

Screening and Diagnosing Osteoporosis Among Postmenopausal Women in Primary Care Settings in Malaysia: A Systematic Review

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ABSTRACT

Background: As the population of Malaysia is aging, osteoporosis is becoming more common, prompting the development of various clinical practice guidelines for screening and diagnosing in primary care settings. Given the lack of a systematic assessment of recommendations, we aimed to determine the extent between the guidelines and actuarial screening and diagnosing among postmenopausal women in Malaysia.

Methods: The present research is a systematic review following the Cochrane Handbook for Systematic Reviews and the preferred reporting items for systematic reviews and meta-analyses (PRISMA) for clinical practice guidelines on the screening and diagnosing of osteoporosis in primary care settings (updated January 1, 2022). For this purpose, several databases were searched, including MEDLINE, EMBASE and CINAHL. Medical subject headings search terms were related to diagnosis and treatment of osteoporosis, clinical practice guidelines, primary settings and postmenopausal women. Two authors assessed records following consensus and evidence-based processes and reviewed the quality of identified studies using the Joanna Briggs Institute Critical Appraisal tools.

Results: Six cross-sectional studies were included in our review. All of them showed a fair level of osteoporosis screening among postmenopausal women in Malaysia primary care settings. Included studies reported that 50% of participants had been diagnosed as osteopenia or osteoporosis. Advancing age, increase of menopause years, low bone mass index, low calcium intake, low education level and low income are positive indicators for osteoporosis. The diagnosis of osteoporosis is influenced by the accessibility of primary care providers on osteoporosis care and knowledge of osteoporosis among postmenopausal women.

Conclusions: This systematic review has confirmed that there was a fair screening status in Malaysia. A renewed effort in primary care is needed to reduce the explicit gap in practice and meet the osteoporosis guideline. However, further reviews are needed to best inform future practice, specifically examine the challenges of primary care providers in osteoporosis management.

Keywords: chiropractic, DXA, orthopaedic surgeon, osteoporosis, pharmacist, primary care.

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Abbreviations:

BMD=bone mineral density;
 BMI=body mass index;
 DXA=dual-energy X-ray absorptiometry;
 FRAX=fracture risk assessment tool;
 IOF=International Osteoporosis Foundation;
 MOH=Ministry of Health;
 MOS=Malaysian Osteoporosis Society;
 OASKL=Osteoporosis Awareness Society
 Kuala Lumpur;
 OSTA=osteoporosis self-assessment tools for
 Asians;
 PRISMA=preferred reporting items for
 systematic reviews and meta-analyses;
 QUS=quantitative ultrasound;
 RCTs=randomized controlled trials;
 WHO=World Health Organization

INTRODUCTION

In Malaysia, older age groups (≥ 70 years) are projected to increase to 4.8 million in 2050 and the number of people aged over 50 is expected to increase by 163% to 13.9 million (1). According to the Malaysian Osteoporosis Society (MOS), the economic burden of osteoporosis is estimated to escalate with the aging population (2). In order to reduce the burden of osteoporosis among postmenopausal women in Malaysia, early screening and timely management of osteoporosis is urgently needed.

Clinical guideline for the management of postmenopausal osteoporosis

The first clinical guideline for the management of postmenopausal osteoporosis in Malaysia was issued in 2001 as a result of collaboration between MOS, the Ministry of Health (MOH) and Academy of Medicine. It provides a framework to aid high-risk healthcare providers to screen, diagnose, and refer osteoporosis patients to the relevant specialists. This guideline is suitable for all healthcare professionals, including medical doctors, nurse practitioners, pharmacists, chiropractors, and physiotherapists (2).

There are five tools to screen and diagnose osteoporosis among postmenopausal women (Table 1). Firstly, osteoporosis self-assessment tool for Asians (OSTA) is the most commonly recommended by the Malaysian Clinical Guideline in screening women aged over 65 (3).

TABLE 1. Screening and diagnose tests for osteoporosis among postmenopausal women (2)

	Tools	Grade of recommendation
Screening test	Osteoporosis self-assessment tool for Asians (OSTA)	Grade B, level III
	Quantitative ultrasound (QUS)	Grade C, level IV
	Bone turnover markers	Grade B, level IIa
	Fracture risk assessment tool (FRAX)	Grade B, level III
Diagnosis test	Dual-energy X-ray absorptiometry (DXA)	Grade C, level IV

Secondly, qualitative ultrasound (QUS) is an inexpensive and radiation-free heel device to measure bone mass (3), which cannot be used for either the diagnosis of osteoporosis or monitoring of treatment results (4). Thirdly, bone turnover markers are non-diagnostic tool used as reference markers for fracture risk prediction and to assess compliance with osteoporosis treatment (4). Forthly, fracture risk assessment tool (FRAX) estimates the 10-year probability of hip and major fracture using clinical risk factors (5). Lastly, dual-energy X-ray absorptiometry (DXA) is the gold standard in diagnosing and monitoring osteoporosis but it is a costly approach (3). Therefore, primary care providers firstly conduct high sensitivity screening tests and refer high risk patients for diagnostic test to avoid unnecessary DXA scanning and save the limited resources in hospitals (3).

