Policy Brief

Reducing the Treatment Gap and Public Health Burden of Osteoporotic Fractures

K2P Policy Briefs bring
together global research evidence,
local evidence
and context-specific knowledge to
inform deliberations about health
policies and programmes.
It is prepared by synthesising
and contextualizing the best
available evidence about
the problem and viable solutions
through the involvement of
content experts, policymakers
and stakeholders.

Policy Brief

+ Included

Description of a health system problem

Viable options for addressing this problem

Strategies for implementing these options

× Not Included

Does not make **recommendations**

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K2P Policy Brief

Reducing the Treatment Gap and Public Health Burden of Osteoporotic Fractures

Knowledge to Policy Center K2P

Authors
Nadeen Hilal, Marlene Chakhtoura, Diana Jamal, Ghada El-Hajj Fuleihan, Fadi El-Jardali

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Key Messages

Key Messages

What is the problem?

Osteoporosis constitutes a major burden on the Lebanese healthcare system. Despite the gravity of the disease and the evidence on its growing burden, the effective screening of at risk populations, diagnosis, and treatment of osteoporosis face gaps and constraints in the existing health system arrangements.

What do we know about three elements of an approach to addressing the problem?

Element 1› Practice improvement aiming at enhancing the delivery of services and improving osteoporosis-related outcomes

- The use of physician support tools such as reminders and guidelines improved the utilization of diagnostic approaches and medications, enhanced the adoption of healthy habits by patients, and reduced the incidence of fractures.
- Continuing medical education targeting physicians resulted in a significant improvement in the use of FRAX, fall risk assessment by physicians, calcium levels, vitamin D levels, and medication adherence by patients.
- An osteoporosis educational program presented to nurses significantly increased osteoporosis-related knowledge and nurses' willingness to engage in osteoporosis preventive behaviors.
- An osteoporosis educational program targeting female pre-internship nursing students enhanced osteoporosis knowledge, osteoporosis health beliefs, and self-efficacy.
- Adoption of several care delivery models such as disease management, case management, task shifting, and a fracture liaison service increased the number of screening DXA scans performed, the number of patients receiving anti-osteoporosis medications, and specialized referrals, and decreased hip fracture rates and healthcare costs.
- Discordance and poor agreement in the results obtained through the use of various BMD devices called for

standardization, calibration, caution against the use of non-established densitometers, and against combining data on the rate of bone loss acquired using different manufacturers' densitometers.

- Quality control of bone densitometry improved scan quality and performance, increased the number of usable scans, and reduced the difference in the duplicate scans.
- Practice improvement through multifaceted interventions such as physician notification, physician education, and patient education improved rates of BMD scanning and osteoporosis treatment and adherence.

Element 2› Public Education and Awareness Aiming at Enhancing Knowledge and Changing Behaviors

- Many reported osteoporosis educational programs resulted in increased patients' knowledge of osteoporosis as well as their health-related quality of life, physical activity and psychosocial functioning and improved adherence with treatment recommendations. Other studies reported poor effectiveness of patient education on outcomes of medication adherence, health beliefs, and self-efficacy.
- Educational interventions targeting postmenopausal women improved knowledge and the rate of DXA completion and increased dietary calcium intake and attention for home environment safety.
- Educational interventions targeting men increased knowledge, health beliefs, and osteoporosis preventive behaviors.
- Educational interventions targeting the young improved osteoporosis knowledge.
- Educational interventions targeting the elderly population improved knowledge, health beliefs, and the intention to adhere to drug therapy.

Element 3› Securing Financial Coverage for Osteoporosis Diagnosis and Management

- Revision of reimbursement guidelines aiming at increasing the utilization of DXA in men and women aged 70 years and older resulted in doubling the proportions of DXA referrals for men and tripling those for women.

- Subsidizing anti-osteoporosis drugs increased the rate of osteoporosis drug dispensation and the rate of patients treated.
- Removing drug co-payments was estimated to result in a 7% decrease in fractures and an 8% decrease in costs, worth millions of dollars in savings.

Implementation considerations

To enhance osteoporosis diagnosis and management in Lebanon, a variety of implementation considerations need to be kept in mind at the levels of patients, professionals, organizations, and systems.

رسائل أساسية

تعريف المشكلة

يشكّل مرض هشاشة العظام عبئاً كبيراً على نظام الرعاية الصحية في لبنان. وعلى الرغم من خطورة المرض والدلائل على عبئه المتنامي، ثمة تحديات متزايدة تحد من القيام بفحص الفئات السكانية المعرّضة للإصابة به وتشخيصه، ومعالجتها على نحو فعال؛ وهذه التحديات تتمثل بوجود ثغرات وتقييدات في التدابير المتخذة في الأنظمة الصحية القائمة حالياً.

يقترح هذا الموجز ثلاثة عناصر لمعالجة مشكلة هشاشة العظام في لبنان بهدف تعزيز عمليتي تشخيص هذا المرض ومعالجته.

