World Academy of Science, Engineering and Technology
International Journal of Medical and Health Sciences
Vol:14, No:8, 2020

Survey on Awareness, Knowledge and Practices: Managing Osteoporosis among Practitioners in a Tertiary Hospital, Malaysia

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***Abstract*—**This study evaluates the management of osteoporosis in a tertiary care government hospital in Malaysia. As the number of admitted patients having osteoporotic fractures is on the rise, osteoporotic medications are an increasing financial burden to government hospitals because they account for half of the orthopedic budget and expenditure. Comprehensive knowledge among practitioners is important to detect early and avoid this preventable disease and its serious complications. The purpose of this study is to evaluate the awareness, knowledge, and practices in managing osteoporosis among practitioners in Hospital Tengku Ampuan Rahimah (HTAR), Klang. A questionnaire from an overseas study in managing osteoporosis among primary care physicians is adapted to Malaysia's Clinical Practice Guideline of Osteoporosis 2012 (revised 2015) and international guidelines were distributed to all orthopedic practitioners in HTAR Klang (including surgeons, orthopedic medical officers), endocrinologists, rheumatologists and geriatricians. The participants were evaluated on their expertise in the diagnosis, prevention, treatment decision and medications for osteoporosis. Collected data were analyzed for all descriptive and statistical analyses as appropriate. All 45 participants responded to the questionnaire. Participants scored highest on expertise in prevention, followed by diagnosis, treatment decision and lastly, medication. Most practitioners stated that own-initiated continuing professional education from articles and books was the most effective way to update their knowledge, followed by attendance in conferences on osteoporosis. This study confirms the importance of comprehensive training and education regarding osteoporosis among tertiary care physicians and surgeons, predominantly in pharmacotherapy, to deliver wholesome care for osteoporotic patients.

***Keywords*—**Awareness, knowledge, osteoporosis, practices.

I. Introduction

OSTEOPOROSIS is a skeletal disorder defined by low bone mass, degeneration of bone tissue and disruption of bone microarchitecture which can lead to the weakening of bone and an increase in the risk of fractures [1]. Osteoporosis is known as an a symptomatic condition which remains undiagnosed until a patient is hospitalized due to a low-trauma fracture of the hip, spine, proximal humerus, pelvis, and/or wrist [2]. Osteoporosis commonly affects the hip, spine, and wrist [3]. In worldwide, osteoporosis causes 8.9 million fractures yearly and affects 200 million women and 75 million people in Europe, USA and Japan [4]. At the age of over 50, one in every two women and one in every eight men will have an osteoporosis-related fracture in their lifetime. In 1996-1997, the incidence of hip fracture over the age of 50 was 90 per 100,000 individuals per year and the average hospital costs were 6000 USD as reported by the Malaysian Osteoporosis Society and the Osteoporosis Awareness Society of Kuala Lumpur [5]. By 2050, it is estimated that the incidence of hip fractures will reach 3.25 million in Asia as the elderly population rises. The prognosis for women who have suffered a hip fracture is poor, with approximately 28% of them dying within six months and 33% dying within one year of fracture [6]. Osteoporosis occurs due to an imbalance of bone formation and bone resorption [7]. Amongst the risk factors for osteoporotic fractures are old age, female gender, inadequate calcium intake, prolonged immobilization, vitamin D deficiency, cigarette smoking, excessive alcohol and caffeine consumption, family history of fracture or genetic factors, low bone mineral density, low body mass index, certain medical conditions such as rheumatoid arthritis, use of corticosteroids, anticonvulsants, loop diuretics, and liability to falls [8].

Osteoporosis can be diagnosed with the dual-energy *x*-ray absorptiometry (DXA) scans to measure bone mineral density (BMD) at the spine and hip [9]. The treatment of osteoporosis includes both non-pharmacological and pharmacological treatment. Non-pharmacological treatment includes adequate calcium and vitamin D intake, weight-bearing exercise, smoking cessation, limitation of alcohol/caffeine consumption, and fall-prevention techniques. Pharmacological treatment, on the other hand, is categorized as either antiresorptive which includes bisphosphonates (such as alendronate, ibandronate, risedronate, zoledronic acid), estrogen agonist/antagonists (such as raloxifene), estrogens, calcitonin, and denosumab; or anabolic (such as teriparatide). Newer novel drugs to treat osteoporosis will be introduced in the near future [10].

