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ORIGINAL ARTICLE

Management of osteoporosis in the Middle East and North Africa: a survey of physicians' perceptions and practices

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Abstract

Summary We surveyed 573 physicians in the Middle East regarding osteoporosis management. Sixty percent had access to, but were not in charge of, densitometry reporting. Screening for secondary causes was common; 62% were aware of FRAX®; less than half used it. Medications were accessible, and most participants had concerns regarding bisphosphonates. Barriers to care were identified.

Introduction The 2011 IOF Middle East Osteoporosis Audit highlighted major care gaps in osteoporosis care in the Middle East and North Africa (MENA) region. We investigated osteoporosis management practice patterns in this region.

Methods We mailed an electronic survey to a convenience sample of physicians, explaining the study rationale and methods. It gathered information on physicians' profiles, availability and utilization of resources, risk assessment, and management.

Results Five hundred seventy-three responses were obtained from the United Arab Emirates (UAE, 36%), Saudi Arabia (KSA, 25%), Lebanon (14%), and others (25%). Endocrinology was the single most represented specialty. Sixty percent of participants had access to densitometers, but treating physicians were not in charge of densitometry reading. Screening for vitamin D deficiency and secondary contributors to osteoporosis was frequently implemented. Although two-thirds of professionals were aware of FRAX®, only 42% used it, either because of lack of know how or of a country specific calculator. Almost all (96.0%) had access to oral and 68.9% to intravenous bisphosphonates, and over half to teriparatide (46.4%) and denosumab (45.0%). Most participants (92%) were aware of concerns regarding side effects of bisphosphonates, and this changed the management in the majority (73%). Important barriers to osteoporosis care were lack of osteoporosis awareness among physicians, patients, and cost of treatment.

Conclusions This first look at physicians' practice patterns on the diagnosis and treatment of osteoporosis in the MENA region underscores the pressing need for an official call for action, at all levels, to address this large care gap.

Keywords Osteoporosis · FRAX · MENA region · Bone health · Physicians' practices · Care gap

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Introduction

With improved health care, urbanization, sedentary lifestyle, and increased longevity, osteoporosis (OP) disease burden will constitute a large proportion of the growing list of non-communicable diseases (NCDs) in the Middle East and North Africa (MENA) region [1]. In 2011, the Middle East Osteoporosis Africa IOF audit provided a comprehensive assessment of the status of osteoporosis in the region. It underscored the lack of national databases, registries, and cohorts and identified gaps in resources, knowledge, and care [2]. Osteoporosis is an orphan condition being claimed by different specialties in different countries, and despite the large incurred disease burden, it is not on the classic list of NCDs. It therefore remains un-recognized as a national health care priority in many countries globally, and in the region [2, 3], and puts affected patients at even greater risk of late recognition, suboptimal management, and poorer outcomes [4, 5].

The diagnosis of osteoporosis, fracture risk assessment, and management relies primarily on the presence of fragility fractures, bone mineral density (BMD) measurements, and personal risk factors [6]. However, this diagnostic process is hindered in many Middle East and North Africa (MENA) countries in light of the scarcity of BMD devices and costs [2]. Only two countries, the United Arab Emirates (UAE) and Lebanon, met the IOF recommendation for number of devices available per capita [2]. The fracture risk assessment tool (FRAX®), developed by the WHO Sheffield group, predicts the 10-year probability of osteoporotic fracture based on either risk factors alone or in combination with a femoral BMD [7]. This risk calculator has the added advantages of ability to be calibrated to country-specific epidemiology of hip fractures and longevity. The paradoxical vitamin D deficiency in the MENA region, despite abundant sunshine almost all year round, highlighted the need for evaluation of vitamin D deficiency and replacement [8–10] Furthermore, concerns regarding the long-term use of bisphosphonates has resulted in a substantial decrease in their use in western populations [11]. How widely these issues are recognized and how well they are addressed in the MENA region is unclear.

The specific objectives of this survey conducted in the region to (1) identify current attitudes and management practices of physicians in the MENA region with regard to osteoporosis, (2) gain insight into the perceptions among these physicians on the applicability and current utilization of FRAX® in their practice, (3) assess the medical resources available to the practicing physician involved in osteoporosis care, and (4) identify the unmet needs in osteoporosis care and barriers to osteoporosis identification and treatment.

Materials and methods

Survey design

The study is based on web-based survey of a pooled data base of physicians in the MENA region conducted over the period of April 2015 to November 2016. Targeted respondents consisted of database of attendees to major national and regional endocrine and osteoporosis meetings. The commercial survey service (Survey Monkey, Palo Alto, CA, USA) was employed. All target study population received an initial e-mail and four subsequent reminders at weeks interval. A unique e-mail-specific electronic link to the survey questionnaire was provided. Repeat submissions from the same link were automatically blocked by the survey server. Survey responses were anonymously collected, stored electronically, and analyzed at the end of the study.