Osteoporosis is currently underdiagnosed and undertreated in Malaysia (1). There is a lack of structured programmes to promote and prevent osteoporosis at the national level. As primary care practitioners are not adequately recognising osteoporosis among postmenopausal women, they do not implement the clinical guideline (1). Therefore, the apparent gap between guidelines for osteoporosis management and current practice needs to be examined. This systematic review aimed to identify the gap as well as the factors of increasing the risk of postmenopausal osteoporosis, challenges of osteoporosis diagnosis among postmenopausal women, and making recommendations to improve the screening and diagnosing procedures. □

MATERIAL AND METHODS

The review method was informed by both the Cochrane Handbook for Systematic Reviews and PRISMA (6). A two-step search strategy was used to identify all relevant published reports. Firstly, three electronic databases, including MEDLINE, EMBASE and CINAHL, were systematically searched. Secondly, a manual search of the grey literature was performed to identify additional relevant research to augment our meta-analysis (7), and the key journals were hand searched at the International Osteoporosis Foundation (IOF), MOS, the World Health Organization (WHO), Web of Science and the National Clinical Guideline Centre. Searches were limited to studies in English which were published from 2009 onwards, with a geographical area limited to Malaysia.

Our review included cross sectional studies. The objective of this review required descriptive evidence which is best provided by observational studies (8). Cross sectional studies measure the outcome (status of osteoporosis screening) and exposures (age, menopausal years, bone mass index, ethnicity, calcium intake, vitamin D intake, physical exercise, alcohol intake, education level and income level) among study participants (postmenopausal women) based on inclusion and exclusion criteria set for each study at the same time. Other than that, cross-sectional studies were used for population-based surveys to assess and estimate the prevalence of diseases (osteoporosis) in clinical-based samples and by estimating the odds ratios in order to explore the association between exposures and osteoporosis. Furthermore, this type of study design is used for public health planning, monitoring and evaluation, which enables to study the current osteoporosis screening among postmenopausal women in primary care settings of Malaysia (9). Methods of documenting BMD in selected studies included questionnaires, QUS devices and DXA machines.

The following inclusion criteria were used: postmenopausal women, study conducted in Malaysia, study published in the last 10 years, primary osteoporosis, and study in English.

Exclusion criteria were as follows: studies investigating secondary osteoporosis, studies regarding secondary or tertiary care on osteoporosis, studies not reporting primary or secondary

outcome measures, previous systematic reviews, letters and editorials, previous dissertations, qualitative studies, randomized controlled trials (RCTs), and meta-analysis.

Outcome measures include primary outcome measures such as BMD measurement and diagnosis of osteopenia or osteoporosis, and secondary outcome measures such as BMD measuring tools in primary care settings, positive predictors of developing osteoporosis among postmenopausal women, positive predictors of osteoporosis diagnosis, and osteoporosis management intervention in primary care settings. □

RESULTS

A total of 145 abstracts were retrieved from three databases. The grey literature identified three potential studies to screen, and hand searching yielded 15 articles. A total number of 163 abstracts were screened, and 23 articles were identified as potentially eligible. The second stage assessed 21 full texts against the inclusion and exclusion criteria for the present review, and six studies appeared eligible (Figure 1). Table 2 summarizes the results of quality assessment of included studies.

The present systematic review included six cross-sectional studies, all of which including records of participants' demographic characteristics through questionnaires. Age and menopausal years were the most commonly reported data (10-13) (Table 3).

Study sample size varied from 116 (12) to 362 postmenopausal female participants (10). The mean age of postmenopausal women ranged from 48.8 to 65.5 years. Only three of the included studies had recorded the mean duration of menopause, which was 12.13 years (12), 9.8 ± 5.2 years (14) and 10 ± 7 years (11). Various recruitment methods were utilized, including purposive sampling method, quota sampling method (10, 12, 13), and convenience sampling method (11, 14, 15).