Patients affected by osteoporotic fractures require more medical visits, some may be hospitalized and placed in a nursing home and therefore, it causes huge personal and economic burden. Comprehensive knowledge is crucial to avoid the potentially preventable disease as well as to avoid more serious complications from early detection. This study is done to assess the knowledge, awareness and the practice of orthopaedic doctors in our setting and finally, an appropriate educational program to raise their awareness and improve their practice could be developed [11]. A study done in Saudi Arabia found that the knowledge of osteoporosis risk factors was satisfactory among primary healthcare physicians but only 16% of the respondents knew and 31% of them used the national guideline. The study suggested the need to empower

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the knowledge of osteoporosis in primary healthcare physicians, especially on the pharmacotherapy [12]. Similarly, a study done in Germany found that only half of its primary care physicians knew and used the national guideline in the management of osteoporosis and suggested for proper dissemination of the guideline Another [13] study done in the United Arab Emirates reported the lack of early identification skills among the primary health physicians which compromise effective and adequate management of osteoporosis. The study emphasizes the need to address practical issues and expertise that are needed for the diagnosis and treatment of osteoporosis through interactive, case-based workshops [14]. The study suggested that comprehensive training and motivation may enhance the support between primary and secondary care to promote a fully integrated care for osteoporotic patients [14]. Besides that, a research article also reported that orthopaedic surgeons or the general practitioners do not investigate well on low trauma distal radial fractures although there is the awareness of low trauma fractures in patients over 50 years being associated with osteoporosis. Hip fracture caused by fragility is also associated with underlying osteoporosis and pharmacological treatments for osteoporosis could reduce up to 50% of subsequent fractures [15]. Another article concluded that there is a prerequisite to provide strong guidelines and to equip the knowledge of physicians with regards to the treatment of osteoporosis [16]. To further improve the management of osteoporosis, research done in Korea suggested educational programs for both patients and doctors [17]. This study is conducted to determine the awareness, knowledge, and practices in managing osteoporosis among orthopaedic surgeons, orthopaedic medical officers, endocrinologists, rheumatologists and geriatricians in HTAR Klang.

II. Materials and Method

This is a single-center cross-sectional study of orthopaedic surgeons, orthopaedic medical officers, endocrinologists, rheumatologists and geriatricians in HTAR Klang, who filled a questionnaire. The validated questionnaire was adapted from a study done in Israel in managing osteoporosis among primary care physicians [18]. The questionnaire has also been adapted to Malaysia's Clinical Practice Guideline of Osteoporosis 2012 (revised 2015) and the international guidelines. The study population includes all orthopaedic surgeons and orthopaedic medical officers, endocrinologists, rheumatologists and geriatricians currently working in HTAR, Klang. Total orthopaedic surgeons and orthopaedic medical officers currently working in HTAR are 38. Total endocrinologists, rheumatologists, and geriatricians currently working in HTAR are 7. Thus, the total sample for this survey, n = 45. The method of sampling adopted is a universal sampling. Orthopaedic surgeons and orthopaedic medical officers will be approached during orthopaedic weekly continuing medical education (CME) on Tuesday afternoon between Nov 2019 and Dec 2019. Endocrinologists, rheumatologists, and geriatricians will be approached during clinic days in the medical outpatient clinic. House officers currently under orthopaedic department rotation in HTAR, orthopaedic medical officers and surgeons working in HTAR < 6 months, masters' doctors from other hospitals currently under attachment in orthopaedic HTAR and medical officers and house officers working in departments other than orthopaedics, are excluded from this survey. A questionnaire will be distributed to collect all necessary data required for the study (Appendix I). The questionnaire includes a subject ID to avoid repetitive subjects answering the questionnaire.

Each correct answer is given one mark and incorrect or no response is given zero marks. The total score is converted into percentages ranging from 0–100. Responder's baseline information, work experience, and education level are also collected. Age and seniority of study participants were described as means and standard deviations and compared across the professional levels (orthopaedic surgeons/ orthopaedic medical officers/endocrinologists/ rheumatologists/geriatricians) using ANOVA. The test score was compared across age, seniority, gender and professional level using ANOVA. Data that will be obtained from the study will be analyzed using Excel 2016 for all descriptive and statistical analyses as appropriate. Descriptive statistics for continuous variables will be summarised as mean ± standard deviation (SD). Categorical variables will be reported as frequency (n) and percentage (%). For categorical variables, comparisons between groups will be performed using the chi-squared test.