Study population

The MENA region is a well-recognized geopolitical and economic entity that includes 22 countries and comprises 6% of the world population. There is no single master database for all endocrinologists. A large convenience sample included practicing physicians who were identified on academic databases of health-related bodies, professional groups, and recent continuous professional development events (or e.g., AACE Gulf Chapter annual meetings), and/or by virtue of their contribution to the medical literature in the subject, mostly endocrinologists and internists with special interest in endocrinology. In Lebanon, updated mailing lists of members of concerned societies, members of the Lebanese Society of Osteoporosis and Metabolic Bone Disorders (OSTEOS), were accessed (endocrinologists, rheumatologist, internists, gynecologists, and radiologists). In Saudi Arabia, the emails were specifically sent to all individuals associated with the Saudi Endocrine Society. Due to the heterogeneity of the pool, respondents were asked to identify themselves in terms of specialties, age group, duration, and volume of practice (Table 1), to enable characterization of demographic and professional profiles similar to previously published surveys-based studies from the region [12, 13]. Only respondents practicing in the MENA region were included in the analysis. No data could be captured on the non-responders. A total of 616 responses were received; with an estimated response rate of 10% based on the total number from the combined email invitation list.

The survey questionnaire

The questionnaire was addressed to medical doctors and formulated de novo based on the objectives of the study although several questions were inspired by questionnaires used in two previous studies with similar objectives [14, 15]. These

Table 1 The five domains of the survey and their corresponding questions

1. Demography and professional profile: Q1-Q9	Confirmation of eligibility, an electronic consent, country of practice, gender and age group. Specialty, professional grade, type, nature and locality of practice
2. Profile of respondents clinical practice Q10-Q13	Existence of national osteoporosis management guidelines? Do you see and treat patients with osteoporosis? How many patients with osteoporosis do you currently see and treat per month? Who is the typical osteoporotic patient you see?
3. Resource availability and utilization Q14-Q19	Do you assess bone density in your patients? What kind of densitometry device do you have access to in your clinical practice? Who does the reporting of bone densitometry in your practice? If the reporting of bone densitometry is done by a physician other than yourself, do you look at the scan/printout and confirm the reporting physician's findings?
4. Risk assessment and screening for secondary osteoporosis Q20-Q29	Do you classify your patients with osteoporosis into risk groups? Have you heard of FRAX ® prior to today? Do you use FRAX ® in your practice? If you have heard of FRAX ® but do not use it in your practice, what is the main reason you do not use it? If your country has osteoporosis treatment guidelines, has FRAX ® been incorporated into the guidelines? Do you screen for vitamin D sufficiency status in your patients with osteoporosis and fragility fractures? Do you routinely obtain blood tests before initiating treatment with anti-osteoporosis agents in your patients? If you do not obtain blood tests, what is the reason?
5. Management and barrier to osteoporosis care Q30-Q34	What medications are available in your country for the treatment of osteoporosis? Are you aware of concerns about side effects associated with bisphosphonate use? If you are aware of the recent concerns about side effects associated with bisphosphonate use, has this awareness changed your management practice? If your practice with regard to prescribing bisphosphonates has changed, how has it changed? What do you perceive as the biggest barrier to osteoporosis care in your practice/country?

The full version of the survey is available online [Appendix 1]

questions were adapted to suit regional circumstances and to address additional contemporary concerns. The questionnaire was user-friendly, with a simple format and clear instructions. It prevented any deviations from the response options that were predefined for each question by using a multiple-choices format with occasional extra options for comments to be added when needed. The questionnaire was beta-tested by 12 endocrinologists prior to launch. It included 34 questions about the physicians' attitude to current issues and the barriers to osteoporosis management in the following five domains (demography and professional profile, practice profile, resources availability and utilization, risk assessment and screening for secondary osteoporosis, and management and barrier to osteoporosis care in the practice/country; (see Table 1). The survey was conducted in English being the language used in most professional communications in the region (see Appendix 1 for full details on survey questions). The use of common questions between the current survey and the previous two [14, 15] allowed for comparisons on practice patterns across regions.

Analysis

The results are expressed in actual numbers as a proportion of total responses per a given question or adjusted as percentages to account for differences of responses between questions. For comparisons of proportions between groups, we used the chi-square test, and the online calculator of the Southwestern Adventist University (http://turner.faculty.swau.edu) was used for all analyses. P value < 0.05 was considered statistically significant. Country-wise subgroup analyses of practice were explored using data from three countries contributing the largest numbers of respondents namely United Arab Emirates, Saudi Arabia, and Lebanon [see Supplementary Material (Appendix 2)] for intra-regional variations. We also compared our results with the two previously published surveys from Korea and Asia [14, 15] [see Supplementary Material (Appendix 3)] for inter-regional variations.

