PREVALENCE OF OSTEOPOROSIS IN LOW ECONOMIC COUNTRIES: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract

Background: Osteoporosis, a prevalent metabolic condition, is defined by reduced bone strength and represents a significant contributor to bone fractures, especially in the older demographic. Despite its prevalence, there is currently insufficient synthesized evidence regarding its distribution and occurrence in the population under study, necessitating comprehensive research in this area.

Objective: The primary objective of this systematic review and subsequent meta-analysis was to determine and synthesize the prevalence of osteoporosis within the studied adult population. The study sought to fill the knowledge gap surrounding osteoporosis and provide valuable insights for healthcare policy decision-making.

Study design: A systematic review and meta-analysis

Methodology: A thorough systematic search, adhering to predefined standardized criteria, was conducted across several electronic databases, including authentic articles and journals. A systematic review followed the Joanna Briggs Institute methodology, focusing on osteoporosis prevalence in adults aged 18 and above via Bone Mineral Density (BMD) measurements (DEXA and heel ultrasound). It included general population, school, and hospital surveys but excluded inaccessible texts, duplicates, modeling studies, and more. Data was extracted by two independent reviewers using a standardized tool. Findings were synthesized narratively, with meta-analysis when possible, using R software. Subgroup analyses and heterogeneity assessment were conducted, along with publication bias evaluation.

Results: This review examined 7 selected articles from an initial pool of 520 papers. The region's osteoporosis data scarcity is due to a lack of registries and diagnostic resources, with few DXA machines in urban areas. Recent hospital-based studies mainly used heel ultrasound, lacking DXA

data. There was a different prevalence of osteoporosis in different time frames. It was 12.9% in 2007, 6.7% in 2009, it was between 24-48% in 2010. Furthermore, it was 27% in 2011, 17.8% in 2012 and in 2015 it was 28.6%

Conclusion: This comprehensive study provides a vital estimate of osteoporosis prevalence and highlights the pressing need for healthcare policy adjustments and the provision of necessary resources to address this public health concern. Enhanced accessibility to healthcare services and increased focus on health systems and policy research are essential for promoting osteoporosis screening and treatment.

Keywords: Prevalence, meta-analysis, osteoporosis, bone disorders, systematic review

Introduction
Osteoporosis is a commonly occurring metabolic disorder marked by diminished bone strength. Its operational diagnosis relies on assessing bone mineral density (BMD). According to the World Health Organization (WHO), osteoporosis is identified when BMD registers a deviation of 2.5 standard deviations or greater below the established normal values. [1]. Osteoporosis stands as a primary cause of bone fractures, particularly among the elderly, often remaining asymptomatic until fractures occur [2]. Decreased BMD renders bones susceptible to fractures from minor stress, leading to chronic pain that significantly impairs daily activities [3]. Systematic reviews have reported a prevalence of 23.1% global osteoporosis in women and 11.7% in men [4]. Osteoporosis is categorized primarily as primary and secondary, with primary osteoporosis predominantly affecting postmenopausal women and individuals aged 70 and above, while secondary osteoporosis is linked to diseases (systemic and endocrine), lifestyle factors, and certain treatments [5]. Diagnosis typically involves BMD measurement via dual-energy X-ray absorptiometry (DXA) or ultrasound imaging [6].

Numerous risk factors play a role in the development of osteoporosis, encompassing gender, age, race, genetic predisposition, excessive body weight, smoking, alcohol consumption, and lack of physical activity. These risk factors are particularly heightened in women experiencing early menopause and loss of ovarian function [7]. Osteoporosis-related fractures are a leading cause of mortality among the elderly, frequently occurring in three regions: the vertebrae, distal arm, and hip, with a higher occurrence in women [8]. Although osteoporosis affects both genders, most research has centered on women [9]. Numerous studies worldwide have examined osteoporosis.

We systematically reviewed all accessible studies in this field and utilized meta-analysis methods to ascertain the combined prevalence of osteoporosis. The purpose of this investigation is to provide a structured examination of the current body of evidence and research, with the intention of reporting on the prevalence of osteoporosis within the study region. Understanding the prevalence and incidence of osteoporotic fractures is essential for developing effective strategies to mitigate the burden of this health challenge [10].

Methodology
The systematic review adhered to a predefined protocol following the Joanna Briggs Institute methodology for prevalence and incidence systematic reviews. The selection criteria for studies included in this review have been described in brief detail.

We included studies that encompassed osteoporosis in individuals aged 18 years and older. These studies reported the prevalence of osteoporosis, which was diagnosed through BMD measurements using recognized equipment such as a DEXA densitometer or heel ultrasound. These measurements could either be the primary focus of the study or secondary objectives, or they could be reported as covariates. The primary emphasis of our review was on surveys or screening programs conducted within the general population, educational institutions, or healthcare facilities.

Exclusion of studies with unavailable or inaccessible full texts, lacking age classification, providing duplicate data from the same sample, offering mortality estimates, or being modeling studies. We took into account descriptive or analytical observational studies, including baseline reports from longitudinal cohort studies and analytical cross-sectional studies. However, we excluded experimental

studies, qualitative research designs, conference abstracts, protocols, books or book chapters, preprints, reviews, letters, news articles, opinions, and commentaries from our analysis.

All studies, regardless of methodological quality, underwent data extraction and synthesis. Sample size appropriateness was determined using predetermined cut-offs based on an estimated community prevalence of 1% for osteoporosis.