The subject's names will be kept on a password-protected database and will be linked only with the study identification number for this research. The identification number instead of patient identifiers will be used on subject datasheets. All data will be keyed into a computer that is protected with a password. On completion of the study, data on the computer will be copied to CD and the data in the computer will be erased. The CD and the hardcopy data will be kept in a locked office of the primary investigator and kept for a minimum of three years after the study is completed. The CDs and data will then be destroyed. Subjects will not be allowed to view their study data, as the data will be consolidated into a database. Subjects can write to the investigators to request access to study findings. The investigators declare no conflict of interest. Personal information of the respondent will not be disclosed when the findings of the survey are published.

III. Results

A. Practitioners' Characteristics

All 45 practitioners who treat osteoporosis, comprising of 8 orthopaedic surgeons, 3 endocrinologists, 1 rheumatologist, 2 geriatricians, and 31 orthopaedic medical officers currently working in HTAR, filled the questionnaire. Mean ages according to professional status are presented in Table I.

The results of the questionnaire were summarized in Table II. The practitioners scored highest on expertise in prevention, followed by diagnosis, treatment decision and lastly medication.

TABLE I
PROFESSIONAL STATUS AND AGE OF PARTICIPATING PRACTITIONERS

Characteristics	All	Professional status				
		Orthopaedic surgeons	Endocrinologists	Rheumatologists	Geriatricians	Orthopaedic medical officers
No. of practitioners	45 (100%)	8 (17.8%)	3 (6.7%)	1 (2.2%)	2 (4.4%)	31 (68.9%)
Age (mean ± SD)	34.93 ± 5.65	40.0 ± 4.8	39.7 ± 3.8	45.0 ± 0	42.5 ± 3.5	32.4 ± 4.1

TABLE II
RESULTS ON THE EXPERTISE OF PRACTITIONERS ON THE DIAGNOSIS AND TREATMENT OF OSTEOPOROSIS (N = 45)

	Item	Correct responses, n	% of correct responses out of total survey participants
Diagnosis	Diagnostic tests	18	40.0
	Treatment initiation	10	22.2
	Fracture correlates	35	77.8
	Clinical fracture risk factors	2	4.4
Prevention	Vitamin D & Calcium	21	46.7
Treatment decision	Treatment goal, 66 y/o	20	44.4
	Recommendation, 54 y/o	10	22.2
	Treatment duration	15	33.3
Medications	Mechanism of action	23	51.1
	DXA in Osteoporosis	4	8.9
	Atypical fracture	38	84.4
	Side effects	0	0.0
	Contraindications	9	20.0

B. Osteoporosis Diagnosis

The first four questions studied the knowledge of practitioners in diagnosing osteoporosis. The first question was 'Which test should be performed on a 60-year-old asymptomatic woman before determining the need for medical treatment of osteoporosis?' 18 practitioners (40%) chose the correct answer of (A) blood test: levels of calcium, phosphorus, albumin, creatinine, blood count; (B) bone density scan using DXA and (E) medical history and physical examination. For the second question, 'Which patients should commence treatment without further testing to confirm the diagnosis of osteoporosis? 10 practitioners (22.2%) correctly chose the answer of (B) a 76-year-old male with an inter-trochanteric fracture in the hip caused by falling from a standing height after tripping on the carpet in his home and (D) a 74-year-old female with a sub-capital hip fracture caused by a fall in the garden while weeding. To the third question, 'What are the clinical factors associated with increased risk of osteoporotic fractures?', 35 practitioners (77.8%) correctly chose all the 5 options, which is (A) over the age of 65, (B) female gender, (C) presently smoking, (D) a family history of femoral fractures and (E) present alcohol consumption of more than three servings per day. The fourth question examined the clinical condition which increases the risk for osteoporotic fractures. Only 2 practitioners (4.4%) correctly chose the correct answer of (A) chronic oral glucocorticoid treatment of more than 3 consecutive months, (B) rheumatoid arthritis, (C) Type 2 diabetes, (E) Type 1 diabetes, (F) overactive thyroid gland and (I) primary hyperparathyroidism.

C. Osteoporosis Prevention

Question 5 scrutinized the awareness of practitioners on osteoporosis prevention, which tested them on the recommended dosage of Calcium and Vitamin D supplement for postmenopausal women. 21 practitioners (46.7%) correctly answered (E) 800 units of Vitamin D and 1000mg of Calcium.