Results

Demographics of respondents

Out of 616 responses received, 573 met the entry criteria (viz. medically qualified, agreeing to participate in the survey, residing/practicing in the MENA region and provided meaningful responses to the clinical questions). The countries with the largest number of respondents were United Arab Emirates (36.2%), Saudi Arabia (25%), and Lebanon (13.6%). The gender distribution showed more males marginally, one-third of respondents were 31–40 years, and almost two-thirds were 41–60 years (Table 2).

Professional and practice profiles

These are detailed in Tables 2 and 3. Nearly one-third were endocrinologists, whereas primary care/family medicine and internal medicine specialists represented around 20% each. Over half were consultants and 29% were sub-consultant specialists/fellows. The type of clinical practices were university or teaching hospitals (57.6%), district or community hospitals (20.2%), or private practice (15.3%). The majority were treating physicians and most worked in large city-based practices. Existence of osteoporosis management guidelines was reported by 48.7% of

Table 2 Demographic and professional profiles of respondents and clinical practice characteristics

Characteristic (N responders)	Response options	Number[a]	Per cent (%)[a]
A. Demographic characteristics			
Country of residence/practice (572)	United Arab Emirates	207	36.2%
	Saudi Arabia	143	25.0%
	Lebanon	78	13.6%
	Rest of Gulf + Iraq	69	12.1%
	North Africa	50	8.7%
	Pakistan and Iran	20	3.5%
Age (years) (571)	20–40	168	32.5%
	41–50	190	33.3%
	51–60	141	24.7%
	Above 60	54	9.5%
Gender (571)	Male:Female	332:239	58%:42%
Locality of practice (572)	Small town	54	9.4%
	Large city	518	90.6%
B. Professional profiles of respondents			
Type of profession (570)	Treating/non-treating HCP	534/36	93.7%/6.3%
Type of clinical practice (569)	Teaching hospital	328	57.6%
	Community hospital	115	20.2%
	Private practice	87	15.3%
	Research- based	10	1.8%
	Primary care	24	4.2%
	Other	5	0.9%
Clinical specialty (570)	Endocrinology	180	31.6%
	Family practice	116	20.4%
	General IM	68	11.9%
	IM + endocrine interest	44	7.7%
	Gynecology	33	5.8%
	Specialist IM	31	5.4%
	Rheumatology	27	4.7%
	Orthopedics	17	2.3%
	Physical medicine	9	1.6%
	Others	45	7.8.%
Professional grade (570)	Consultant	313	54.9%
	Specialist/fellow	165	29.0%
	Resident	46	8.1%
	Other grades	46	8.1%
C. Clinical practice characteristics:			
Do you treat osteoporosis? (564)	Yes	466	82.6%
	No	98	17.4%
Number of osteoporotic patients seen per month (466)	Less than 10	261	56.3%
	10–20	129	27.8%
	21–50	46	9.9%
	51–100	21	4.5%
	More than 100	7	1.5%
Type of patients seen (460)	Referred for DXA	28	6.1%
	Already diagnosed	135	29.4%
	New fragility fracture	26	5.7%
	All of the above	271	58.9%
Does your country have osteoporosis management guidelines? (571)	Yes	278	48.7%
	No	174	25.7%
	Not sure	146	25.6%
If you have osteoporosis guidelines; has FRAX® been incorporated in it (481)	Yes	132	24.7%
	No	93	19.3%
	Do not know	256	53.2%

[a] Responses are expressed as absolute numbers as well as adjusted percentages (calculated per individual questions). *HCP*, health care professional; *IM*, internal medicine; *DXA*, dual-energy X-ray absorptiometry

respondents in their respective countries. 82.6% of respondents managed patients with osteoporosis: over half of respondents treated less than 10 patients a month, 5% between 50 and 100, and only 1.5% would see more than 100 patients a month. One-third of their patients were described as already being diagnosed with osteopenia or osteoporosis (1/3); a minority were referred from primary care for DXA screening, or had a new fragility fracture, whereas a combination of all of these was identified by over half of respondents.

Table 3 Utilization of densitometry and FRAX® for risk assessment and management of osteoporosis

Characteristic (responders)	Details of answer options	Number[a]	Percent[a]
Do you classify your patients with osteoporosis into risk groups? (526)	Yes	416	79.1
	No	110	29.9
Do you assess bone density in your patients? (535)	Yes	441	82.4
	No	94	18.6
Who does the reporting of bone densitometry in your practice? (527)	Myself	96	18.2
	Another physician	449	85.2
Specialty of who reports bone densitometry in your practice? (530)	Radiologist	441	83.2
	Endocrinologist	76	14.3
	Rheumatologist	65	12.3
	Clinical physicist	30	5.7
Have you heard of FRAX® prior to today? (532)	Yes	345	64.8
	No	187	35.2
Do you use FRAX® in your practice? (532)	Yes	244	42.2
	No	307	57.8
If you use FRAX® in your practice, how do you use it? (223)[b]	With risk factors alone	13	5.6
	Risk factors + BMD	88	39.5
	Both possibilities	122	54.7
If you use FRAX® in your practice, which country model do you use? (221)[b]	Lebanon	104	47.1
	Jordan	59	26.7
	USA/UK	19/8	8.6/3.6
	Tunisia/Morocco/Palestine	6/4/4	2.7/1.8/1.8
	Other[c]	17	7.7%
Screening for vitamin D status in patients with osteoporosis? (521)	Yes	497	95.4%
	No	24	4.6%
Routine blood tests before initiating anti-osteoporosis treatment? (514)	Yes	455	88.5%
	No[d]	59	11.5%
Awareness of concerns about side effects of bisphosphonates? (505)	Yes	467	92.5%
	No	38	7.5%
If aware, has this awareness changed management practice? (461)	Yes	336	72.9%
	No	125	27.1%