ما الذي نعرفه حول ثلاثة عناصر يتم اعتمادها في المقاربات لمعالجة هذه المشكلة؟

العنصر الأول> تحسين الممارسات الهادفة إلى تعزيز طريقة تقديم الخدمات والنتائج المتعلقة بهشاشة العظام

- ← إن من شأن استخدام أدوات دعم الأطباء المعالجين، مثل الرسائل التذكيرية والدلائل، تحسين سبل الإستفادة من طرائق التشخيص ومتابعة العلاج، وتعزيز آلية تبني العادات الصحية، وخفض معدل الإصابات بالكسور.
- ← أدت العملية المستمرة لتثقيف الأطباء المعالجين الى تحسين ملحوظ في ما يتعلق باستخدام أداة تقييم خطر الإصابة بالكسور (Frax) وتقييم مخاطر السقوط ومستويات الكالسيوم وفيتامين (د) والتقيد بالعلاج.
- ← أسهمت إحدى البرامج التثقيفية المتعلقة بهشاشة العظام المقدمة للممرضين، بإزدياد ملحوظ في اللمعرفة المتعلقة بهشاشة العظام وفي إقبال الممرضين على ممارسة السلوكيات الواقية من هذا المرض.
- ← عزّزت إحدى البرامج التثقيفية حول هشاشة العظام التي استهدفت طلبة التمريض قبل مرحلة التدريب من الإناث، المعارف والمعتقدات الصحية المتعلقة بالمرض، والكفاءة الذاتية.
- ← تزايد استخدام صورة فحص كثافة العظام (bone densitometry) وعدد المرضى الذين يتلقون أدوية مضادة لهشاشة العظام وعدد الإحالات الى اخصائي ، وانخفضت نسبة كسور الورك وتكاليف الرعاية الصحية ؛ وسبب

ذلك عائد إلى تبني عدة نماذج من تقديم الرعاية مثل إدارة المرض وإدارة الحالات وتحويل المهام وعمل دائرة الإتصال المعنية بالكسور (fracture liasion service).

- ← استدعى اللاتوافق والفروقات في النتائج التي يتم التوصل اليها عبر استخدام أجهزة متنوعة لقياس كثافة العظام توحيد المقاييس والمعايرة وتوخي الحذر إزاء استعمال أجهزة قياس غير معتمدة.
- ← حسّنت عملية مراقبة جودة قياس كثافة العظام نوعية الفحوصات الشعاعية وأداءها؛ وأسهمت في ارتفاع عدد الفحوصات الصالحة للإستخدام وتقليل الفروقات في الفحوصات الشعاعية المكررة.
- ← أسهم تحسين الممارسات من خلال التدخلات المتعددة الأوجه مثل تبليغ الطبيب المعالج وتثقيفه وتثقيف المرضى، في رفع نسبة الفحوصات التي تعتمد أجهزة قياس كثافةالعظام، وتحسين سبل معالجة هشاشة العظام والتقيد بالعلاج.

العنصر الثاني> الثقافة العامة والوعي العام بهدف تعزيز المعرفة وتغيير السلوكيات

- ← ادت العديد من البرامج التثقيفية حول هشاشة العظام الى تعميق معرفة المرضى بهشاشة العظام و حياتهم الصحية والى زيادة الانشطة البدنية وتقوية الأداء النفسي والإجتماعي، والى تحسين عملية التقيد بالتوصيات العلاجية. كما لحظت دراسات أخرى لا تأثير يذكر لعمليّة تثقيف المرضى على نتائج التقيد بالعلاج والمعتقدات الصحية والكفاءة الذاتية.
- ← حسّنت التدخلات التثقيفية التي استهدفت النساء فيما بعد سن اليأس، المعارف ومعدل إتمامهن فحوصات قياس كثافة العظام، وزادت كمية الكالسيوم الغذائية المستهلكة ولفتت الانتباه إلى سلامة البيئة المنزلية.
- ← ازدادت المعارف والمعتقدات الصحية والسلوكيات المتعلقة بهشاشة العظام بفضل التدخلات التثقيفية التي استهدفت الرجال.
- ← حسّنت التدخلات التثقيفية التي استهدفت الشباب معرفتهم بهشاشة العظام.
- ← حسّنت التدخلات التثقيفية التي استهدفت المسنين معرفتهم بالمرض ومعتقداتهم الصحية وقوّت عزيمتهم في ما يتعلق بالعلاج بالأدوية.

العنصر الثالث> تأمين التغطية المالية لتشخيص مرض هشاشة العظام وإدارته.

- ← أدّت التغيرات المتعلقة بالتعويضات المالية الهادفة الى زيادة نسبة استخدام قياس كثافة العظام من قبل الرجال والنساء ممن هم في السبعين من العمر وما فوق،و إلى ارتفاع نسبة الإحالات إلى هذا الإختبار بشكل مضاعف بالنسبة الى الرجال وبثلاثة أضعاف لدى النساء.
- ← أسهمت الخدمات المالية المقدمة لشراء عقاقير هشاشة العظام في رفع نسبة صرف هذه الادوية وفي تنامي عدد المرضى المعالجين.
- ← أشارت التقديرات الى أن حذف الإشتراك في دفع تكاليف العقاقير يخفض نسبة الكسور الى 7% ونسبة التكاليف الى 8%، أي ما يوازي ملايين الدولارات من المدخرات.