D. Osteoporosis Treatment Decision

Subsequently, the next three questions assessed the practice in their treatment decisions. Question 6 reads as 'What is the therapeutic goal for a 66-year-old patient diagnosed with osteoporosis and treated with alendronate and calcium 600 mg/day?' 20 practitioners (44.4%) chose the correct answer of (B) which is reducing the risk of fracture by 25% to 50% in the various skeletal sites. A total of 10 practitioners (22.2%) agreed with the answer for question 7 that treatment should remain unchanged for a 54-year-old female with severe menopausal symptoms, currently on estradiol and norethisterone for a year whose quality of life has significantly improved and the BMD T-SCORE was -3 SD for spinal vertebrae and -2.4 SD for hip bone. For question 8 on the maximum treatment duration with various bisphosphonates for which fracture risk reduction efficacy was demonstrated in postmenopausal women, 15 practitioners (33.3%) correctly chose (B) which is three to five years.

E. Osteoporosis Medication

The next five questions studied the expertise of practitioners in the pharmacotherapy. Question 9 requires the practitioners to identify the mechanism of action either as an anti-resorbing agent or as an anabolic agent. Collectively, 23 practitioners (51.1%) answered all the medications correctly, Individually, the proportions of practitioners answered correctly were 40 practitioners (88%) for alendronate, 28 practitioners (62%) for raloxifene, 36 practitioners (80%) for teriparatide, 35 practitioners (78%) for risedronate, 33 practitioners (73%) for denosumab and 38 practitioners (84%) for zoledronate, with all listed medications being anti-resorbing agent except teriparatide being an anabolic agent. Question 10 evaluates the

expertise of practitioners on a follow-up of a patient with osteoporosis using the BMD test with DXA and only 4 practitioners (8.9%) chose the correct option of (E) which is none of the above. Question 11 requires the practitioners to characterize an atypical fracture of the hip and 38 practitioners (84.4%) answered correctly (C) which is a fracture in the femoral shaft in a sub-trochanteric site linked with long term use of bisphosphonates. For question 11, none of the practitioners correctly identified the possible side effects of all the six medications listed. For alendronate, no practitioners correctly identified the side effects of musculoskeletal pain, upper gastrointestinal bleed, epigastric pain, and heartburn and esophagitis. 17 practitioners (38%) answered correctly for raloxifene whose side effects included venous thromboembolism event and aggravation of menopausal symptoms. 7 practitioners (15%) answered correctly for teriparatide's side effect which included hypercalcemia. None of the practitioners correctly identified the side effects of risedronate which were the same answer as alendronate. 1 practitioner (2%) correctly identified the side effect of denosumab as hypocalcemia and erysipelas. Lastly, 1 practitioner (2%) correctly identified the side effects of zoledronate as musculoskeletal pain and muscle pain, flu-like symptoms. The final question tested the knowledge of the practitioners on the contraindication in which 9 practitioners (20%) correctly chose the medication alendronate, risedronate and zoledronate not to be administered to an osteoporotic patient with an eGFR of less than 30 mL/min.

F. Sources of Knowledge

Practitioners who answered the questionnaire rated that by reading professional literature and self-education is the most effective source of knowledge in the approach to diagnose and treat osteoporosis, followed by attending expert lectures at continuing education seminars and conferences, consultation with peers, discussion with representatives of pharmaceutical companies at exhibitions and conferences, clinical experience, knowledge from medical school and finally the observing press and television. The majority of the practitioners (33.3%) responded that they had attended an update lecture on osteoporosis between 2 to 5 years ago.

TABLE III
PERCENTAGE OF RESPONDERS ATTENDING LAST LECTURE ON OSTEOPOROSIS

Time from last lecture on osteoporosis	n (% of responders)
0-3 months	3 (6.7%)
3-6 months	3 (6.7%)
6-12 months	5 (11.1%)
12-24 months	10 (22.2%)
2-5 years	15 (33.3%)
Over 5 years	9 (20%)

G. Mean Test Score and Practitioner Characteristics

None of the practitioners rated their level of knowledge to be high. A total of 19 practitioners rated their level of knowledge to be adequate for providing effective, quality care for patients, and achieved a mean test score of 64.3%. 26 practitioners rated that their level of knowledge on osteoporosis to be low and achieved a mean test score of 62%. However, the difference between the mean test score was not statistically significant ($p = 0.47$).

No statistically significant differences were found in the mean test score between practitioners less than 30 years old and 30 years old and above ($p = 0.089$). The mean test score for practitioners less than 30 years old was 58.5% and 64.6% for practitioners 30 years old and above.

Practitioners performed better as the years of practice increased. Practitioners reporting less than 5 years of practice scored 61.5%, 5-10 years of practice scored 62.3% and above 10 years of practice scored 69%. However, the results were not statistically significant ($p = 0.25$).