In order to meet the inclusion criteria of the review, identification of primary osteoporosis women was done. Chee *et al* recruited participants with more than four years of menopause further confirmed by measuring serum follicle stimulating hormone (FSH), which was above 25 IU/l (14). Subramaniam *et al* excluded postmenopausal women who were either taking thi-

Study	Chee <i>et al</i> , 2010	Chin <i>et al</i> , 2016	Hasnah <i>et al</i> , 2012	Nurumal <i>et al</i> , 2019	Subramaniam <i>et al</i> , 2019	Yeap <i>et al</i> , 2010
Did the study address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes	Yes
Did the authors use an appropriate method to answer their study question?	Yes	Yes	Yes	Yes	Yes	Yes
Were subjects appropriately recruited?	Yes	Yes	Yes	Yes	Yes	Can't tell
Were outcome measures accurately measured to reduce bias?	Yes	Can't tell	Yes	Yes	Yes	Can't tell
Were data collected in a way that addressed the research issue?	Yes	Yes	Yes	Yes	Yes	Yes
Did the study have enough participants to minimise the chance of play?	No	Yes	No	No	No	No
How are the results presented and what are the main results?	54% of participants diagnosed with osteopenia and 10% with osteoporosis	35.3% of postmenopausal women had osteopenia and 8.1% of them osteoporosis	38% of participants diagnosed with osteopenia and 6% of them with osteoporosis	52.6% of participants had osteopenia and 47.4% osteoporosis	49.3% of women had osteopenia and 15.3% osteoporosis	Low accessibility of primary care providers to osteoporosis care and knowledge of osteoporosis among postmenopausal women
Was the data analysis sufficiently rigorous?	Yes	Yes	Yes	Yes	Yes	Yes
Is there a clear statement of findings?	Yes	Yes	Yes	Yes	Yes	Yes
Can results be applied to the local population?	Yes	Yes	Yes	Yes	Yes	Yes
How valuable is the research?	Moderate	Moderate	Moderate	Moderate	Strong	Weak
Score	10/11	10/11	10/11	10/11	10/11	8/11

TABLE 2. Quality assessment of included studies

azide diuretics, glucocorticoids, cancer treatment or disabled; Nurumal *et al* excluded women who suffered from any chronic illness and Chin *et al* excluded those who were either previously diagnosed with osteoporosis or currently taking a pharmacological treatment for osteoporosis or other treatments which may si-

gnificantly affect bone metabolism or disable participants (10, 12, 13).

Outcome measures

Bone mass density was designed as an outcome measure. Its measurement was done by using either a DXA machine in studies of Chee *et al*,

