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Elderly musculoskeletal disease burden in Karachi, Pakistan: Associations and implications for developing countries

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Abstract

Objective: The global rise in the older population has increased the rates of osteoporosis and osteoarthritis, conditions that impact mobility and functionality. There is limited data on musculoskeletal disease in older populations residing in developing countries.

Methods: A community-based study using multistage cluster random sampling of older individuals was conducted in Karachi. Predefined criteria were used for osteoporosis and osteoarthritis. Gait assessment was performed.

Results: More than half of the participants were females and 53% reported illiteracy. Around 30% had osteoporosis and two-thirds had osteoarthritis. Multivariate analysis showed associations of female sex, Pashtun ethnicity, illiteracy, and hypertension with the combined variable of osteoporosis and osteoarthritis.

Conclusions: The prevalence of osteoarthritis was higher than in other regional studies. Presence of both osteoporosis and osteoarthritis increased the risk of certain geriatric syndromes. High rates of musculoskeletal morbidity are seen in the elderly in Pakistan. Measures at a health-system level are required for better outcomes in older adults.

KEYWORDS

community, osteoarthritis, osteoporosis

1 | INTRODUCTION

The global rise in aging is causing higher rates of osteoporosis, a condition that reduces bone density and quality.¹ One out of three women in North America suffers from osteoporosis and the lifetime risk of osteoporotic fractures is approximately 40% in women and 20% in men.² South Asian women have a greater risk of osteoporosis, with 52% and 29% of Indian women aged 30 to 60 years reportedly having osteopenia and osteoporosis, respectively.³

Aging leads to changes in bone metabolism that increase the risk of osteoporosis. Furthermore, age-related nutritional deficiencies,

reduced muscle mass, and mobility increase the risk of falls and/or disability.² In Asia, osteoporosis is further compounded by high prevalence of vitamin D deficiency and poor socioeconomic conditions, both of which negatively impact bone mass accumulation at younger ages.³

Osteoarthritis increases with age due to wearing down of protective joint cartilage. The rising number of older adults has increased osteoarthritis rates, with estimates of 12% to 40% across different regions.^{4,5} In Pakistan, studies have reported osteoarthritis rates of 14% to 20%.^{6,7} Osteoarthritis is associated with frailty, falls, and impaired mobility in the elderly. Moreover, it is linked to chronic pain and disability.

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Osteoporosis and osteoarthritis form the bulk of musculoskeletal morbidity in older adults. Both affect functionality, quality of life, and lead to complications like falls, incontinence, and depression. Although high disease burden with varied risk factors is likely, few data on musculoskeletal morbidity from low and middle-income countries (LMICs) are able to highlight its impact on the lives of older adults.

Pakistan is the fifth most populous country globally. Literature reports high prevalence of vitamin D deficiency amid poor socioeconomic conditions and nutritional deficiencies with low bone density at younger ages.⁸ Despite its younger population base, an estimated 15 million older individuals (60 years and older) reside in Pakistan with numbers expected to rise at a rapid rate.⁹

Given the above background, this study aimed to identify skeletal morbidity patterns and associated illnesses/complications in a community-dwelling geriatric population in Karachi, Pakistan.

2 | METHODS

A community-based cross-sectional survey was conducted in Karachi, the largest city of Pakistan. More than 20 million people reside in this city and its suburban areas. It is a metropolis and the hub of economic activity of the country. Multistage cluster random sampling was done to collect a representative sample from 1200 individuals across the city. Fifteen enumeration blocks (called primary sampling units as clusters) of the Pakistan Bureau of Statistics were randomly selected and households were systematically selected from each cluster. Males and females aged 60 years and above were selected from the household. Details of sampling technique have been previously published.¹⁰

A questionnaire was administered to collect demographic and health information. A comprehensive geriatric assessment that included domains of cognition, depression, and functional status was conducted.¹⁰ Gait testing was performed on all mobile participants. Presence of falls was identified by self-reporting.

We defined osteoporosis on clinical grounds, obtaining history of fragility fractures, visible kyphosis, and self-reporting of participants based on prior diagnosis of osteoporosis by physicians.¹¹ Osteoarthritis was based on self-reporting of chronic large joint pain (ie, knees, hips and lower back).