According to professional status, specialists demonstrated better overall knowledge with a mean test score of 69.5% and medical officers scoring a mean test score of 60.1%. The mean test score was statistically significant between the two groups ($p = 0.005$).

Rheumatologist scored the highest mean score of 79.2%, followed by endocrinologists scoring 72.2%, orthopaedic surgeons and geriatricians scoring 67.7% respectively and finally orthopaedic medical officers scoring 60.1%.

Constraint to Optimal Care

Practitioners reported that the lack of effective and fact-based means for assessing the risk of fractures in patients as the most significant factors limiting optimal care for patients with osteoporosis, followed by patients' financial hardships, which limit their ability to purchase medication, followed by inadequate knowledge in the field, lack of consistent compliance by patients, bureaucratic difficulties, lack of physician-patient time, side effects of presently administered medication and the least on the lack of trust in the efficacy of the products for the treatment of osteoporosis.

Majority of the practitioners (40%) reported self-education from articles and books as the most effective way to update their knowledge about osteoporosis in the future, followed by attending conferences for family physicians on osteoporosis (35.6%), adding the topic to physicians' in-service seminars (13.3%), discussion and presentations of cases to specialists in the field (6.7%) and lastly on using a dedicated online tutorial for practitioners that grand study credits (4.4%).

IV. DISCUSSION

Several studies that had been done previously found that there was insufficient knowledge amongst practitioners in managing osteoporotic patients [18]. Osteoporosis, which can lead to bone fracture in postmenopausal women, can be prevented earlier by a proper diagnostic test [19].

In the first part of the questionnaire, we evaluated the practitioners' knowledge on the diagnosis of osteoporosis. We found that practitioners achieved the highest score (77.8%) in factors associated with increased risk of osteoporotic fractures which include the female gender, age of 65 years and above, smoker, excessive alcohol intake and familial history of femoral fracture. Pisani et al. reported that early recognition and referral for therapy is the mainstay to reduce the impact of

osteoporosis on public health burden [20]. On the contrary, practitioners (4.4%) scored poorly in the co-morbidities associated with increased risk of osteoporosis such as diabetes, rheumatoid arthritis, primary hyperthyroidism, and chronic oral glucocorticoid treatment. These secondary factors should be identified early as they may augment the risk of fragility fracture [21]. Our study also found that only 40% of the practitioners were aware of the diagnostic tests which should be carried out before deciding on the pharmacotherapy for osteoporosis. These included blood tests on levels of calcium, phosphorus, albumin, creatinine and blood count, bone density scan using DXA and medical history and physical examination. There were 14 practitioners (31%) who responded that x-ray of thoracic and lumbar vertebrae was required which were not mandatory as stated in Malaysia's Clinical Practice Guideline on Management of Osteoporosis 2012 (revised 2015). The local guideline has also suggested that osteoporosis is a presumptive diagnosis and treatment should be initiated with or without BMD measurement with DXA if a patient presented with a low trauma fracture [22]. Our study found that only 8 practitioners (22%) gave the correct response with regards to this. A study done by Chami et al. found that general physicians and surgeons were aware that patients over 50 years old with low trauma fracture require investigation for osteoporosis but a huge proportion of patients with osteoporotic fractures were not being offered on the advantages of secondary prevention [15].

In the second part of the questionnaire, we evaluated the awareness of practitioners on the prevention of osteoporosis. Calcium and vitamin D are two elemental nutrients fundamental in maintaining and supporting bone health. The local guideline suggested for a supplement of 800 units of vitamin D and 1000 mg of calcium for optimal postmenopausal patient care [22]. 46.7% practitioners responded correctly in the recommended dosage. This is supported by Bischoff-Ferrari et al. and Cumming and Nevitt which reported that vitamin D of 700-800 units per day and 1000 mg elemental calcium per day can reduce 26% hip fracture and 30% fracture risk respectively and its continuous use is recommended for optimal fracture risk reduction [23]-[25].