[a] Absolute numbers as well as adjusted percentages (calculated per question) are presented [b] Only responses from those who confirmed using FRAX in their practice were included. [c] Some responses included non-existing models. [d] Relevant details in figure

Evaluation of bone health and utilization of FRAX®

Almost 60% of subjects had access to central DXA devices, around 13% to peripheral devices, and almost a third were not sure or had none (Fig. 1a). Although more than three quarters of subjects classified patients with osteoporosis into risk groups and used densitometry to assess their patients, BMD reporting was not made by the physicians themselves but rather by the radiologists in over 83% of the time (Table 3). Only approximately two-thirds of physicians had heard about FRAX, less than half used it in their practice. Forty percent of those who used FRAX, did so with risk factors and BMD, 6% with risk factors alone, whereas the remaining 54%, used both options depending on the case (Table 3). The models most commonly used were Lebanon by 47%, Jordan 26.7%, the USA 8.6%, followed by the UK, Tunisia, Morocco, and Palestine in very small proportions. Furthermore, over one-third of respondents did not know how to use FRAX; 23% of physicians were too busy and had no time to do it; 18% felt FRAX not to be applicable, or listed no Internet access or other reasons (Fig. 2a). Screening for vitamin D was done by over 95% of physicians and other routine investigations before initiating medications by 88.5% of physicians (Table 3). Respondents who do not perform blood tests gave a variety of reasons (Fig. 2b). Over 80% of them were not sure which tests for secondary causes would be relevant, were concerned about costs, and felt the tests were not relevant or not applicable.