ما هي الجوانب التي يجب أخذها بعين الاعتبار عند التطبيق العملي؟

لتعزيز عمليتي تشخيص ومعالجة مرض هشاشة العظام في لبنان، لا يجب أن يسهى عن البال الالتفات الى باقة متنوعة من اعتبارات للتنفيذ على مستوى المرضى والمهنيين والمؤسسات التنظيمبة والأنظمة.

Policy Brief

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The Problem

Osteoporosis constitutes a major burden on the Lebanese healthcare system, inflicting a significant toll in terms of morbidity (Sibai et al, 2011). The socioeconomic burden is also substantial whereby the average hospital bed days per year of a hip fracture corresponds to almost 1.5 times that of breast cancer or ovarian cancer (MOPH and National Cancer Registry, 2004). Despite the gravity of the disease, the effective screening of at risk populations, diagnosis and treatment of osteoporosis are increasingly challenged by gaps and constraints in the existing health system arrangements.

Size of the Problem

A recent study comparing the prevalence of osteoporosis to other more feared non-communicable diseases demonstrated that up to 80% of elderly Lebanese above the age of 65 years had osteoporosis, depending on how osteoporosis is defined. Prevalence of osteoporosis by far exceeded the prevalence of other non-communicable diseases (NCDs) (Bassatne et al., 2020).

The financial burden of osteoporosis in Lebanon is not yet precisely quantified. However, annual and projected costs of hip fractures are expected to reach around 18 million dollars in 2050 (El Hajj Fuleihan et al, 2011). These numbers do not take into account costs due to work absenteeism, medications use, and other less tangible costs, nor do they take account for the risk of fracture recurrence (Saad, Beydoun, & El Hajj Fuleihan, 2019).

Underlying factors

Governance

Efforts have been made by the MOPH to optimize osteoporosis care. In 2002, the Calcium Metabolism and Osteoporosis Program (CaMOP) at the American University of Beirut Medical Center (AUBMC) and members of the Lebanese Society for Osteoporosis and Metabolic Bone Disorders (OSTEOS) developed the Lebanese guidelines for osteoporosis assessment and treatment which were updated in 2007 and then in 2013 with the

Background to Policy Brief

A K2P Policy Brief brings together global research evidence, local evidence and context-specific knowledge to inform deliberations about health policies and programs. It is prepared by synthesizing and contextualizing the best available evidence about the problem and viable solutions and options through the involvement of content experts, policymakers and stakeholders.

The preparation of the Policy Brief involved the following steps:

1) *Selecting a priority topic according to K2P criteria*
2) *Selecting a working team who deliberates to develop an outline for the policy brief and oversee the litmus testing phase.*
3) *Developing and refining the outline, particularly the framing of the problem and the viable options*
4) *Litmus testing by conducting one to one interviews with up to 15 selected policymakers and stakeholders to frame the problem and make sure all aspects are addressed.*
5) *Identifying, appraising and synthesizing relevant research evidence about the problem, options, and implementation considerations*
6) *Drafting the brief in such a way as to present concisely and in accessible language the global and local research evidence.*
7) *Undergoing merit review*
8) *Finalizing the Policy Brief based on the input of merit reviewers, translating into Arabic, validating translation, and disseminating through policy dialogues and other mechanisms.*

incorporation of the FRAX calculator (El Hajj Fuleihan et al, 2008; Chakhtoura et al, 2017). These guidelines were endorsed by the Lebanese Ministry of Public Health (MOPH). However, not all guideline recommendations, such as the use of a western normative database to derive T-scores, are fully implemented. The fracture liaison service (FLS) is also one of the recommended models by the guidelines and multiple osteoporosis organizations worldwide (IOF, 2019) that is not properly introduced in Lebanese hospitals yet. The FLS has been proposed by the CaMOP since 2018 and approved as a quality care measure by the medical practice committee at AUBMC since January 2019 (CaMOP, 2017).

As for the formation of registries, in 2008, the MOPH issued a decree requiring all hospitals to complete a form for each patient admitted for hip fracture during the year 2007 (Maalouf et al, 2013). This national hip registry captures information exclusively on patient cared for by the MOPH, thus accounting for only around 50% of the Lebanese population.

Following the launching of the Lebanese fracture risk assessment tool (FRAX) in 2009 (Kreidieh et al, 2014; IOF, 2014; Chakhtoura et al, 2017), the corresponding FRAX-based Lebanese osteoporosis treatment guidelines were initiated in 2012 and completed early 2014 (Chakhtoura et al, 2017). In 2010, through a ministerial decree, the MOPH also established the Lebanese National Task force for Osteoporosis and Metabolic Bone Disorders (El Hajj Fuleihan et al, 2011).