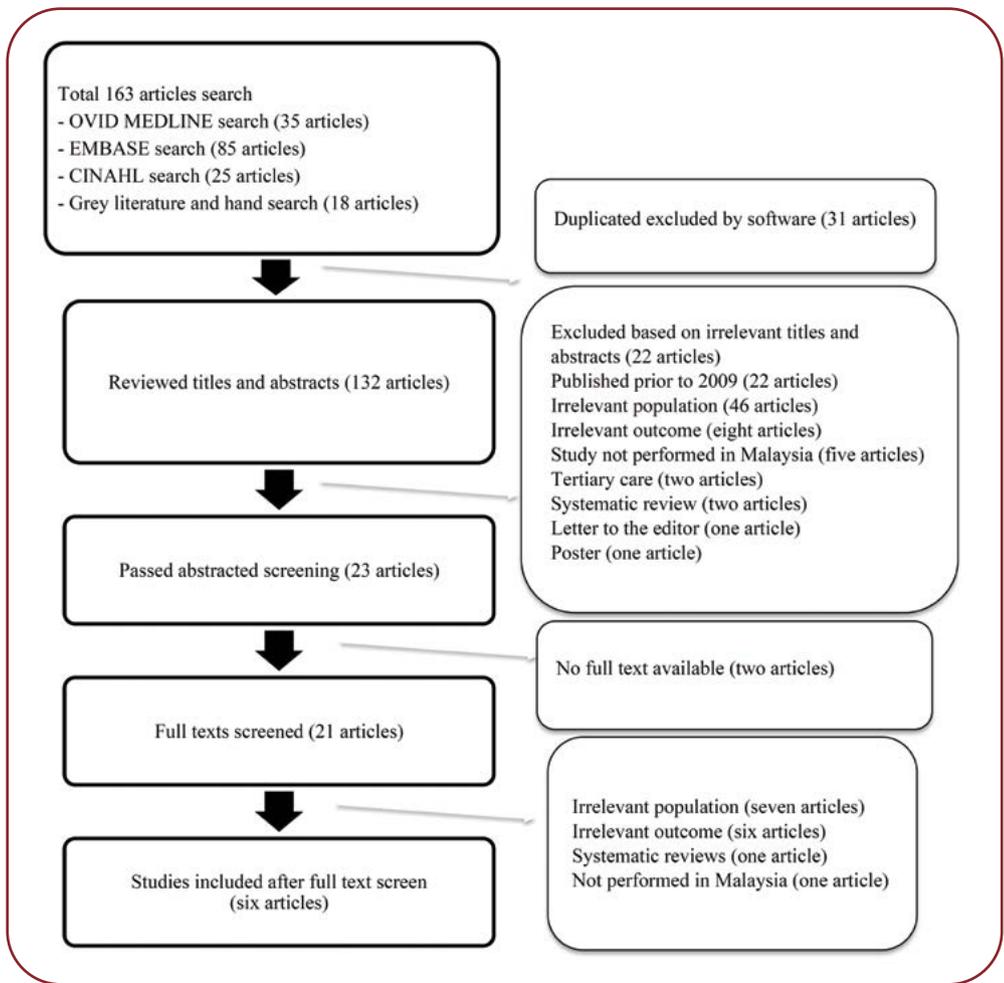


FIGURE 1. Flow chart of search strategy

TABLE 3. The characteristics of the six included studies

Author, date, study design	Population	Method	Outcomes
Chee <i>et al</i> , 2010 Cross-sectional study	N = 178 (mean age 59.7±5.0)	DEXA scan	Documentation of body mass index, current calcium intake and vitamin D intake
Chin <i>et al</i> , 2016 Cross-sectional study	N= 362 (mean age 61.69)	QUS device	Documentation of ethnicity and BMI
Hasnah <i>et al</i> , 2012 Cross-sectional study	N= 125 (mean age 57.5)	QUS device	Documentation of BMI, dietary nutrition intake and income level
Nurumal <i>et al</i> , 2019 Cross-sectional study	N= 116 (mean age 65.5)	DEXA scan	Documentation of ethnicity, level of education and income
Subramaniam <i>et al</i> , 2019 Cross-sectional study	N= 185 (mean age 59.15)	DEXA scan	Documentation of BMI, physical exercise level, alcohol intake, education level and income level
15 Cross-sectional study	N= 338 (mean age 48.8±13.8)	Self-administered survey	Documentation of education level, accessibility of primary care providers on osteoporosis care and knowledge of osteoporosis among postmenopausal women

Study	Chee <i>et al</i> , 2010	Chin <i>et al</i> , 2016	Hasnah <i>et al</i> , 2012	Nurumal <i>et al</i> , 2019	Subramaniam <i>et al</i> , 2019	Yeap <i>et al</i> , 2010
Did the study address a clearly focused issue?	Yes	Yes	Yes	Yes	Yes	Yes
Did the authors use an appropriate method to answer their study question?	Yes	Yes	Yes	Yes	Yes	Yes
Were the subjects recruited in an appropriate way?	Yes	Yes	Yes	Yes	Yes	Can't tell
Were outcome measures accurately measured to reduce bias?	Yes	Can't tell	Yes	Yes	Yes	Can't tell
Were data collected in a way that addressed the research issue?	Yes	Yes	Yes	Yes	Yes	Yes
Did the study have enough participants to minimise the chance of play?	No	Yes	No	No	No	No
How are the results presented and what are the main results?	54% of participants were found with osteopenia and 10% with osteoporosis	35.3% of postmenopausal women had osteopenia and 8.1% of them osteoporosis	38% of participants diagnosed with osteopenia and 6% of them with osteoporosis	52.6% of participants had osteopenia and 47.4% osteoporosis	49.3% of women had osteopenia and 15.3% osteoporosis	Low accessibility of primary care provider on osteoporosis care and knowledge of osteoporosis among postmenopausal women
Was the data analysis sufficiently rigorous?	Yes	Yes	Yes	Yes	Yes	Yes
Is there a clear statement of findings?	Yes	Yes	Yes	Yes	Yes	Yes
Can the results be applied to the local population?	Yes	Yes	Yes	Yes	Yes	Yes
How valuable is the research?	Moderate	Moderate	Moderate	Moderate	Strong	Weak
Score	10/11	10/11	10/11	10/11	10/11	8/11

TABLE 4. Quality assessment of studies included in the review

Nurumal *et al* and Subramaniam *et al*, or quantitative ultrasound (QUS) device in studies of Chin *et al* and Hasnah *et al* (11-14). On the other hand, Yeap *et al* focused on secondary outcome to study the accessibility of primary care provider on osteoporosis and knowledge of osteoporosis among postmenopausal women.

Statistical analysis

All studies had used descriptive statistics by statistical package for social science (SPSS) software. Chee *et al* and Hasnah *et al* used the Pearson correlation coefficient (r) to measure the strengths of association between relevant predictors and osteoporosis (11, 14). All other studies reported