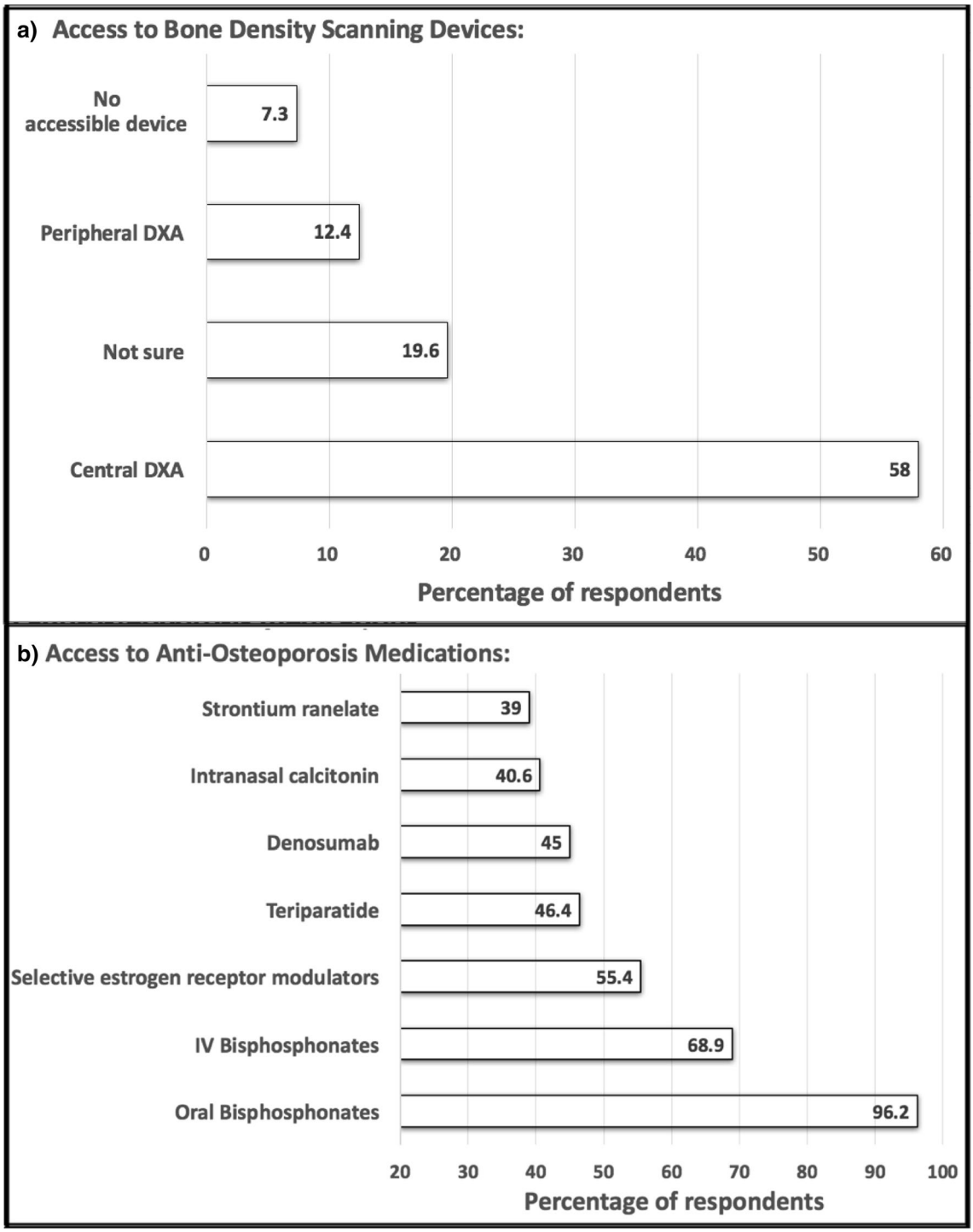

Fig. 1 Reported access to diagnostic and therapeutic facilities for management of osteoporosis in the MENA region. **a** Access to bone densitometry devices. **b** Access to anti-osteoporotic medications (n = 502). Results are adjusted as percentage of total responses to the given questions. In both questions, multiple answers were possible. DXA, dual-energy X-ray absorptiometry; SERMs, selective estrogen receptor modulators

Management of osteoporosis practices and barriers to optimal care

Several anti-osteoporotic medications were reportedly available in the region including, almost invariably, oral bisphosphonates (BPs), followed intravenous BPs, and others (Fig. 1b). The majority of physicians were concerned about bisphosphonates, and for 73%, this has changed in their practice (Fig. 2c). Several factors were identified as the biggest barriers to osteoporosis care in their corresponding practice/country (Fig. 2d). Most notably,