2.1 | Statistical analysis

We performed analysis on IBM SPSS for Windows V. 22.0. Descriptive statistics of the study population were determined. Prevalence of osteoporosis, osteoarthritis, and their combination were determined for the overall population and also among males and females. Sociodemographic data, comorbidities, mobility assessment, get-up and go test, and activities of daily living were assessed for their association with osteoporosis, osteoarthritis, and the combined variable of osteoporosis and osteoarthritis. Adjusted odds ratios (AOR) with their 95% confidence intervals (CI) were calculated

through multivariate logistic regression analysis. A *P* value of <0.05 was considered statistically significant.

2.2 | Ethical approval

The ethical approval of the study was obtained from Ethical Review Committee of Aga Khan University, Karachi (ID: 1862-FM-ERC-11). Written informed consent was taken from study participants/caregivers before recruitment. Confidentiality of the data was maintained using identifier numbers during data analysis.

3 | RESULTS

3.1 | Sociodemographic characteristics of the participants

Table 1 shows the sociodemographic characteristics of the elderly (≥ 60 years) participants ($n = 1200$) enrolled in the study. More than half were between 60 and 69 years, 55% were female, 55% were married, and 53% were illiterate. Languages spoken in the household were mainly Urdu (56%) and Punjabi (17%).

3.2 | Burden of osteoporosis and osteoarthritis and resulting impact on mobility and falls among males and females

Table 2 shows the participants' musculoskeletal morbidity and related symptoms, and a comparison among males and females ($n = 1200$). Around 30% of the participants had osteoporosis while two-thirds had osteoarthritis. Almost one-third (30%) reported a fall in the last year and 34% had difficulty in rising from a chair. Almost half (48%) reported medication use for comorbid conditions. Of those taking medicines, 12% were using pain medicines. However, no specific medicines for osteoporosis were reported. Around 31% had abnormal gait and 5.5% used an ambulatory aid (cane, walker or wheelchair). The prevalence of osteoporosis and osteoarthritis was significantly higher in females (37% vs 20% [$P < 0.0001$] and 77% vs 54% [$P < 0.0001$], respectively). History of fall (37% vs 22%) and difficulty in rising from chair (40% vs 26%) were also significantly higher in females ($P < 0.000$ and $P < 0.0001$, respectively). Men fared worse in the get-up and go test (86% vs 77%, $P < 0.0001$).

3.3 | Multivariate logistic regression analysis of risk factors for osteoporosis and osteoarthritis among elderly population

Table 3 shows the risk factors for osteoporosis and osteoarthritis after mutual adjustment of variables in multivariate analysis. Osteoporosis was more likely to occur in females (AOR, 1.8; 95%

TABLE 1 Sociodemographic characteristics of elderly (≥ 60 years) in Karachi, Pakistan (n = 1200)

Variable	Frequency (%)
Respondent age (years)	
60-64	393 (32.8%)
65-69	272 (22.7%)
70-74	261 (21.8%)
75-84	214 (17.8%)
85 or older	60 (5.0%)
Sex	
Male	537 (44.8%)
Female	663 (55.3%)
Marital status	
Married	663 (55.3%)
Widowed	518 (43.2%)
Single	17 (1.4%)
Education	
Illiterate	640 (53.3%)
Primary (up to Grade 7)	245 (20.4%)
Secondary (up to Grade 12)	225 (18.8%)
Tertiary (undergraduate degree or higher)	90 (7.5%)
Ethnicity	
Urdu	674 (56.2%)
Punjabi	198 (16.5%)
Sindhi	60 (5.0%)
Pashtun	63 (5.3%)
Hindko	56 (4.7%)
Others	149 (12.4%)
Household size (in number)	
<5	159 (13.3%)
5-7	341 (28.4%)
8-9	247 (20.6%)
10 or more	453 (37.8%)
Number of children in the household	
None	178 (14.8%)
1-2	210 (17.5%)
3-4	251 (20.9%)
5-6	259 (21.6%)
7 or more	302 (25.2%)