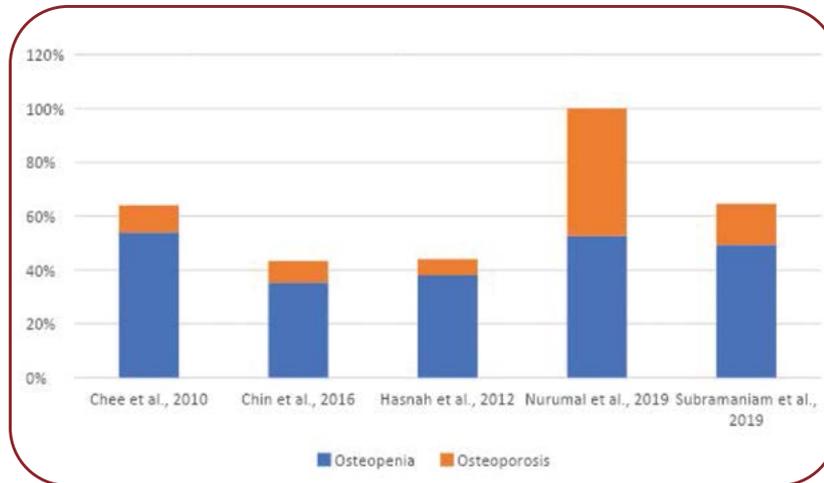


FIGURE 2. Prevalence of osteopenia and osteoporosis among included studies

significant P values with $p < 0.05$ (10-14). Some studies performed multivariate logistic regression to explore factors that were independent predictors of osteoporosis among postmenopausal women and reported the results as odds ratio (OR) alongside 95% confidence interval (CI) (10, 11, 13, 14).

Quality assessment of included studies are reviewed according to the tool (16) used to assess the methodological quality (Table 4). Recordings of bone mass density and diagnosis of osteopenia or osteoporosis were the primary outcome measures. Secondary outcome measures were predictive factors of osteoporosis, predictive fac-

tors of osteoporosis diagnosis and osteoporosis management intervention in primary care settings (Table 5). Most of the included studies recorded bone mass density as a primary outcome in order to diagnose osteoporosis or osteopenia (Figure 2). Predictive factors of osteoporosis among postmenopausal women were analysed in relation to develop the risk of osteoporosis in all studies (Table 6).

Age and number of menopausal years

Four included studies agreed upon a positive correlation between bone health status and age or number of menopausal years. The number of

TABLE 5. Outcome measures of included studies

Authors, date	BMD recording and diagnosing of osteopenia or osteoporosis	Predictive factors of developing osteoporosis	Predictive factors of osteoporosis diagnosis	Osteoporosis management intervention in primary care setting
Chee <i>et al</i> , 2010	√	√		Healthy nutrition lifestyle
Chin <i>et al</i> , 2016	√	√		Early detection of osteoporosis by QUS device
Hasnah <i>et al</i> , 2012	√	√		Healthy nutrition lifestyle
Nurumal <i>et al</i> , 2019	√	√		Healthy nutrition lifestyle
Subramaniam <i>et al</i> , 2019	√	√		Healthy nutrition lifestyle, early detection of osteoporosis, especially among elderly women from low socioeconomic background
Yeap <i>et al</i> , 2010			√	Increased awareness of osteoporosis among postmenopausal women through printed materials and responsibility of primary care providers on delivering osteoporosis information to the public

Age	Chin <i>et al</i> , 2016: p <0.001 Hasnah <i>et al</i> , 2012: p < 0.05 Nurumal <i>et al</i> , 2019: p=0.004 Subramaniam <i>et al</i> , 2019: p <0.001
Number of menopausal years	Chin <i>et al</i> , 2016: p <0.001 Hasnah <i>et al</i> , 2012: p < 0.05 Nurumal <i>et al</i> , 2019: p=0.028 Subramaniam <i>et al</i> , 2019: p <0.001
Body mass index	Chee <i>et al</i> , 2010: (r=0.181, p < 0.05) Hasnah <i>et al</i> , 2012: (r=0.887, p <0.001) Subramaniam <i>et al</i> , 2019: (OR=0.885, 95% CI: 0.840–0.933; p<0.001)
Ethnicity	Nurumal <i>et al</i> , 2019: p=0.996 Chin <i>et al</i> , 2016: p >0.05
Calcium intake or vitamin D intake	Chee <i>et al</i> , 2010: mean calcium intake (652±342 mg/day); mean vitamin D intake (51.3±11 nmol/L) Hasnah <i>et al</i> , 2012: mean calcium intake (505±263 mg/day) Subramaniam <i>et al</i> , 2019: (OR=4.163, 95% CI: 1.274–13.606; p=0.018)
Physical exercise	Subramaniam <i>et al</i> , 2019: p=0.349
Alcohol intake	Subramaniam <i>et al</i> , 2019: p=0.180
Education level	Nurumal <i>et al</i> , 2019: p=0.016 Subramaniam <i>et al</i> , 2019: p=0.119
Income	Nurumal <i>et al</i> , 2019: p=0.270 Subramaniam <i>et al</i> , 2019: p=0.123

TABLE 6. Predictive factors of osteoporosis among postmenopausal women

menopause years tends to increase with age. One study showed a linear relationship between age and osteoporosis ($r=1$, $p < 0.05$) (11). Another study revealed a significant correlation between age and menopausal years with bone health status ($p=0.004$ and $p=0.028$, respectively) among postmenopausal women (12). The remaining studies showed a significant correlation between age and bone health status ($p < 0.001$), especially in postmenopausal women aged over 65 (Chin *et al*, $p < 0.05$). Similarly, the prevalence of osteoporosis gradually increased from 4.2%, 8.8%, 21.9% and 32.6% in the age groups of 40-50, 51-60, 61-70 and above 70 years (13).