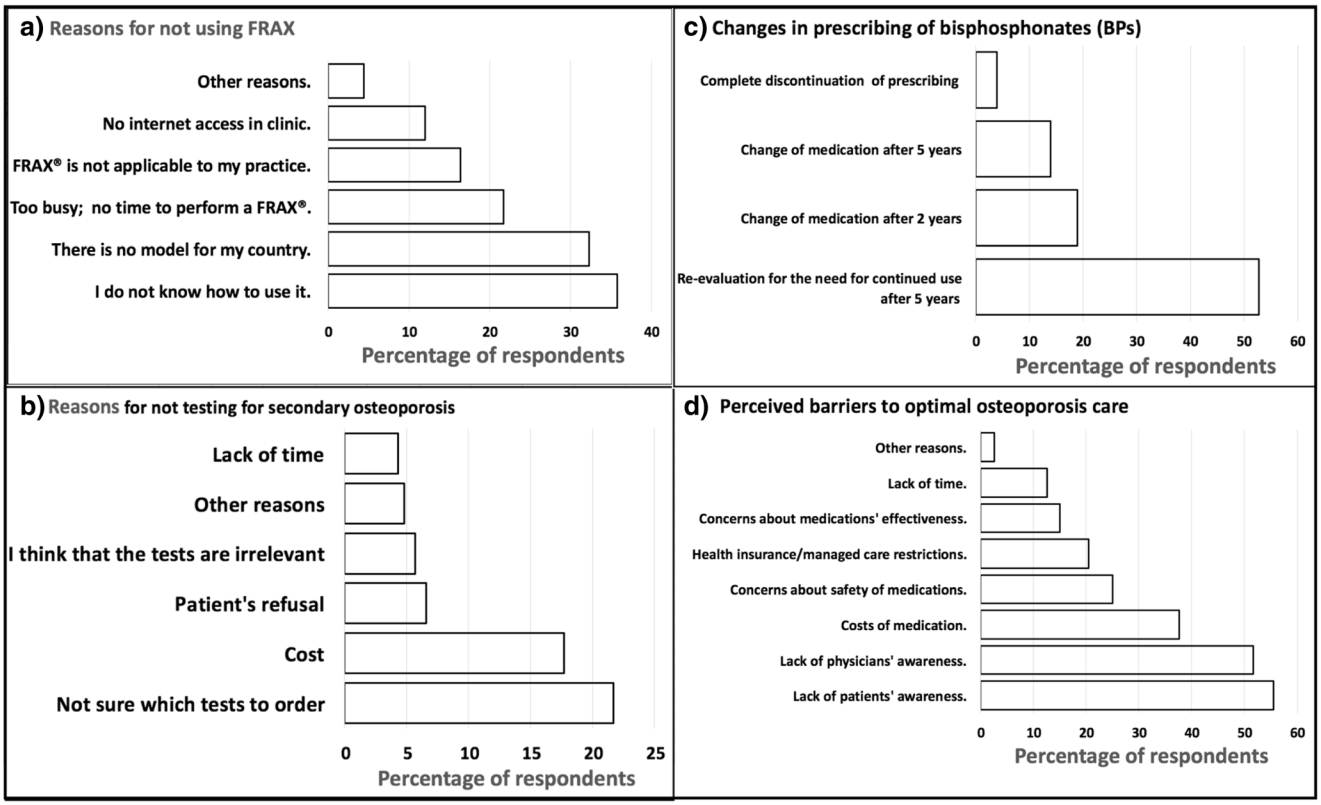

Fig. 2 Reported patterns of certain osteoporosis management practices. **a** Reasons for not using fracture-risk assessment (FRAX) tool ($n = 296$). **b** Reasons for not screening for secondary osteoporosis ($n = 57$). **c** Changes in practices in prescribing of bisphosphonates ($n = 336$). **d** Perceived barriers to good osteoporosis care in the MENA region countries from all surveyed physicians (501). Responses are expressed as percentages (adjusted for the total responses to individual questions)

these included lack of physicians' and patients' awareness (over 50% each), closely followed by costs and concerns about safety (Fig. 2d).

Variations of practices within the MENA region

Country-wise subgroup analyses of practice were explored using data from three countries contributing the largest numbers of respondents namely United Arab Emirates, Saudi Arabia, and Lebanon [see Supplementary Material (Appendix 2)]. The majority of participants practiced in large cities (> 84%) and over half practiced in university settings but more respondents from Lebanon were in private practice (26.9%). Almost half of the participants from Lebanon and KSA were endocrinologists and physicians from UAE were more likely to be in internal medicine (25%); and 25% were in family medicine in all three countries. Respondents from Lebanon saw a larger volume of patients with osteoporosis; almost half evaluated between 10 and 50 patients with osteoporosis per month, compared with 33% in KSA and 24% in UAE (Appendix 2). Furthermore, more respondents from Lebanon would use FRAX, and it was FRAX Lebanon almost exclusively. Half of those who did not use FRAX responded that it was due to short of time in clinic. However, the FRAX for Jordan, Lebanon, and the USA were used by 48.7%, 19.7%, and 10.5% of the respondents from KSA and by 44.3%, 19.3%, and 9.1% of respondents from UAE. Respondents from KSA and UAE who did not use FRAX attributed their practice to the lack of country model or lack of knowledge of how to use the model. Access to all types of drugs was substantially higher in the Lebanese, including oral BP, IV BP, denosumab, teriparatide, and strontium ranelate, compared to UAE and KSA counterparts (Appendix 2).

Comparisons of practices in the MENA region, Korea, and Asia

The survey responses pertaining to utilization of densitometry and FRAX® for risk assessment and to the management of osteoporosis in the MENA region are from the present study; Korean and Asian data were made [14, 15]. Differences and similarities are highlighted (Supplementary Material, Appendix 3). The Korean participants were younger than the other two groups, but the location and type of practice were similar in the three groups. Although endocrinologists in all regions were highly represented, there were more so in the MENA survey than in the Korean and Asian surveys, which included more physicians in musculoskeletal specialties

(orthopedic surgeons, rheumatologists, and rehabilitation physicians). More than half, 56% of respondents have less than ten cases per month, contrasted with smaller corresponding low volume care respondents (14% and 21%) in the Korean and Asian groups respectively. Furthermore, less patients were seen for either DXA assessment or new fragility fracture added together by the MENA group (13%) compared with the Korean and Asian groups (32% and 24%) respectively. More respondents from the MENA region would assess vitamin D status and evaluate other biochemical parameters but do less assessment of BMD and personally review of the BMD images than in the other two surveys. Despite the availability of several FRAX model in the region, awareness and utility of FRAX was lower in our survey compared with the other two. Perceived barriers to optimal care were different in the three groups, whereas cost was particularly noted by Asian respondents; time restrictions were felt by the MENA group, and restrictions imposed by regulators and funders were noted in the Korean study.

Discussion

In this study, we surveyed the perceptions and practices of physicians from the MENA region to several contemporary issues relevant to osteoporosis management. In particular, we documented their utility of the FRAX® risk assessment and BMD measurements, availability and utilization of resources, and attitudes to current concerns about safety of anti-osteoporosis drugs. More than three quarters do classify their patients with osteoporosis into risk groups but only two-thirds were aware of the FRAX®. Majority of the respondents used bone density assessment to help them in diagnosis and making treatment decisions using central DXA, but most scans are reported by radiologists rather than the treating physicians. Those who are aware of FRAX® did not use it in their practice for several reasons, and those who use it seem to be using several models with unclear justifications. Screening for secondary causes of osteoporosis before initiation of treatment with anti-osteoporosis agents and screening for vitamin D insufficiency are common practices (Table 3). Several anti-osteoporotic medications were reportedly available in the MENA region and most physicians were aware of concerns about bisphosphonate long-term use and this has changed their management practice. Perceived barriers to optimal care for osteoporosis include lack of physicians' and patients' awareness and concerns about safety and costs of medications.