Financing

The DXA scan, blood tests, and treatments are 80 to 100% covered or reimbursed by several health plans, not including the MOPH (except for some medications), provided justification for testing is available (El Hajj Fuleihan et al, 2011). The cost of scans ranges between 50,000 LBP and 800,000 LBP depending on factors such as the number of sites tested by scan and geographic location of the testing center. However, in some cases, decision for financial coverage is not scientifically based but rather dependent on the personal judgment of the staff responsible for approvals.

Delivery

Lebanon has the highest rate of DXA machines per million population in the region (>20 per million), exceeding the recommended average of 11 DXA machines per million population in Europe. However, of the 130 DXA machines in Lebanon, only 82 are FDA approved. In addition, there is a lack of national quality assurance measures for densitometry testing and reading. Centers across Lebanon also depend on different BMD reference databases to extract their T-scores and Z-scores, adding to the problem of inconsistent results (El Hajj Fuleihan et al, 2007). Only one center in Lebanon has its faculty and staff rigorously abide by quality assurance measures and are all certified by the

International Society for Clinical Densitometry. It is also the only International Society for Clinical Densitometry (ISCD) accredited facility outside the United States (ISCD, 2019b).

As for the availability of tools, the Lebanese fracture risk assessment tool (FRAX) was launched in 2009, becoming an essential tool for physicians in Lebanon (Kreidieh et al, 2014; IOF, 2014; Chakhtoura et al, 2017). At total of 87% of Lebanese respondents reported using FRAX in their practice (Beshyah, Al-Saleh, El Hajj Fuleihan, 2019).

Regarding professional education, there are few certified training courses in the region, provided by both the International Osteoporosis Foundation (IOF) and the ISCD (El Hajj Fuleihan et al, 2011). Courses used to be regularly held each year, but less frequently recently due to decreasing attendance rates and financial challenges.

As for public awareness, one study found out that due to the limited knowledge about osteoporosis, especially among Lebanese women aged 50 years and older, delays in diagnosis and treatment might incur (Ahmadieh et al, 2018).

Elements of a comprehensive approach to address the problem

Three elements to address the problem of osteoporosis in Lebanon, through enhancing osteoporosis diagnosis and management, are proposed.

Element 1

Practice improvement aiming at enhancing the delivery of services and improving osteoporosis-related outcomes

The use of **physician support tools** demonstrated a positive impact on the utilization of diagnostic approaches and medications and the adoption of healthy habits. One systematic review revealed that combining reminders and education targeted to physicians and patients at the clinical setting significantly increased BMD testing and osteoporosis medication use, as compared to controls (Kastner & Straus, 2008). Distributing an evidence-based guideline for prevention of osteoporosis at municipal health centers resulted in increased dietary calcium intake for postmenopausal women and increased use of exercise for elderly persons, as compared to pre-intervention (Nakatani et al, 2012). Patient-specific clinical guideline advice delivered to the primary care provider by electronic medical record message or electronic reminder resulted in around 10-fold increase in the number of patients receiving post-fracture BMD measurement or osteoporosis medication as compared to usual care (Feldstein et al, 2006). Adoption of guidelines was found to be highly cost-effective and cost saving (Schousboe et al, 2005).

As for **care delivery models**, according to two studies, implementation of disease management programs targeting patients at risk for osteoporosis resulted in a significant increase of in the number of screening DXA scans done and the number of patients receiving anti-osteoporosis medications; along with a significant decrease in the hip fracture rate, as compared to pre-intervention (Newman et al, 2003; Greene & Dell, 2010). This was associated with a substantial reduction in health care costs (Newman et al, 2003). Adoption of the case management model has also shown to significantly increase BMD screening, treatment initiation, and referrals to specialist clinic, along with reduced fracture recurrence as compared to controls (Bell, Strand, & Inder, 2014; Majumdar, 2018). Specifically, nurse-led case management delivered at the clinic following wrist surgery resulted in a higher likelihood of patients undergoing BMD testing and receiving appropriate care as compared to patients receiving a multifaceted intervention (Majumdar et al, 2011a). Cost for case management ranged between 44 (Majumdar et al, 2011a) and 56 (Majumdar et al, 2009) Canadian dollars per patient and two studies demonstrated that case-management is highly cost-effective (Sander et al, 2008; Majumdar et al, 2009; Majumdar, 2018). As for task shifting, one systematic review revealed that as compared to controls, task shifting through one-to-one consultation(s) with a healthcare professional resulted in improved quality of life, medication compliance, and calcium intake (Lai, Chua, & Chan, 2010). Another systematic review demonstrated that as compared to controls, pharmacist delivered interventions applied at various settings improved BMD testing and calcium intake among high risk patients (Elias, Burden, & Cadarette, 2011). A fracture liaison service applied at the hospital setting improved patient evaluation and management (McLellan, 2003; Bogoch et al, 2006; Carpintero et al, 2009; Wallace, Callachand, Elliott, & Gardiner, 2011), referral (Bogoch et al, 2006), adherence to treatment (Chevalley et al 2002; Boudou et al, 2011), and resulted in fewer fractures (Dell, 2011; Solomon et al, 2014; Yates et al, 2015) and improved QALYs, as compared to pre-intervention (Solomon et al, 2014; Yates et al, 2015). In this regard also, several studies revealed that a fracture liaison service was cost-effective (Mclellan et al, 2011; Cooper, Palmer, & Seibel, 2012; Ahmed et al, 2012; Solomon et al, 2014; Yates et al, 2015), with incremental cost-effectiveness ratio reaching up to $31,749 (Yates et al, 2015). Fracture liaison service was mostly cost-effective when delivered by a case-manager (Majumdar et al, 2019). Finally, comparing BMD study reporting style revealed that patients receiving ‘consultative’ report received more prescription treatment as compared with those receiving the ‘results only’ format (Oppermann et al, 2010).