Body mass index

Three studies found a positive correlation between the body mass index (BMI) and bone health status: $r=0.887$, $p < 0.001$; $r=0.181$, $P < 0.05$; and $OR=0.885$, 95% CI: 0.840–0.933; $p < 0.001$ (11, 13, 14). One author found that subjects with osteoporosis had a significantly lower BMI (21.7 ± 2.6 kg/m²) than those with

osteopenia (23.1 ± 3.1 kg/m²) and normal bone mass ones (23.9 ± 3.4 kg/m²) (14). Another study also supports the theory according to which underweight subjects ($OR=3.543$, 95% CI: 1.029–12.198, $P=0.045$) had a higher risk of being diagnosed with osteoporosis than overweight ones ($OR=0.517$, 95% CI: 0.087–3.066, $p=0.467$) (13).

Ethnicity

Two of the included studies reveal there is no significant association between ethnic groups (Malay, Chinese, and Indian) on osteoporosis after adjustment for BMI using linear regression analysis (10, 12).

Calcium and vitamin D intake

Two studies reported a low calcium intake among postmenopausal women in Malaysia and a positive association with low bone mass (11, 14). Only 5% of participants in the study of Hasnah *et al* and 14% of subjects of Chee *et al*'s study met the recommended daily calcium intake (11, 14). Furthermore, the study of Subrama-

niam *et al* reveals a positive correlation between calcium supplements and bone health status, while Chee *et al* found that half of participants had hypovitaminosis D. The mean vitamin D intake was lower in subjects with osteoporosis (51.3 ± 11 nmol/L) than those with osteopenia or normal bone density (60.4 ± 13.5 nmol/L and 61.4 ± 18.9 nmol/L, respectively). However, there was no significant positive correlation between vitamin D intake and bone mass (14).

Physical exercise and alcohol intake

The study of Subramaniam *et al* showed that the risk of developing osteoporosis was not significantly associated with physical exercise ($p=0.349$) and alcohol intake ($p=0.180$) (13).

Education level

Subramaniam *et al* reported a low education level positively associated with the prevalence of osteoporosis ($p=0.119$); their study showed that women who had secondary school education (OR=0.112, 95% CI: 0.021–0.589; $p=0.010$), certificate or diploma (OR=0.062, 95% CI: 0.009–0.453; $p=0.006$), and a university degree or above (OR=0.037 95% CI: 0.003–0.437; $p=0.009$) had a low risk of developing osteoporosis comparing to those with a primary school or informal education (13). Also, Nurumal *et al* agreed that women's low education level was significantly correlated with low bone health status (12).

Income

Two studies concluded that higher income was not correlated with bone health status (12, 13), and one of them found that subjects with a lower monthly income had a greater risk of suffering from osteoporosis (13).

Accessibility of primary care providers

Regarding the accessibility of primary care providers to osteoporosis care, the majority of people would approach general practitioner (30.6%), followed by orthopedists (28.4%), other hospital specialists (23.8%), rheumatologists (22.4%), and pharmacists (11.4%) (15). Most people received osteoporosis information from printed materials such as newspapers (55.7%), magazines (46.4%) and brochures (30.2%), followed by social media (34.2%), public talks (30%), relatives (29.6%) and medical clinics 22.6% (15). The awareness of

postmenopausal women on osteoporosis was low and participants did not know that postmenopausal risk factors (27.5%), BMI (23.9%) and calcium intake (1.6%) were related to the bone health status (15). Furthermore, 21% of them did not know that osteoporosis would lead to falls, bent spine, fracture and loss of height (15). The same study found that women with more than 10 years of schooling were more likely to have heard of osteoporosis (15).

Osteoporosis management interventions

All included studies focused on preventive intervention on osteoporosis instead of referral or medication intervention. Four studies recommended healthy nutrition lifestyle such as calcium and vitamin D intake, especially for menopausal and elderly women, to slow down the progression of osteoporosis (11-14). Two studies suggested that early detection of osteoporosis should be targeted towards the elderly population because the duration of menopause and advancing age were positively correlated with bone mass density (10, 13). One study emphasized that elderly women from low socioeconomic backgrounds should be highly targeted in preventive diagnostic test, whereas another one suggested the use of QUS device as an early detection of osteoporosis due to its cost-effectiveness (10, 13). Lastly, one author suggested that awareness of osteoporosis should be raised through printed materials and highlighted the responsibility of general practitioners towards public education, which could stimulate the response of postmenopausal women to osteoporosis diagnostic test (15).

