3	15.9
China – Shanghai[15]	6584	4.1	1.9	6.2
India – urban[21]	8145	5.5	2.5	5.3
Iran – urban[22]	10 291	15.3	11.0	19.9
Pakistan[26]	2090	1.8	1.5	2.6
Philippines – rural[28]	846	3.0	2.8	3.1

Risk factors for knee OA

Studies designed to identify risk factors (RFs) of knee OA are few and have been published only in recent years. However, important tentative observations were made in cross-sectional surveys and also in a few comparative studies.

Observations from cross-sectional surveys

In the study on the Aboriginal community in Australia, 75% of patients with primary OA were overweight.[11] In Bangladeshi urban population, the prevalence increased with increased body mass index (BMI).[32] In the rural study, the prevalence was higher in normal weight individuals compared to the underweight (BMI < 18.5), but it was again lower in the overweight subgroup possibly because of the small number of overweight respondents.[33] In a first information report of the Shantou COPCORD study, residents in multi-storied buildings was associated with higher prevalence of knee pain.[40] Although exact figures are not reported, Wigley *et al.*, from their observations in a Filipino village, concluded that squatting might be associated with causation of knee OA.[28] Despite a general trend of female preponderance, in the urban slum community in Bangladesh, the prevalence was higher in men (Table 3). The majority of the men in that slum were engaged in rickshaw-pulling and earth digging and carrying, occupations requiring high physical workload along with repetitive knee bending and twisting.[12] These two occupations conferred significantly greater risk for knee OA compared to other occupations in this study.[32] In the Bangladeshi rural community, cultivation and

home-making were associated with knee OA prevalence, significantly higher than other occupations.[33]

Comparative studies

In some COPCORD reports, data from different subgroups have been compared. In China, knee joint abnormalities on physical examination were present in 29% and 2.6% in northern and southern rural areas, respectively. The authors suggested that latitude might be one of the RFs for knee OA.[14] To further substantiate this claim, in Shanghai, the prevalence of knee complaints was lower than those in Beijing but higher than those in Shantou.[15] The prevalence of knee pain was significantly higher in Pakistanis living in England than those living in Pakistan.[41] The prevalence of knee OA was significantly higher in Turks (15.3%) than in Caucasians (12.3%) residing in Tehran. The differences between prevalence rates of other RDs were not significant.[42]

Rural/urban divide

The prevalence was higher in urban affluent communities than in the urban poor in Bangladesh[12] and Pakistan.[26] In Bangladesh, the mean BMI of respondents in affluent communities was significantly higher.[32] The prevalence was higher in urban communities compared to rural ones in Bangladesh[12] and Pakistan,[26] but higher in rural communities in Iran[22,23] and the Philippines.[28,29] In India, the crude prevalence rate of knee OA was higher in the Pune urban community (5.5%) than in the Bhigwan rural community (3.3%). After adjusting the age–sex distribution to the standard India census population, the prevalence became much higher in the rural community (4.42% *vs.* 3.41%). Joshi and Chopra explained this by a larger proportion of elderly population in the urban community.[22] It may further be speculated that the differences in BMI between rural and urban populations in Bangladesh and Pakistan have offset the increased risk posed by the physical overload characteristic of rural living. It appears that the nutritional status, longevity and physical workload are three major determinants of the urban/rural divide apparent in developing countries.

RF identification studies

In the literature, there are three studies dedicated to identification of RFs of knee OA within COPCORD protocol. In a study in Taiyuan, China, 244 knee OA patients were compared with 1944 non-knee OA subjects. Older age, female sex and high BMI were found to be positively associated with knee OA.[34] In a study in Shanghai, 190 subjects with knee pain were compared with 510 subjects without knee pain; 72% and 42% of those with and without knee pain, respectively, had radiological knee OA. Older age, female sex and high BMI were found as RFs for radiological (both symptomatic and asymptomatic) knee OA.[35]

In a policy-making meeting held in July, 2006 in Kuala Lumpur, the COPCORD investigators appreciated the need for a core questionnaire containing most suggested RFs, testing for validity and reliability of the questions and proper case controlled studies for detection of RFs.[43] Investigators from Bangladesh, China, Indonesia, Iran and Philippines accepted the task of development of the core questionnaire. A questionnaire was developed through multipartite collaboration.[44] Dahaghin *et al.* carried out a study with 480 knee OA patients and age, sex and socio-economic class-matched controls in a community in Tehran. Mean BMI of the patients was significantly higher than controls. Squatting and cycling for > 30 min a day were independent RFs. Each of walking on flat grounds and sitting in a chair for 1–2 h a day were found to protect against knee OA.[45] Contrary to popular belief or anecdotal evidence, house-keeping, nature of job (sedentary[46] or labor[47]), participation in games and sports, standing, walking uphill or downhill, stair-climbing,[48] knee-bending[48] and weight-lifting[48] were not found to carry higher risks for knee OA.