Studies have also attempted to compare results obtained through using different BMD measuring devices. Both Hologic and Norland systems were comparable in terms of precision, accuracy, linearity of response, and exposure efficiency (Lai et al, 1992). However, three studies reported that despite

significant correlations, the agreement between the results of the Lunar and Hologic instruments was not high (Genant et al, 1994; Pocock et al, 1997; Gillette-Guyonne et al, 2003). As bone mineral content increased, an underestimate of change in bone mineral density occurs, with the change in BMD underestimated to a greater extent by the Hologic instrument as compared to the Lunar instrument (Peel & Eastell, 1995). Discordance in the results was also demonstrated with higher BMD values obtained through the use of the Challenger device as compared to the Hologic device (Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005). In the same study, values were obtained using affordable densitometry devices that were not approved nor commonly used in developed countries. As a result, and according to several studies, **standardization and calibration** are essential for minimizing such discrepancies between various densitometers (Genant et al, 1994; Faulkner, Roberts, & McClung, 1996). Furthermore, most studies advocated for caution against the use of non-established densitometers that potentially lead to over or under diagnosis of patients and inappropriate treatment strategies (Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005). Studies also cautioned against combining data on the rate of bone loss acquired using different manufacturers' densitometers (Peel & Eastell, 1995) or comparing DXA measurements using different machines (Gillette-Guyonne et al, 2003).
As for the adoption of **quality control measures**, one study emphasized that quality control of bone densitometry improved scan quality, increased the number of usable scans, and reduced significantly the difference in the duplicate scans (Wahner et al, 1994). Another study concluded that the development of quality control protocols enables detection of changes in machine function and adjustment for alterations in performance (Orwoll, Oviatt, & Biddle, 1993).
One study revealed that **continuing medical education** targeting physicians resulted in significant improvement in the use of FRAX, fall risk assessment, calcium levels, vitamin D levels, and medication adherence, as compared to pre-intervention (Greenspan et al, 2013). Another study revealed that an osteoporosis educational program presented to nurses significantly increased osteoporosis-related knowledge and nurses' willingness to engage in osteoporosis preventive behaviors and to discuss osteoporosis with their family, friends, patients, and primary care provider (Berarducci, Lengacher, & Keller, 2002). Delivery of an early educational intervention was also deemed valuable. An osteoporosis educational program at a nursing educational institute targeting female pre-internship nursing students significantly increased osteoporosis knowledge, osteoporosis health beliefs, and self-efficacy (Zhang et al, 2012).

Practice improvement interventions were also implemented and evaluated as part of **multifaceted interventions**. One systematic review revealed that combining reminders and education targeted to physicians and patients at the clinical setting significantly increased BMD testing and osteoporosis medication use among high-risk patients (Kastner & Straus, 2008). In another

systematic review, implementation of interventions designed to modify the behavior of healthcare professionals or implement a service delivery change resulted in positive effects on the outcomes of rates of BMD scanning and osteoporosis treatment, as compared to controls (Little & Eccles, 2010). One systematic review revealed that multifaceted interventions involving physician notification, physician education, and patient education resulted in an increased incidence of osteoporosis treatment initiation and BMD testing for high-risk patients, as compared to pre-intervention (Laliberte et al, 2011). Two systematic reviews also concluded that monitoring subjects' bone turnover markers at the clinical setting along with patients and physicians education resulted in improvement in treatment adherence as compared to controls (Gleeson et al, 2009; White et al, 2010), though the value of the isolated use of bone turnover markers in clinical practice remains uncertain (Vasikaran et la, 2011). In addition, according to one systematic review, compared to usual care, combination of a general practitioner alerting system on a patient's increased risk of osteoporosis along with a patient-directed intervention improved the general practitioner's behavior with regard to diagnostic BMD testing and osteoporosis medication prescribing (Tzortziou et al, 2016). One systematic review also revealed that simplification of dosing regimens, electronic prescription, and pharmacist intervention increased medication adherence or persistence as compared to controls (Hiligsmann et al, 2013). Another systematic review revealed that patient self-scheduling of DXA plus education increased the outcome of BMD testing (Nayak & Greenspan, 2018).Additionally, two studies demonstrated the cost-effectiveness of several combinations of multi-faceted interventions (Beukelman et al, 2010; Majumdar et al, 2011b).