CI, 1.3 to 2.6), people with illiteracy (AOR, 2.1; 95% CI, 1.0 to 4.2), and those of Pashtun ethnicity (AOR, 2.6; 95% CI, 1.4 to 4.9). Participants with osteoporosis had greater likelihood of urinary incontinence (AOR, 2.1; 95% CI, 1.5 to 2.9), history of fall (AOR, 1.5; 95% CI, 1.1 to 2.1), and abnormal gait (AOR, 1.4; 95% CI, 1.0 to 2.0). Taking three or more medicines was significantly associated with the risk of osteoporosis (AOR, 1.6; 95% CI, 1.0 to 2.5). However, having seven or more children in the household (AOR, 0.2; 95% CI, 0.1 to 0.3) was protective for osteoporosis and the

combined variable of osteoporosis and osteoarthritis (AOR, 0.2; 95% CI, 0.1 to 0.3).

For osteoarthritis and the combined variable of osteoporosis and osteoarthritis, female sex (AOR, 2.0; 95% CI, 1.5 to 2.8; and AOR, 1.7; 95% CI, 1.2 to 2.5, respectively), illiteracy (AOR, 1.8; 95% CI, 1.0 to 3.1; and AOR, 2.1; 95% CI, 1.0 to 4.4, respectively), and urinary incontinence (AOR, 1.5; 95% CI, 1.0 to 2.2; and AOR, 2.3; 95% CI, 1.7 to 3.3, respectively) had a significant association. Of the comorbid illnesses, hypertension was significantly associated with both osteoarthritis (AOR, 1.9; 95% CI, 1.4 to 2.5) and the combined variable of osteoporosis and osteoarthritis (AOR, 1.5; 95% CI, 1.0 to 2.0). Pashtun ethnicity (AOR, 2.2; 95% CI, 1.1 to 4.2), history of fall (AOR, 1.8; 95% CI, 1.3 to 2.4), and use of three or more medicines (AOR, 2.0; 95% CI, 1.1 to 3.6) were significantly associated with the combined variable of osteoporosis and osteoarthritis.

4 | DISCUSSION

This study found that two-thirds of the elderly population in urban areas had osteoarthritis and one-third had osteoporosis with almost half suffering from other comorbid illnesses. Being female, low literacy, and Pashtun ethnicity were risk factors for osteoarthritis. Osteoarthritis, osteoporosis, falls, decreased mobility, and urinary incontinence are more likely to coexist and negatively impact each other. This study is among the few that have reported coexisting conditions with musculoskeletal disease in a representative older population from an LMIC.

The overall prevalence of osteoarthritis is higher than in regional studies^{12,13} but the osteoporosis rate is comparable. The prevalence estimate for the combined variable of osteoarthritis and osteoporosis in this study was also higher than previously reported in Pakistan.¹⁴⁻¹⁶ Another study from north Pakistan reported a prevalence of 37% of osteoarthritis among males and females,¹⁷ while Haris et al reported a prevalence of 24% in males and 32.6% in females for osteoporosis in urban Karachi, Pakistan.¹⁶ These differences in estimates are likely due to use of different operational definitions and tools for assessing osteoporosis and osteoarthritis. In addition, diverse age groups were studied in comparative studies, in contrast to the geriatric cohort in this study.

We found that Pashtun ethnicity, female sex, low literacy, and coexisting conditions (such as hypertension, urinary incontinence, abnormal gait, and falls) were more likely to be associated with osteoarthritis and osteoporosis.

Karachi is a multicultural city with a sizeable Pashtun community. Interestingly, this study found an association with osteoporosis, osteoarthritis, and combined conditions (osteoarthritis and osteoporosis) among Pashtuns in contrast to other ethnicities. No previous studies have identified this group's vulnerability to osteoporosis. Societal norms and low physical activity, especially among females, in this ethnic group may be likely contributors. The high odds ratio does indicate the need for further studies to confirm this finding and explore the reasons for this vulnerability.