Assessment of heterogeneity

Clinical diversity is also reviewed in the included studies, which were conducted from different geographical settings across Malaysia in order to explore the accessibility of osteoporosis diagnostic tools in different places. Four studies were conducted in urban community areas (11, 13-15), menopause clinics (12) and hospitals (10, 12). Five studies reported the recording of bone mass density and prevalence of osteopenia or osteoporosis (11-15). One study emphasized the secondary outcome measures, which included the accessibility of primary care providers on osteoporosis and knowledge of osteoporosis among postmenopausal women (12). Moreover, each of

the included studies had examined different possible predictors of osteoporosis diagnosis. Besides, various prevention strategies are also recommended by the included studies such as nutrition advice, early detection test and education.

The methodological diversity in terms of data collection and outcome measurement is reviewed in all cross-sectional studies of this systematic review. There were different types of recruitment methods for postmenopausal participants such as quota sampling technique (13) and purposive sampling method (10, 12). Also, different types of questionnaires are used as predictors of osteoporosis diagnosis among postmenopausal women. Lastly, two diagnostic devices were used to measure bone mass density (DXA and QUS). □

DISCUSSION

This review provides evidence of the extent to which osteoporosis is currently screened and diagnosed in primary care settings. We obtained fair results regarding current screening and diagnosing osteoporosis between guidelines and current practice. However, as the clinical guidelines for osteoporosis are not being fully implemented into practice, the improvement of osteoporosis management can be made by increasing awareness and early detection of the disease.

According to the algorithm for the management of postmenopausal osteoporosis, high sensitivity, simplicity and cost-effectiveness clinical assessment screening test included OSTA as the first step to select potential patients at risk for osteoporosis and referral for DXA scan (2); FRAX was not highly applicable in Malaysia (2). The FRAX was developed and validated in Caucasian populations, therefore it substantially overestimated hip fracture risk in Asian women (18). None of the included studies had used screening tests prior to using osteoporosis diagnostic test. With these, subjects without osteopenia or osteoporosis might undergo expensive and unnecessary DXA scans (3). The current cost of a DXA scan ranges between 40-100 USD, while the average salary of Malaysians is 1287 USD; therefore, low income patients cannot afford the test, which leads to underdiagnosis of osteoporosis among grassroot (1).

Advancing age, increase of menopause years, low BMI, low calcium intake, low education and

low income were considered positive predictors of developing osteoporosis among postmenopausal women in this review. Included studies agreed that bone mass density declined with advancing age and increase of menopause years (10-13). With the extension of life expectancy, the ageing population will continue to rise and the prevalence of osteoporosis is expected to continue to grow (4). Depletion of oestrogen, the hormone that maintains bone health during postmenopausal years, leads to more bone resorption than formation, which increases the risk for osteoporosis (3).

In addition, BMI was positively related to bone health status. In Thailand, osteoporosis is commonly found in low BMI women (52.1%), followed by normal BMI (20.3%) and high BMI (15.7%) ones. This is due to body weight increase enabling mechanical stress on bone and increase to accommodate the load (19). However, both Chee *et al* ($r=0.181$) and Hasnah *et al* ($r=0.887$) included studies that reported large differences in correlation coefficients in relation to BMI. This may be explained by the mean calcium intake in Hasnah *et al*'s study (505 ± 263 mg/day), which was lower than Chee *et al*'s study (652 ± 342 mg/day) (11, 14). Therefore, subjects in Hasnah *et al*'s study had a higher risk of developing osteoporosis (11). A meta-analysis showed that calcium supplementation among postmenopausal women lead to a BMD increase by 2.05% compared with those who had calcium intake in their diet (20).

Low education was one of the determinants of osteoporosis among women due to low income associated with lower knowledge and awareness of osteoporosis (21). However, higher income was not related to bone health status (12, 13). Subramaniam *et al* noticed that lower monthly income was prone to osteoporosis. Prus *et al* also explained that low income families had financial restrictions to their access to healthcare, healthy foods and supplements, and thus, a greater risk for osteoporosis and hip fracture (22).

On the other hand, our review found negative associations between ethnicity, vitamin D intake, physical exercise and alcohol intake with the risk for osteoporosis. These findings were consistent with those reported by supporting studies. A cross-sectional study which was conducted in a tertiary medical centre in

Kuala Lumpur, Malaysia, found there were no significant differences in QUS indices among Chinese, Malay and Indian women (23).

Besides that, although the study showed there was no significant positive relationship between vitamin D intake and bone mass (14), Robbins *et al* reported that women with both calcium and vitamin D supplements intake had a 29% reduction of their hip fracture risk compared to those with only vitamin D intake (24). A randomised controlled trial study found that weight bearing exercise with calcium and vitamin D supplements increased bone mass density by 1.3% over 14 months among postmenopausal women, compared with a 1.2% decrease in the control group (25). It also showed that exercise was important to strengthen muscles, improve balance and prevent falls (25). Another study also explained that low bone mass was more significant in chronic heavy alcohol consumption during adolescence and young adulthood compared to postmenopausal women, which lead to the conclusion that alcohol intake did not significantly affect the bone health status of postmenopausal women (26).