DISCUSSION

Knee OA data in COPCORD reports have certain limitations. In spite of such limitations, COPCORD made a significant contribution to the understanding of disease burden and RFs in the studied communities. Finally, they have shed light on the future directions regarding knee OA research for COPCORD investigators.

Limitations of COPCORD knee OA data

As far as knee OA is concerned, COPCORD data have several limitations. Although a uniform COPCORD protocol was designed initially by WHO-ILAR, the protocol allowed some flexibility and different investigators had different opportunities. As a result the approach did not remain the same across all COPCORD studies. For example, many investigators employed trained interviewers,[19–21,25] some employed nurses,[30] whereas others employed trained family physicians[17] for phase 1. In some studies, the three phases

were clearly phased out at intervals,[27,28,48] whereas in some others they were carried out concurrently.[12,20,21] Some workers, for example Indonesians, adopted a symptom-based approach, that is, pain at different sites, without paying attention to the diagnosis.[49] Farooqui and Gibson clinched diagnosis and mentioned little about the sites of pain in their report.[26] Most of the other investigators had adopted a variable admixture of both approaches. Investigators in Brazil,[13] Chenghai, China[16] and Egypt[18] used X-rays as a means to reach the diagnosis of knee OA. Filipino rural investigators[28] mentioned use of American College of Rheumatology (ACR) algorithms for clinical features only.[50] Most other workers mentioned generally that internationally accepted criteria (e.g., ACR criteria) were followed for conditions in which they were available. In the absence of routine use of X-rays, it may be assumed that ACR 'clinical' criteria for classification of knee OA were adopted, although it has not been clearly mentioned in the reports. Use of different operational definitions indicates that the data presented by different workers may not be comparable. COPCORD reports are rich in data on disability, work loss and health-seeking behavior in relation to MSK symptoms, but do not specifically provide opportunities for estimation of consequences of knee OA. Since knee OA was one of the commonest RDs, it may be assumed that a substantial part of disability and work loss might have resulted from knee OA. Unfortunately, data have not been preserved by many workers and also are not preserved in similar formats so that a single body of data might estimate disability and work loss accruing from knee OA alone.

Contribution of COPCORD

As a result of COPCORD studies, we know that knee OA is one of the commonest RDs in studied communities. Its prevalence ranges between 1.4% and 20%. Apart from different approaches and different operational definitions, geographic terrain, customs and activities may contribute to the wide difference in the prevalence estimates. Overweight, squatting and cycling may represent potentially modifiable RFs in these communities.

Future directions

From past COPCORD experience it seems imperative that future COPCORD surveys should be conducted utilizing a common methodology. A common core electronic template may be developed. If all investigators enter their data in that template, a central electronic data repository will develop. It will be possible for a future group of workers to estimate the burden of knee OA more accurately and interchangeably.

The principal objective of COPCORD is prevention and control of rheumatic diseases.[51] At the 2006 Kuala Lumpur policy-making meeting, the COPCORD investigators worked out a roadmap for achievement of this objective.[43] Concerning knee OA, the roadmap requires carrying out more case controlled studies for identification of its modifiable RFs. The Iranian study[45] may serve as a model of such future studies, albeit with some refinements. An electronic template should also be developed for entering RF data and eventual development of an electronic repository so that more precise detection of RFs for knee OA becomes feasible. The investigators should also develop behavior change communication (BCC) modules for the purpose of mass education and simultaneously translate and validate some measure for assessment of outcomes of interventions. The Western Ontario McMaster osteoarthritis index (WOMAC) was considered appropriate. Then the investigators will be able to carry out controlled interventional studies with such BCC modules at the community level. Placing evidence-based BCC modules before policy-makers, curriculum developers and media will be the most important advocacy role for the COPCORD.

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