Diseases and symptoms	Frequency (%)	Males, n (%)	Females, n (%)	P value
Osteoporosis	353 (29.4%)	107 (19.9%)	246 (37.1%)	<.0001
Osteoarthritis	800 (66.7%)	288 (53.6%)	512 (77.2%)	<.0001
Instrumental activities of daily living impairment (n = 1197)	122 (10.2%)	47 (8.8%)	75 (11.3%)	0.148
Time duration for get-up & go (greater than 20 seconds) (n = 1197)	952 (80.7%)	452 (85.8%)	500 (76.7%)	<.0001
History of fall in last year	366 (30.5%)	121 (22.5%)	245 (37.0%)	<.0001
Any use of ambulatory aid (cane, walker or wheelchair)	66 (5.5%)	31 (5.8%)	35 (5.3%)	0.709
Mobility impairment (n = 1186)	81 (6.8%)	33 (6.2%)	48 (7.3%)	0.459
Difficulty in rising from chair	401 (33.8%)	140 (26.5%)	261 (39.7%)	<.0001
Taking any medication	580 (48.3%)	226 (42.1%)	354 (53.4%)	<.0001

TABLE 2 Prevalence of osteoporosis and osteoarthritis, and resulting impact on mobility and falls and functional status (n = 1200)

Low literacy, an indicator of poor socioeconomic condition, was associated with osteoporosis. Whereas a large-scale literacy drive would appear to be the answer, a focused health literacy campaign targeting common chronic diseases may have an impact.¹⁸

The study also found that osteoporosis increased risk of falls, abnormal gait, and urinary incontinence, which are common geriatric syndromes. Falls are likely the result of postural instability, gait abnormality, and diminished muscle strength seen in osteoporosis,^{19,20} impacting functionality and increasing dependency.²¹ Urinary incontinence is an interlinked condition, as abnormal gait caused by osteoporosis increases transit time to toilets.²² Furthermore, incontinence increases risk of fractures due to higher frequency of falls.²³ However, fractures linked to falls were not assessed in this study. Those having both osteoarthritis and osteoporosis were also at increased risk of these geriatric syndromes, likely due to impaired mobility.

This study did not find an association of osteoarthritis with body mass index (BMI), which has been reported in earlier studies. It is important to note that BMI has not been a reliable indicator of obesity in the South Asian population.²⁴

The association of hypertension (a common comorbid condition in Pakistan) with osteoarthritis may explain the higher rates of osteoarthritis in our study. A postulated mechanism of arthritis in hypertensive patients is subchondral ischemia causing bone remodeling.²⁵ It would be interesting to know if control of hypertension could impact the rates or severity of osteoarthritis.

"Metabolic arthritis," found in those with metabolic syndrome,^{25,26} was not explored in this study and may require further investigation considering the high prevalence of noncommunicable illnesses in this region.

Other likely causative factors for osteoarthritis are nutritional deficiencies. Low vitamin D levels (commonly found in Pakistan) are linked to development and progression of osteoarthritis, making it an important factor in our setting.²⁷

An important observation was the high frequency of pain medication usage. This suggests a focus on symptom management rather than specific treatment (ie, lack of osteoporosis-specific therapy) and may relate to individual- and system-level factors. Poor awareness of osteoporosis, underdiagnosis, and inadequate health coverage for the elderly are other possible reasons.

In a health system that lacks formal programs for management of osteoporosis and falls, preventive strategies become imperative. Community interventions using calcium and vitamin D for osteoporosis may be initial steps in this process.²⁸

Whereas medical treatment of early osteoporosis is effective, osteoarthritis is largely managed symptomatically, with joint replacement as the only definitive treatment. Limited preventive strategies, such as weight loss and injury prevention, exist, making early diagnosis and lifestyle modifications key interventions for LMICs.

Despite the global rise in musculoskeletal morbidity among the elderly, it has not received due attention in health-care planning and programs.⁶ This holds especially true for LMICs, where a large majority of older individuals will be residing in the upcoming years.