Next, included studies found general practitioners were the first to be approached regarding osteoporosis, whereas pharmacists the last (15). Similar findings were reported in the study conducted by Kung *et al*, who found that a majority of patients sought osteoporosis information from orthopaedic specialists (76%) rather than general practitioners (11%) (17). Other than that, a survey regarding physicians' attitudes on osteoporosis management found that bone health screening tools (OSTA) were not applicable in primary care settings due to time constraints (76%), feeling of screening tool unusefulness (11.3%), lack of knowledge on application of screening tool (6%) and poor internet access (7%) (27). Another survey among community pharmacists and physicians found there was no significant difference regarding the knowledge of pre-screening tools among both healthcare professions, but only 5% of them were applying pre-screening tools in work settings (28). A qualitative study showed that community pharmacists had a minimal involvement in the provision of osteoporosis management intervention, which limited their role to counselling on osteoporosis prevention (29). Malaysian patients normally obtain their prescription from general practitioners

instead of pharmacists; unlike Australia and the United Kingdom, medication is solely dispensed by pharmacists, which reduces their involvement in the management of osteoporosis (40). Therefore, underutilization and lack of knowledge among primary care providers led to underdiagnosis of osteoporosis among postmenopausal women. Toh's study revealed that pharmacists' involvement in the management of osteoporosis improved the rates of bone mass density test, initiated calcium intake and enhanced patient adherence to osteoporosis medication (30).

Other than that, Kung *et al* found that the major challenge of influencing diagnosis and treatment of osteoporosis among postmenopausal women in Asian countries comprised the lack of patient's awareness (50%), followed by health insurance restriction (47%) and costs of medication (28%) (17). Hence, education is playing an important role in enhancing knowledge of the disease and adopting positive lifestyle practices such as proper nutritional intake and exercise intervention towards bone health among postmenopausal women (12, 13, 15). Also, the study of Yeap *et al* found that printed materials represented the most effective way to educate public regarding osteoporosis (15).

In relation to osteoporosis intervention in primary care settings, all studies agree on preventive strategies for osteoporosis. Healthy nutrition and lifestyles, early detection of osteoporosis tests and public education were emphasised in this study in order to reduce the risk of complications in osteoporosis such as prevalence of osteoporotic fracture and hospitalisation fees (17). Therefore, primary care providers should initiate approaches for early detection of osteoporosis in order to increase the awareness of the disease among postmenopausal women.

Strengths and limitations of the present review

The strength of the present review consists in applying a systematic process to study the current primary practice in relation to one of the major public health challenges in Malaysia. However, there are several limitations of our study. Firstly, some of the exclusion criteria may limit the value of the review. For instance, this review is limited to the included studies within 10 years of publication due to time constraint. Secondly, there was only one type of study design (cross-sectional study) in this review due to limited time and

resources, which resulted in low diversity of methodology and limited insight on secondary outcome. If qualitative literature was included, it may provide better insight into the development of pharmacist led osteoporosis management in primary care settings, enabling the review to better achieve the secondary objectives (30).

The present review included six cross-sectional studies: one of them rated as strong, four moderate and one weak. Another limitation of this review is the self-reported outcome measures alone. Yeap *et al* examines the predictive factors of osteoporosis diagnosis by a self-administered questionnaire, which may lead to response bias and underestimation of results (15). Self-rating bias had the potential of social-desirability bias and underestimation of results (31). In addition, there was a wide range of outcome measures, which may have affected the depth of analysis regarding trends in outcome measure. For example, a single study has investigated the relationship between physical exercise and alcohol on bone health status (13), while only one study focused on the positive predictors of osteoporosis diagnosis (15). These may lead to limited data and affect the strength of the relevant results.

Furthermore, the included studies were mainly conducted in urban areas, including ur-

ban community areas (11, 13-15), menopause clinics (12) and hospitals (10, 12), which may have reduced the external validity of the review, given the limited geographical diversity of the included studies.

Moreover, the plausible effects of cross-sectional studies made the study hard to measure the direction between exposure and outcome at the same time. For instance, low income is associated with poor bone health; however, poor bone health may be related to poor quality of life, with reducing job opportunities and leading to low income.

CONCLUSION

The status of osteoporosis screening and diagnosing among postmenopausal women in primary care settings in Malaysia is fair. This is due to the lack of pre-screening tools (OSTA) in the present study, which implies that current practice does not meet current guidelines. To assist this effort, involvement of primary care providers – for example, by using pre-screening tools – can help to reduce the gap of osteoporosis diagnosis. □

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