Element 2

Public Education and Awareness Aiming at Enhancing Knowledge and Changing Behaviors

One systematic review revealed that group osteoporosis educational programs applied at various settings increased patients' knowledge of osteoporosis as well as their health-related quality of life, physical activity and psychosocial functioning, as compared to pre-intervention (Jensen et al, 2014). Another systematic review demonstrated that healthcare professional-led education improved adherence with treatment recommendations for patients with osteoporosis or those at high risk for the disease (Smith, 2010). Public prevention educational programs were also fount to increase the level of knowledge among participants (Sedlak, Doheny, & and Jones, 2000). In contrast, several other studies reported poor effectiveness of educational interventions on outcomes such as medication adherence (Hiligsmann et al, 2013), health beliefs (Sedlak, Doheny, & and Jones, 2000), and self-efficacy (Nieto-Vázquez et al, 2009). Various

hypotheses for such results were postulated, including that a single intervention alone is unlikely to yield significant results. In these studies, and despite the absence of evidence of direct harm, public education can be recognized as a waste of resources.

Patient educational interventions **targeting sub-populations** were also applied and assessed. One study revealed that patient education applied at various clinical settings and targeting postmenopausal women resulted in a significant increase in the rate of DXA completion whereby17.3% of women in the intervention group completed a DXA, compared to 5.2% in the control group (Warriner et al, 2012). Another study revealed that delivery of an educational program on the prevention, diagnosis, and treatment of osteoporosis for women aged 60 years and older at different community settings resulted in significant changes among the majority of the participants including increasing calcium in their diet, discussing osteoporosis with their health care provider, checking their home environment for safety, and discussing what they had learned with others (Curry et al, 2002). Moreover, an educational workshop targeting women resulted in a significant increase in participants' knowledge of osteoporosis and calcium intake (Ribeiro & Blakeley, 2001). Interventions targeting osteoporotic women aged more than 70 years that could improve treatment initiation and adherence were also found to be cost effective (Penton et la, 2016). As for interventions targeting men, one study revealed that an osteoporosis educational program resulted in a statistically significant increase in both knowledge and health beliefs about osteoporosis and preventive behaviors in comparison with the control group (Tung & Lee, 2006). Three studies demonstrated that an osteoporosis prevention education program targeting the young delivered at school or university settings resulted in statistically significant increases in scores related to osteoporosis knowledge (Chan et la, 2007; Nieto-Vázquez et al, 2009; Brown & Schoenly, 2004). As for the elderly population, two studies showed that an osteoporosis educational program targeting elders delivered at a residential setting or the rehabilitation ward of a geriatric facility improved knowledge (Davis and White, 2000; Ben-Natan, Heyman, & Ben Israel, 2014), health beliefs, and the intention to adhere to drug therapy (Ben-Natan, Heyman, & Ben Israel, 2014) as compared to pre-intervention.

Element 3

Securing Financial Coverage for Osteoporosis Diagnosis and Management

One study revealed that implementing changes to the national health policy through revision of reimbursement guidelines aiming at increasing the utilization of DXA in men and women aged 70 years and older resulted in doubling the proportions of DXA referrals for men and tripling those for women over 7 years

(Brennan et al, 2013). Another study revealed that subsidizing anti-osteoporosis drugs resulted in approximately two-fold increase in the baseline rate of osteoporosis drug dispensation and a 1.6 fold increase in the rate of patients treated between the pre- and post-basket periods (Liel, Castel, & Bonneh, 2003). One systematic review estimated that implementation of a value based insurance design by removing co-payments for alendronate, risedronate, and teriparatide would result in a 7% decrease in fractures and an 8% decrease in costs, mounting to $6.8 million (Chambers et al, 2014).

Several interventions were shown to have deleterious effects on outcomes related to osteoporosis. One study demonstrated that, Medicare reimbursement reduction resulted in a minor decrease in the proportion of women who received a BMD test (McAdam-Marx et al, 2012). Another study revealed that Medicare reimbursement reduction resulted in approximately one-third of physicians indicating that they had either decreased the number of DXAs they performed or declined service contracts or hardware or software updates (Hayes et al, 2010). As a result of such cuts, a third study verified that around 800,000 fewer tests than expected were performed for Medicare beneficiaries over 3 years (King & Fiorentini, 2011).

Increasing drug copayment to 10% of total drug cost significantly decreased patient compliance with clinical practice guidelines from 80% to 57% but did not impact physician compliance (Canoui-Poitrine et al, 2010). Paradoxically and contrary to the results of the study by Brennan et al., one study demonstrated that reimbursement of BMD testing and anti-osteoporotic treatments resulted in a significant decrease in the number of BMD tests, hypothesized to be due to the possibility that women at risk had already being tested even before the test was reimbursed by the National Health Insurance (Canoui-Poitrine et al, 2010). According to the same study, only 25% of those who had an initial BMD test were subsequently treated with an anti-osteoporotic medication.