In countries such as Pakistan that have meager resources and inadequate geriatric support programs, musculoskeletal morbidity poses a huge threat to the well-being and functioning of older individuals. Large-scale primary preventive measures are required to mitigate the expected rise of osteoporosis and osteoarthritis. Health-awareness programs, early vitamin D supplementation, and vitamin D fortification of dairy and grains may be possible preventive solutions.²⁹

There are no national guidelines for the diagnosis and management of osteoporosis. Until contextual guidelines are developed, cost-effective diagnostic strategies should be adopted (eg FRAX scoring or tools like OSTA) for patients unable to obtain bone-density tests. Exercise programs targeting lower extremity strength,

TABLE 3 Multivariate logistic regression analysis of risk factors for osteoporosis and osteoarthritis among elderly (≥ 60 years) in Karachi, Pakistan (n = 1200)

Variables	Osteoporosis		Osteoarthritis		Combined osteoporosis and osteoarthritis	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Sex						
Male (ref.)						
Female	1.81 (1.28-2.56)	0.001	2.01 (1.46-2.76)	<.0001	1.73 (1.20-2.50)	0.003
Respondent age (years)						
60-64 (Ref.)						
65-69	0.73 (0.49-1.11)	0.140	1.01 (0.69-1.46)	0.977	0.67 (0.43-1.03)	0.071
70-74	0.98 (0.65-1.46)	0.908	1.04 (0.71-1.53)	0.837	0.94 (0.62-1.43)	0.790
75-84	0.87 (0.55-1.36)	0.530	0.87 (0.57-1.32)	0.507	0.90 (0.56-1.43)	0.652
85 or older	1.38 (0.68-2.81)	0.373	0.74 (0.38-1.46)	0.383	1.01 (0.46-2.19)	0.983
Education						
Illiterate	2.09 (1.04-4.19)	0.037	1.78 (1.03-3.08)	0.039	2.12 (1.03-4.37)	0.042
Primary (up to Grade 7)	1.87 (0.91-3.84)	0.088	1.18 (0.67-2.09)	0.562	1.42 (0.66-3.02)	0.368
Secondary (up to Grade 12)	1.84 (0.90-3.76)	0.095	1.11 (0.64-1.93)	0.712	1.61 (0.76-3.40)	0.216
Tertiary (undergraduate degree or higher) (Ref.)						
Ethnicity						
Urdu (Ref.)						
Sindhi	1.18 (0.61-2.28)	0.625	1.56 (0.80-3.07)	0.193	1.24 (0.62-2.45)	0.543
Punjabi	0.99 (0.65-1.49)	0.947	0.82 (0.56-1.20)	0.311	0.93 (0.60-1.43)	0.738
Pashtun	2.59 (1.36-4.91)	0.004	1.36 (0.69-2.72)	0.376	2.16 (1.10-4.21)	0.024
Hindko	0.83 (0.39-1.77)	0.639	1.36 (0.69-2.69)	0.372	0.84 (0.38-1.85)	0.666
Others	1.12 (0.72-1.76)	0.608	1.13 (0.73-1.75)	0.583	1.15 (0.72-1.85)	0.551
Body mass index						
<18.5 (underweight)	0.77 (0.50-1.20)	0.248	0.88 (0.60-1.31)	0.534	0.73 (0.46-1.16)	0.186
18.5-24.99 (normal) (Ref.)						
25-29.99 (overweight)	0.92 (0.64-1.33)	0.670	1.09 (0.77-1.54)	0.612	0.98 (0.67-1.43)	0.913
30 or more (obese)	1.42 (0.88-2.28)	0.152	1.62 (0.98-2.69)	0.060	1.54 (0.94-2.53)	0.090
Number of children in the household						
None (Ref.)						
1-2	0.58 (0.36-0.93)	0.024	0.65 (0.40-1.06)	0.084	0.54 (0.33-0.87)	0.011
3-4	0.39 (0.24-0.62)	<.001	0.64 (0.39-1.03)	0.067	0.32 (0.20-0.52)	<.001
5-6	0.24 (0.14-0.39)	<.001	0.69 (0.42-1.12)	0.134	0.19 (0.11-0.32)	<.001
7 or more	0.21 (0.13-0.34)	<.001	0.66 (0.41-1.06)	0.085	0.17 (0.10-0.28)	<.001
Tobacco use (cigarettes/paan/gutka/naswar)						
No (Ref.)						
Yes	1.11 (0.81-1.53)	0.504	1.23 (0.92-1.65)	0.164	1.19 (0.85-1.66)	0.307
Diabetes mellitus						
No (Ref.)						
Yes	1.07 (0.74-1.54)	0.717	1.42 (0.99-2.04)	0.059	1.10 (0.75-1.61)	0.616
Coronary artery disease						
No (Ref.)						