We conducted data extraction through a collaborative effort involving two independent reviewers, utilizing an adapted version of the standardized data extraction tool designed for prevalence and incidence studies. The extracted data encompassed detailed information pertaining to the condition under investigation, the characteristics of the study populations, the methodologies employed, and the proportions associated with osteoporosis within the selected studies.

We conducted a narrative synthesis of pertinent findings extracted from the included studies, considering various subgroups of interest. We subjected the studies to statistical meta-analysis whenever feasible using R software packages. Effect sizes were represented as proportions, accompanied by 95% confidence intervals. Our statistical analyses employed random and fixed-effects models, employing the double arcsine transformation approach for accuracy. Subgroup analyses were conducted where adequate data were at our disposal for further insight.

Results

This review encompassed a comprehensive examination of the available literature, ultimately encompassing a total of 7 articles. These selected articles were meticulously curated from an extensive initial pool of 520 research papers that were identified through our rigorous database searches.

The scarcity of epidemiological data on osteoporosis in the region under study can be attributed to the absence of national registries and limited published information. Diagnostic resources for osteoporosis are notably inadequate, with a limited presence of DXA machines primarily in urban centers. Over the past five years, various hospital-based investigations have examined osteoporosis prevalence using heel ultrasound, while data utilizing DXA technology remains limited. There was a different prevalence of osteoporosis in different time frames. It was 12.9% in 2007, 6.7% in 2009, it was between 24-48% in 2010. Furthermore, it was 27% in 2011, 17.8% in 2012 and in 2015 it was 28.6% (As shown in Table 1)

Table 1. Summary of bone health in the patients under study over the past 2 decades					
Author [Reference]	Number of patients	Year	Age of patients (in years)	BMD testing tool	Prevalence of osteoporosis
Fatima [11]	334	2007	20-60	Heel Ultrasound	12.9%
Baig [12]	925	2009	35-50	Heel Ultrasound	6.7%
Jaleel [13]	170	2010	31-45	Heel Ultrasound	47.8%
Zahoor [14]	240	2010	40-60	Unknown	24.5%
Lowe [15]	140	2011	40-60	Heel Ultrasound	27%
Ejaz [16]	1416	2012	>25	Heel Ultrasound	17.8%
Naeem [17]	203	2015	40-60	DXA	28.6%

Discussion

In the context of our study, it is noteworthy that there exists a prevailing dearth of awareness regarding osteoporosis within the country. Despite isolated efforts made by individuals, it is imperative to acknowledge that no government policies currently recognize osteoporosis as a significant healthcare concern in this region. This scarcity of awareness can be closely associated with factors such as limited educational opportunities, infrequent interactions with healthcare services, larger family structures, and unfavourable economic circumstances. Furthermore, it has come to our attention that individuals often lack insight into the pivotal role of calcium intake during the peri-menopausal phase [14].

Our investigation revealed intriguing insights. Notably, women hailing from higher socioeconomic strata demonstrated markedly superior awareness levels regarding osteoporosis compared to their counterparts in lower socioeconomic tiers. Regrettably, despite this heightened awareness, we did not observe corresponding improvements in lifestyle choices or preventive practices related to

osteoporosis [18]. These findings underscore the critical need for enhanced public health initiatives and policy measures to address the knowledge gaps and promote preventative strategies in the context of osteoporosis management.

Epidemiological data regarding osteoporosis remains notably scarce. However, several escalating risk factors associated with osteoporosis have been identified, including multiparity, increased post-menopausal years, reduced calcium intake, vitamin D deficiency, and a decline in physical activity [11, 12]. Research conducted in Peshawar has incorporated various risk factors into the analysis, encompassing factors such as the age of menopause and menarche, pregnancy history, personal and familial fracture history, smoking history, medication use, occupation, and income. It is noteworthy that the mean calcium intake among the 140 postmenopausal females involved in this study was significantly lower than the dietary intake recommended by the World Health Organization, which stands at 1300 mg/day [15].

Moreover, in a cohort of 103 post-menopausal females who experienced hip fractures, significant osteoporosis risk factors were identified. These included early onset of menopause, prolonged menopausal duration, low body mass index (BMI), disadvantaged socioeconomic status, multiparity, smoking, limited literacy, absence of calcium supplements, inappropriate use of steroids, and impaired visual acuity. The average age in this study group was 64.6 years, with an average menopausal duration of 9.9 years. It is noteworthy that 70.9% of these women did not engage in regular exercise [19].

As per The National Osteoporosis Foundation, lifestyle choices can have a substantial impact, accounting for 20–40% of adult bone mass. Consequently, the adjustment of lifestyle factors constitutes a pivotal strategy aimed at mitigating the risk of osteoporosis in older individuals. A recently conducted community-based study, originating from our center, specifically focused on females. This study unveiled that significant predictors of vitamin D deficiency included factors such as aging, housing structure, and the town of residence [20].

Conclusion

This comprehensive and in-depth analysis offers a crucial assessment of the prevalence of osteoporosis, underscoring the immediate imperative for healthcare policy reforms and the allocation of essential resources to tackle this critical public health issue. It becomes increasingly evident that facilitating wider access to healthcare services and intensifying efforts in health systems and policy research constitute indispensable measures for advancing osteoporosis screening and treatment initiatives. As such, the imperative for proactive policy adjustments and resource allocation cannot be overstated in addressing this pertinent public health challenge.

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