In the subsequent part of the questionnaire, we evaluate the practice of practitioners in terms of their treatment decision. 44% of practitioners were familiar with the local guideline which stated the goal of alendronate is to reduce the risk of fracture by 25% to 50% in the various skeletal sites. This is also supported by Cummings et al. who reported that alendronate reduced clinical fractures by 36% in women with baseline osteoporosis at the femoral neck > 2.5 SDs below the normal young adult mean and decreased the risk of radiographic vertebral fractures by 44% overall [26]. Our findings also showed that only 22% of practitioners agreed to continue treatment unchanged for a 54-year old post-menopausal patient who had been taking hormone therapy for one year, with significant improvement in her quality of life, despite T-SCORE for spinal vertebra of -3 SD and hip bone -2.4 SD. A study by Utian and Woods found that hormone therapy provides a substantial benefit for menopause specific quality of life in midlife women through relief of symptoms and also a global increase in sense of well-being [27]. Cook reported that all 13 relevant studies on estradiol which were reviewed have demonstrated efficacy at increasing BMD with 3 to 5 years of follow-up [28]. 33% of the practitioners agreed that the maximum treatment duration of various bisphosphonates for which fracture risk reduction efficacy was demonstrated in postmenopausal women is three to five years. Villa supported that drug holiday should be initiated after 3–5 years of bisphosphonate treatment in patients with low risk and moderate risk, with a recommended bone health reevaluation every 1–3 years [29]. Our study found that practitioners did not score well in the treatment decision as reported by another survey done in the United States, which found that physicians overestimated the 5-yr hip fracture risk by a factor of 10 or more but was accurate in their estimates of lifetime fracture risk. The study reported that 36–45% of the physicians who suggested treatment for patients whose history and BMD does not require treatment according to local guideline [30].

Practitioners responded poorly in the final part of the questionnaire regarding osteoporotic medication. 51% of practitioners were able to identify bisphosphonates, selective estrogen receptor modulator (SERM) and monoclonal antibody as an anti-resorbing agent and recombinant human parathyroid hormone as an anabolic agent. None of the practitioners were able to correctly identify the side effects of the osteoporotic medication and only 20% of the practitioners were aware of the contraindication of osteoporotic medication. The result of our study was supported by two studies done in Israel whereby the level of knowledge among physicians' knowledge was comparatively low with regards to the adequate dosage of several medications. The need for clear guidelines to improve practitioners' knowledge with regards to the pharmacotherapy of osteoporosis was also supported [18], [31]. Another study done by Berhe reported that insufficient medication knowledge was observed among healthcare professionals and this may be explained by a lack of adequate drug information resources and up-to-date reference books [32]. The lack of knowledge of practitioners on the side effects of osteoporotic medications may also be due to the rare side effects experienced. In a study by Saqib et al., practitioners found that the presence of pharmacist to be mandatory as they were equipped with the medicine-related information, vital for educating patients as well as to help doctors by clarifying any medicine-related issues [33].

Most practitioners (33.3%) responded that they have attended updates in osteoporosis lectures 2 to 5 years ago in which it can be related to the poor awareness and knowledge in osteoporosis management. Professional literature and self-education were rated as the most effective source of knowledge in the approach. Practitioners are encouraged to be acquainted with the recommendations provided in local clinical practice guidelines. A study done by Chenot et al. reported that only 50% of their surveyed respondents reported familiarity with the most recent osteoporosis guidelines [13].

62% of practitioners rated that they have poor knowledge in providing optimal care for osteoporotic patients which is consistent with the study done by Fogelman et al. [18]. Our study found that specialists demonstrated better overall knowledge (69.5%) as compared to medical officers (60.1%). This result is in line with the year of practice in which practitioners who practiced more than 10 years scored better (69%).

In this study, the main constraints to optimal care for patients reported by practitioners are the lack of effective and fact-based means for assessing the risk of fractures in patients. In comparison to a study done in Israel, the surveyed physicians reported that lack of consistent compliance by patients and lack of knowledge of physicians as the most significant factor limiting optimal care for patients [18]. Another study done by Malochet et al. found that cost and authorizations of diagnosis and treatment are the factors that limit the optimal care [34].

In conclusion, our study found that there is a lack of knowledge and awareness amongst HTAR practitioners involved in the management of osteoporosis, predominantly in terms of treatment decision and medication. Our findings suggest that efforts should be done to target osteoporosis by addressing the issues faced by practitioners such as the availability of effective and fact-based means for risk estimation. Every practitioner regardless of subspecialties should be equipped with evidence-based medicine knowledge, attitude, and skill which is imperative for patient education and optimal care.

APPENDIX I (QUESTIONNAIRE)

Subject ID: ……..

Approach to Diagnosis and Treatment of Osteoporosis – A Questionnaire

The World Health Organization lists Osteoporosis among the ten most significant diseases. Osteoporosis causes a decline in quality of life, greater morbidity, and a rise in mortality and high financial costs to the health system, mainly in the treatment of osteoporotic fractures. This questionnaire is designed to assess your approach to the diagnosis and treatment of osteoporosis.