(Continues)

TABLE 3 (Continued)

Variables	Osteoporosis		Osteoarthritis		Combined osteoporosis and osteoarthritis	
	OR (95% CI)	P value	OR (95% CI)	P value	OR (95% CI)	P value
Yes	1.24 (0.82-1.86)	0.312	0.98 (0.64-1.47)	0.907	1.01 (0.66-1.56)	0.951
Hypertension						
No (Ref.)						
Yes	1.19 (0.87-1.64)	0.281	1.88 (1.39-2.54)	<.001	1.46 (1.04-2.04)	0.027
Depression						
No (Ref.)						
Yes	1.25 (0.92-1.70)	0.149	1.09 (0.82-1.45)	0.538	1.31 (0.95-1.80)	0.102
Urinary incontinence						
No (Ref.)						
Yes	2.07 (1.48-2.91)	<.001	1.52 (1.03-2.23)	0.034	2.35 (1.66-3.33)	<.001
History of fall in last year						
No (Ref.)						
Yes	1.52 (1.11-2.08)	0.009	1.23 (0.89-1.69)	0.200	1.76 (1.27-2.44)	0.001
Any use of ambulatory aid (cane, walker or wheelchair)						
No (Ref.)						
Yes	1.28 (0.66-2.47)	0.469	0.83 (0.41-1.66)	0.594	0.96 (0.48-1.92)	0.903
Gait						
Normal (Ref.)						
Abnormal	1.43 (1.02-1.99)	0.036	1.90 (1.34-2.68)	<.001	1.41 (1.00-2.00)	0.053
Medication use						
No medicines (Ref.)						
One medicine	1.05 (0.69-1.61)	0.807	1.10 (0.74-1.63)	0.653	1.09 (0.70-1.71)	0.693
Two medicines	0.90 (0.54-1.51)	0.702	1.28 (0.78-2.10)	0.338	0.95 (0.56-1.62)	0.861
Three medicines	2.20 (1.24-3.90)	0.007	1.38 (0.73-2.58)	0.320	2.00 (1.10-3.64)	0.023
More than three medicines	1.58 (1.01-2.49)	0.046	1.02 (0.65-1.62)	0.923	1.53 (0.95-2.46)	0.082

mobility, and balance in those already affected may help mitigate complications, such as dependency, falls, and incontinence.³⁰

Health-care policy-makers should consider the implications of musculoskeletal disease burden that puts a rapidly aging population and their families at risk of functional and financial dependency.

4.1 | Limitations

Objective measurements, such as bone mineral density test and X-rays, were not used for assessment, and this study relied on self-reported signs and symptoms. Prior diagnosis was used to determine disease burden. Overestimation of disease is a likely possibility; however, every effort was made to minimize self-reporting errors by use of standard questions and validated tools, where applicable.

The study found several associations with comorbid conditions that are interrelated and should be interpreted with caution due to the cross-sectional nature of the study. A cohort study with longer-term

follow-up could confirm the causal relationship between these factors; however, the study highlighted the coexistence of comorbid conditions in a representative low-income older population.

4.2 | Conclusions

The elderly population in Pakistan is burdened with high rates of musculoskeletal morbidity associated with geriatric syndromes. The rising number of older individuals creates a pressing need to improve community awareness, preventive measures, and management at a health-systems level for better outcomes. The study also invites further research on specific ethnicities and associations between comorbid conditions and musculoskeletal health.

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CONFLICTS OF INTEREST

Nothing to disclose.

AUTHOR CONTRIBUTIONS

Saniya Sabzwari conceived and designed the research proposal, wrote the Introduction, Results and Discussion, helped with data interpretation, and added citations. Zafar Fatmi contributed to Methods, data collation, interpretation, analysis, and manuscript review. Adeel Ahmed Khan performed data interpretation, result tabulation, developed the tables, and helped with manuscript review and revision. All authors agree to be accountable for the accuracy of the manuscript.

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