Implementation considerations

Barriers to implementation can be overcome at the patient, professional, organizational and system levels.

موجز للسياسات الصحية العامة

تعريف المشكلة

يشكل مرض هشاشة العظام عبئاً ثقيلاً على نظام الرعاية الصحية في لبنان، ما يتسبب في خسائر كبيرة في ما يتعلق بانتشار المرض وارتفاع عدد الحالات المرضية (سباعي وآخرون، 2011). كما أنّ العبء كبير على المستويين الإقتصادي والإجتماعي بحيث يوازي معدل أيام الإقامة بالمستشفيات سنوياً جراء الإصابة بكسور في الورك ضعفاً ونصف ضعف معدل الإصابات بسرطان الثدي أو سرطان المبيض (وزارة الصحة العامة والسجل الوطني للسرطان للعام، 2004). ورغم خطورة المرض، ثمة تحديات متزايدة بوجه القيام بفحص الفئات السكانية المعرّضة للإصابة به وتشخيصه، ومعالجتها على نحو فعال ؛ وهذه التحديات تتمثل بوجود ثغرات وتقييدات في التدابير المتخذة في الأنظمة الصحية القائمة حالياً.

حجم المشكلة

بيّنت نتائج إحدى الدراسات الحديثة التي تقارن بين نسبة انتشار مرض هشاشة العظام ونسب انتشار أمراض أخرى غير معدية أكثر مدعاة للقلق والخشية، أنّ أكثر من 80% من المسنين اللبنانيين ممن تفوق أعمارهم الخمسة وستين عاماً أصيبوا بهشاشة العظام. وقد فاقت بكثير نسبة انتشار هذا المرض نسب انتشار أمراض أخرى غير معدية (بساتنة وآخرون، ٢٠٢٠).

لم يحدد بعد حجم العبء المالي لمرض هشاشة العظام على نحو دقيق، إلا أنه من المنتظر أن تبلغ التكاليف السنوية لكسور الورك حوالي 18 مليون دولار في عام 2050 (الحاج فليحان وآخرون ، 2011). ولا تأخذ هذه الأرقام بالحساب التكاليف جرّاء التغيب عن العمل وكلفة الأدوية المستهلكة وغيرها من التكاليف أوتلك الناتجة جراء التعرض لمعاودة الإصابة بالكسور (سعد وبيضون والحاج فليحان، 2019)

العوامل المسببة

الحوكمة

قامت وزارة الصحة العامة ببذل الجهود لتحقيق المستوى الأمثل لرعاية المرضى المصابين بهشاشة العظام. وفي عام 2002، وضعت الوزارة القواعد التوجيهية اللبنانية لتقييم هشاشة العظام وسبل العلاج (استحدثت في العامين 2007 و2013) (الحاج فليحان وآخرون ، 2008؛ وشختورة وأخرون، 2017). غير أنه ثمة توصيات توجيهية أخرى لم تنفذ بالكامل، مثل اعتماد إحدى قواعد البيانات المعيارية الغربية *(western normative database)* أو إعتماد دائرة اتصال للكسور(fracture liaison service)، التي تمثل أحد النماذج التي أوصت بها القواعد التوجيهية، إضافة لتوجيهات متعددة من منظمات عالمية معنية بهشاشة العظام لم يتم اعتمادها في المستشفيات اللبنانية كما يجب حتى الآن.و كان قد سبق أن قدّم برنامج استقلاب الكالسيوم وهشاشة العظام التابع للمركز الطبي في الجامعة الأميركية في بيروت اقتراحاً قضى بإنشاء دائرة

اتصال للكسور، وذلك منذ عام 2018، و هو معتبر كأحد مقاييس الجودة من قبل لجنة الممارسات الطبية في المركز الطبي منذ شهر كانون الثاني من عام 2019 (المركز الطبي في الجامعة الأميركية في بيروت، 2017).

أما بالنسبة الى تكوين السجلات، فقد أصدرت وزارة الصحة اللبنانية مرسوماً في عام 2008 طلبت بمقتضاه من جميع المستشفيات ملء استمارة عن كل مريض أدخل الى المستشفى جراء الإصابة بكسر في الورك في سنة 2007 (معلوف وآخرون، 2013). ويحتكر هذا السجل الوطني لكسور الورك المعلومات في ما يتعلق بالمرضى الذين تمت رعايتهم من قبل وزارة الصحة العامة، ويشكل هؤلاءحوالي 50% فقط من سكان لبنان.