In the MENA region, guidelines are produced by a couple of national and regional bodies [2, 16, 17], and there is ready access to guidelines made freely available by several international societies [6, 18, 19]. However, there does not seem to be a clear pattern of clinical management of osteoporosis as suggested by a couple of small reports from Saudi Arabia and UAE [20–23]. The large proportion indicating BMD assessments might be influenced by selection bias, as all our respondents. A critical shortage of DXA machines in most MENA countries has been reported with the exception of Lebanon and UAE [2], countries from which a disproportionately larger number of respondents came. The assessment of bone density is an important step in the establishment of the diagnosis and the further treatment and monitoring of osteoporosis. BMD loss has been shown to correlate well with future fracture risk. DXA assessment in patients with fragility fractures has been shown to vary widely [24]. Strangely, although radiologists are no-treating physicians, according to this survey, they seemed to lead and report DXA scans more often than endocrinologists and rheumatologists in this region. It could be strongly argued that radiologists may not be the most suitable specialists to undertake this role within a comprehensive osteoporosis management program [25]. Although the ISCD and IOF have conducted several densitometry training courses in the region over the years, our survey did not specifically assess that point. Another interesting finding that almost all of our participants had access to at least one form of bone densitometry device and this can partly be explained by the substantial fraction of participants from large cities, with higher availability of bone densitometers than in rural areas. Osteoporosis treatment rates have been shown to be crucially linked to DXA accessibility [26]. Practicing physician ought to be familiar with the proper performance of the DXA procedure and interpretation of the scan findings themselves [27, 28].

The FRAX® risk calculator used to guide intervention thresholds in several national osteoporosis guidelines [29, 30]. The Lebanese FRAX model is notably the first to be launched in the region and the most developed [17]. It was based on country-specific national data on hip fractures, obtained over more than 1 year and provided the basis for national FRAX-based osteoporosis guidelines endorsed by multiple societies and the Lebanese Ministry of Health [17]. However, the extent of BMD and FRAX use in clinical practice in the region at large is not known. This survey reveals that over one-third of physicians (35.2%) were not aware of FRAX®, even those who knew about were not using it consistently, a situation caused by the lack of knowledge or of a country-specific FRAX model (Table 3). Indeed, at the time the survey was launched only five country-specific calculators were available. These were for Lebanon, Jordan, Morocco, Tunisia, and Palestine. Since the survey, an additional three country-specific calculators were added in Kuwait (March 2016), Abu Dhabi (Nov 2016), and Iran (Nov 2016), (https://www.shef.ac.uk/FRAX/pdfs/FRAX_Release_Notes.pdf). The development of a reliable country-specific FRAX® model requires procurement of high-quality hip fracture incidence data, and life expectancy, at a minimum [29]. In the

absence of a country-specific FRAX model, the joint ISCD and IOF position is to recommend the use of a surrogate country [31]. Efforts should be made towards acquiring such data and producing reliable and validated models. FRAX is available in phone and hand-held calculators and also in paper charts for practices that are not fully computerized.

Vitamin D deficiency is common in the MENA region despite the abundance of sunshine [32]. Significant vitamin D deficiency might be associated with osteoporosis [8–10, 32, 33]. In our survey, universal screening for vitamin D deficiency seems not to be in the majority of practice in the MENA region. Vitamin D supplementation is safe and cheap for patients with osteoporotic fractures, and is recommended, if vitamin D deficiency is present, by several international guidelines [34–36]. Some of the respondents in our survey screen none or only selected osteoporotic patients using metabolic blood tests. However, finding contributing factors of osteoporosis for the individual patient is crucial for initiating adequate treatment [38]. The main reasons cited by the survey respondents who did not routinely screen for secondary causes in their patients with osteoporosis were lack of knowledge which tests to cost and lack of perceived relevance. These beliefs are ill-founded may lead physicians to take wrong management decisions. Poor investigation and treatment rates for osteoporosis have already been shown to be present in many countries [24] and constitute a major barrier to improving patients' outcomes.

Recent concerns have been raised of long-term use of bisphosphonate [11, 37, 38]. Over 90% of the respondents in our survey were aware of these new concerns and have reported having made changes in their real practice. Similar findings were reported by the recent surveys [14, 15]. In order to guarantee individually matched treatment, options should exist for sufficient choice among several anti-osteoporotic drugs. In this survey, the availability of different anti-osteoporosis medications was reassuring. The fact that bisphosphonates (both oral and parenteral) are most accessible to the surveyed health care, professionals concur with current recommendations for osteoporosis treatment [18, 38]. A recent report provided comprehensive guidance on BP therapy duration with a risk-benefit perspective [11], and underscored that 5 years of bisphosphonate use would prevent 160 fractures for each potential AFF incurred.