1. What are the tests you would perform for a 60-year-old asymptomatic female patient before deciding on the need for osteoporotic pharmacotherapy? (You may choose more than one answer.)

A. Blood tests: levels of calcium, phosphorus, albumin, creatinine, blood count.
B. Bone density scan using DXA
C. Ultrasound bone density scan, the device is available for use at a nearby private clinic
D. X-ray of thoracic and lumbar vertebrae
E. Medical history and physical examination
F. Bone scan

2. For which of the following patients would you start treatment **without further testing for confirming diagnosis of osteoporosis**? (You may choose more than one answer.)

A. A 45 year-old female patient, generally healthy, regular menstrual cycle with TSCORE -2.9 in the spinal vertebra.
B. A 76 year-old male with an inter-trochanteric fracture in the hip caused by falling from a standing height after tripping on the carpet in his home .
C. A 68 year-old female, generally healthy, with a collapsed L4-vertebra after falling from a meter-high rock while hiking.

3. A 74 year-old female with a sub-capital hip fracture caused by a fall in the garden while weeding
What are the clinical factors associated with increased risk of osteoporotic fractures? (You may choose more than one answer.)

A. Over the age of 65
B. Female
C. Presently smoking
D. A parental history of femoral fractures
E. Present alcohol consumption of more than three servings per day

4. What are the clinical conditions that increase the risk for osteoporotic fractures? (You may choose more than one answer) –

A. Chronic oral glucocorticoid treatment (taken for more than 3 consecutive months)
B. Rheumatoid arthritis
A. Type 2 diabetes
B. Under-active thyroid gland
C. Type 1 diabetes
D. Overactive thyroid gland
E. Glucocorticoid treatment at a dosage of 40 mg with gradual reduction over the course of a week due to urticaria
F. Ischemic heart disease
G. Primary hyperparathyroidism

5. What is the recommended dosage of calcium and vitamin D supplement for postmenopausal women? (ONE correct answer only)

A. 200 units of vitamin D, 600mg calcium
B. 400 units of vitamin D, 1200mg calcium
C. 600 units of vitamin D, 1000mg calcium
D. 800 units of vitamin D, 600 mg calcium
E. 800 units of vitamin D, 1000 mg calcium

6. What is the **therapeutic goal** for a 66 year-old patient diagnosed with osteoporosis and treated with FOSAMAX PLUS and calcium 600 mg/day?

A. Increasing the bone density in spinal vertebra by at least 2% in two years
B. Reducing the risk of fracture by 25% to 50% in the various skeletal sites
C. Increasing bone density by 5% or more in the femoral shaft, within two years.
D. Increasing bone density by 6% within 5 years, in spinal vertebra.

7. A 54 year-old female with severe menopausal symptoms, has been taking hormone treatment, estradiol +

norethisterone (ACTIVELLE) for one year, which has greatly improved her quality of life. The patient took a bone density test as part of her periodic check-ups: T-SCORE for spinal vertebra:- 3 SD, and hip bone: -2.4 SD. She does not take additional medication, except for calcium 600 mg/day, and 1000 IU of vitamin D per day. Laboratory evaluation is within normal range. What is your recommendation? (ONE correct answer only)

A. Add FOSAMAX 70 mg /week to ACTIVELLE
B. Stop ACTIVELLE treatment and begin treatment with EVISTA (RALOXIFEN)
C. Continue treatment unchanged
D. Add treatment with ACTONEL (RISEDRONATE) 150 mg/month to the ACTIVELLE treatment
E. Add treatment with ACLASTA (ZOLEDRONATE) by intravenous administration once a year
F. Stop ACTIVELLE treatment and begin treatment with FOSAMAX 70 mg/week

8. The maximum treatment duration with various bisphosphonates for which fracture risk reduction efficacy was demonstrated in postmenopausal women is:

A. Two years
B. Three to five years
C. Unlimited duration of treatment
D. The period of time required for an increase in bone density of at least 6% in spinal vertebra
E. Duration can range from two to ten years, depending on the type of bisphosphonates administered.

9. Below is a list of medications used to treat osteoporosis in Malaysia. These drugs have different mechanisms of action.
If the drug is an anti-resorbing agent, mark a **1** beside it. If the drug is an anabolic agent, mark **2** beside it.