The biggest barrier was lack of physician and patient awareness almost to an equal extent. This is partly in line with the Korean survey which showed that lack of patients' awareness was considered by physicians as the biggest barrier [15]. However, this is at variance with two previous studies, both of which reported that cost of treatment was the biggest barrier in the USA and Asia-Pacific region [14, 39]. Perhaps, the low awareness among physicians and patients creates a falsely low demand environment that masked the cost issue which was the third biggest barrier identified by the survey respondents. These were followed by concerns about the safety of medications and restrictions. These findings indicate the urgent need for educational programs for both patients and physicians.

Some limitations of this study need to be acknowledged. The major limitation, is our sample, is the lack of representativeness of practitioners in the MENA region at large, and that it was heavily represented by three countries, mostly with urban practices, that were university based in half of the participants. Also, it is a survey of perception and self-reported practices of physicians rather than an audit/quality assurance exercise of processes and outcomes of actual patient populations. However, such model is being increasingly used to gain insight into physicians' knowledge, attitudes, and practices in many fields of health care, and may represent a surrogate measure of quality of care particularly in clinical conditions where physicians are the main drivers of the care. The lack of homogeneity of the respondents may impair the validity of data on availability of resources as these are country-specific representations and cannot be readily pooled. Comparison between countries was only exploratory and revealed more consistent adherence to the country-specific FRAX model in Lebanon than the in UAE and KSA (Appendix 2). Indeed, 96% of Lebanese participants were aware of FRAX, a finding explained by the fact that the Lebanese National Osteoporosis guidelines incorporated FRAX into their risk assessment strategy as of 2013 [17], as recognized by 81% of participants. Therefore, FRAX was used by 87% of survey respondents, reflecting the intensity of osteoporosis FRAX-based guideline dissemination sessions in Lebanon since their launch. More cost-consciousness was observed in the Lebanese respondents and adherence to regulatory and provider restrictions in Lebanon and UAE than in KSA. Trans-national surveys have previously been criticized as not the ideal method to assess the modalities of osteoporosis care and how the resources available for its care are being utilized [12, 13]. However, our survey was an opportunistic exercise building on the common characteristics of the countries of the region [2]. The high access to all types of medications more readily available to the Lebanese respondents could reflect the relatively higher proportion of specialists likely to treat osteoporosis.

Comparisons of practice patterns in the MENA region Korea and Asia were possible for responses pertaining to common questions posed specifically on utilization of densitometry and FRAX® for risk assessment and to the management of osteoporosis (Appendix 3). Although the endocrinologists in all three surveys were fairly well represented, the proportionately more primary care respondents and less orthopedic surgeons in our survey may have influenced the responses since responses would reflect physicians with less "hands on" acute fracture care and fracture liaison services. The lower volume and the complexity of osteoporosis care (new fragility fractures and referral for DXA) in the MENA group than in the Korean and Asian groups may suggest either a wide spread of

osteoporotic patients between specialties or a limited number of respondents undertaking a leading role in osteoporosis care. Both of these observations call for more centers of excellence of bone health in the MENA region to enable accumulation of expertise to deal with more complex cases. Despite differences in some perceived barriers to optimal care between the three groups, the contribution from low awareness of patients and physicians remained equally important calling for more education and of patients and physicians.

More respondents would measure vitamin D and other biochemical parameters but do less assessment of BMD (and personal review of the images) in the MENA respondents than the other two studies. The overall awareness and utility of FRAX was lower in our study than in the other two studies but this was not true for all the countries in the region. The latter calls for more involvement and training of clinicians to undertake roles in reading and interpretation of DXA scans of their patients.

The survey findings did however provide an overall "birds' eye" view of the state of affairs that is existent in the MENA region with regard to the osteoporosis care. It provided an insight into the current diagnostic and treatment resources, perceptions, and practices, explored the awareness and utilization and of FRAX®, and identified some important barriers to osteoporosis care in the MENA region. It may be useful in guiding future educational initiatives for both patients and physicians. Eight years after the launch of the IOF Middle East/Africa osteoporosis audit [2], some of the determinants of care gaps identified in audit are still present. Based on these findings, the two main potential action plans to close the care gap and improve osteoporosis care should target professional education, patients' awareness and enhancing insurance coverage, and improved patients' access, introducing established osteoporosis management care pathways and good clinical practices coupled with ongoing quality assurance programs to monitor progress. Engaging stakeholder physicians and patient societies would be instrumental to reach that goal.

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Authors' contributions SAB and GEHF conceived the study and developed the questionnaire. All three authors acquired, compiled and analyzed the data, wrote the manuscript, and approved its final version.

Compliance with ethical standards The study was approved by the Institutional review board of Sheikh Khalifa Medical City, Abu Dhabi, UAE. Informed consent was obtained electronically from all individual participants prior to proceeding to the study. Lack of consent terminates the survey automatically. All data were extracted and analyzed anonymously.

Conflicts of interest None.

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