A. ALENDRONATE (FOSAMAX)
B. EVISTA (RALOXIFEN)
C. FORTEO (TERIPARATIDE)
D. ACTONEL (RISEDRONATE)
E. PROLIA (DENOSUMAB)
F. ACLASTA (ZOLEDRONATE)

10. What is true about the **follow-up** for a patient with osteoporosis, using a bone mineral density test with DXA (ONE correct answer only)

A. The test is the most effective means for evaluating the response to pharmacotherapy at the individual level
B. This test is recommended annually for patients with severe osteoporosis, such as patients with a collapsed lumbar vertebra who are taking medication
C. This test is recommended once every two years for osteoporosis patients during treatment, to assess response to the treatment and recovery from the disease
D. If a decrease in bone density by 2% or more is observed, the medication needs to be adjusted
E. None of the above

11. What characterizes an ATYPICAL FRACTURE of the hip? (ONE correct answer only)

A. An osteoporotic fracture that occurs in the femur under the trochanter
B. A fracture that appears in a sub-trochanteric site in the FEMORAL SHAFT while a patient is being treated with TERIPARATIDE (FORTEO)
C. A fracture in the FEMORAL SHAFT in a sub-trochanteric site associated with prolonged use of bisphosphonates
D. A hard-to-heal osteoporotic fracture

12. The following is a list of medications used in treating osteoporosis and beneath it is a list of possible complications associated with the treatment. Please match the common complication to the medication that may trigger it (more than one complication per medication is possible).

A. FOSAMAX (ALENDRONATE)
B. EVISTA (RALOXIFEN)
C. FORTEO (TERIPARATIDE)
D. ACTONEL (RISEDRONATE)
E. PROLIA (DENOSUMAB)
F. ACLASTA (ZOLEDRONATE)

1. Venous thromboembolism event
2. Hypocalcemia
3. Musculoskeletal pain
4. Upper gastrointestinal bleeding
5. Epigastric pain and heartburn
6. Esophagitis
7. Erysipelas
8. Muscle pain, flu-like symptoms
9. Hypercalcemia
10. Aggravation of menopausal symptoms

13. Which of the following medications **should not** be administered to an osteoporosis patient with eGFR <30? (There may be more than one correct answer)

A. FOSAMAX (ALENDRONATE)
B. EVISTA (RALOXIFEN)
C. FORTEO (TERIPARATIDE)
D. ACTONEL (RISEDRONATE)
E. PROLIA (DENOSUMAB)
F. ACLASTA (ZOLEDRONATE)

14. Rate your sources of knowledge regarding the approach to diagnosis and treatment of osteoporosis from 1-5, with 5 being the most significant source and 1 the least significant.

	1	2	3	4	5
A. Medical school					
B. Clinical experience					
C. Professional literature and self-education					
D. Consultations with peers					
E. Representatives of pharmaceutical companies at exhibitions and conferences					
F. Expert lectures at continuing education seminars and conferences					
G. The press, television					
H. Other_____					

15. When was the last time you attended an update lecture on osteoporosis:

A. 0-3 months ago

B. 3-6 months ago
C. 6-12 months ago
D. 12-24 months ago
E. 2-5 years ago
F. 5 years ago or more

16. You consider your level of knowledge on osteoporosis to be (circle the correct answer.):

A. High
B. Adequate for providing effective, quality care for patients
C. Low

17. In the table below, please rate the factors, from 1 to 5, that limit your ability to provide optimal care for your patients with osteoporosis, with 5 being the most limiting factor and 1 having the least influence.

	1	2	3	4	5
Lack of effective and fact-based means for assessing risk of fractures in patients					
Lack of physician-patient time					
Inadequate knowledge in the field					
Bureaucratic difficulties					
Side effects of presently administered medication					
Lack of consistent compliance by patients					
Patients' financial hardships, which limit their ability to purchase medication					
Lack of trust in the efficacy of the products for treatment of osteoporosis					

18. What in your opinion is the most effective way for you to update your knowledge about osteoporosis in the future?

A. Attending conferences for family physicians on the topic
B. Self-education from articles and books
C. Using a dedicated online tutorial for family physicians that grants study credits
D. Adding the topic to physicians' in-service seminars every 3, 6, 12 months (Circle the most appropriate frequency).
E. Discussion and presentations of cases to specialists in the field

Personal Details:

- Age: _____
- Gender: Male / Female
- Specialization:

a) Orthopaedic surgeon
b) Orthopaedic medical officer
c) Endocrinologist
d) Rheumatologist
e) Geriatrician

- The number of years engaged in medical practice _____

Thank you very much for your participation. ☺

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