إثر طرح أداة تقييم خطر الإصابة بالكسور في لبنان في عام 2009 (كريدية و آخرون، 2014 ؛ مؤسسة هشاشة العظام الدولية ، 2014 ، شختورة وآخرون ، 2017) ، أنشئت بموازاتها، وعلى أساسها، القواعد التوجيهية العلاجية لمرض هشاشة العظام في لبنان، وذلك في عام 2012، وأنجزت في بداية عام 2014 (شختورة وآخرون، 2017). وفي عام 2010، وبمقتضى أحد المراسيم الوزارية، أنشأت وزارة الصحة العامة لجنة العمل اللبنانية لهشاشة العظام وأمراض العظام الإستقلابية (الحاج فليحان وآخرون ، 2011).

التمويل

يتم تغطيةأو تسديد تكاليف إختبارات فحص هشاشة العظام وفحوص الدم والعلاجات بنسبة تتراوح بين 80 و100 بالمائة بموجب العديد من الخطط الصحية، ، شرط توافر المبرّر الذي يستدعي إجراء هذه الفحوصات (الحاج فليحان وآخرون ، 2011) ، إلا أن وزارة الصحة العامة لا تقوم بتغطية هذه التكاليف (باستثناء تأمين لبعض الأدوية). وتتراوح كلفة الصور الشعاعية بين 50,000 ليرة لبنانية إلى 800,000 ليرة لبنانية، اعتماداً على عوامل معينة مثل عدد المواضع التي تخضع للفحص الشعاعي والموقع الجغرافي للمركز الذي يجرى فيه الفحص. الا أنه في بعض الحالات ليس للقرار المتخذ بشأن التغطية المالية أساس علمي بل يتوقف على الرأي الشخصي للموظف المسؤول عن إعطاء الموافقات.

مستوى تقديم الخدمات

على صعيد المنطقة، توجد في لبنان النسبة الأعلى من آلات فحص كثافة العظام لكل مليون من عدد السكان (أكثر من 20 لكل مليون)، ما يفوق النسبة المتوسطة الموصى بها والتي هي 11 آلة فحص لكل مليون من عدد السكان في أوروبا. بيد أنّ إدارة الغذاء والدواء (*FDA*) لم توافق سوى على استخدام 82 آلة من الآلات الموجودة في لبنان والتي يبلغ عددها 130 آلة، أضف الى ذلك عدم وجود مقاييس لضمان الجودة على الصعيد الوطني، بالنسبة الى اختبار قياس الكثافة وقراءته. كما تعتمد المراكز الطبية في أرجاء لبنان على قواعد بيانية مرجعية مختلفة لأجهزة قياس كثافة اللعظام، بالإضافة الى مشكلة النتائج المتضاربة (الحاج فليحان وآخرون، 2007). ثمة مركز واحد فقط في لبنان يتوخى الأطباء والعاملون فيه الدقة بالنسبة الى التقيد بمقاييس ضمان

الجودة، وجميعهم معتمدون من قبل الجمعية الدولية لقياس الكثافة العظمية السريرية (الجمعية الدولية لقياس الكثافة العظمة السريري، b2019).

بالنسبة إلى توافر الأدوات، تم إطلاق أداة تقييم خطر الإصابة بالكسور في لبنان في عام 2009 بحيث غدت أداة أساسية للأطباء المعالجين في لبنان (كريدية وآخرون، 2014 ؛ مؤسسة هشاشة العظام الدولية، 2014 ؛ شختورة وآخرون، 2017). وقد بلّغت نسبة الإستخدام 87% من الأطباء اللبنانيين بحسب نتائج إحدى الدراسات (بسياح ، الصالح والحاج فليحان، 2019).

في ما يتعلق بالتثقيف المهني، ثمة عدد قليل من البرامج التدريبية المرخصة في المنطقة تقدمها مؤسسة هشاشة العظام الدولية والجمعية الدولية لقياس الكثافة العظمية السريرية (الحاج فليحان وآخرون، 2011). جرت العادة أن تقام الدورات التدريبية سنوياً ؛ ولكن، وبسبب نسبة الحضور المتدنية مؤخراً، باتت أقل تكرار.

بالنسبة الى التوعية العامة، كشفت إحدى الدراسات إمكانية حدوث تأخيرات في التشخيص والعلاج بسبب المعرفة المحدودة عن هشاشة العظام، وبخاصة في أوساط اللبنانيات ممن هن في الخمسين من العمر وما فوق (أحمدية وآخرون، 2018).

ما هي العوامل التي يجب أخذها بعين الاعتبار عند التطبيق العملي؟

نقترح ثلاثة عناصر لمعالجة مشكلة هشاشة العظام في لبنان من خلال تعزيز عمليتي تشخيص المرض ومعالجته.

العنصر الأول> تحسين الممارسات الهادفة إلى تعزيز الخدمات و تحسين النتائج المتعلقة بمرض هشاشة العظام

تبيّن أنّ لاستعمال أدوات دعم الأطباء المعالجين تأثيراً إيجابيّاً على استخدام طرق التشخيص والعلاج وتبني العادات الصحية. وقد كشفت إحدى المراجعات المنهجية عن تزايد ملحوظ في عدد اختبارات أجهزة قياس الكثافة المعدنية للعظام واستخدام أدوية هشاشة العظام، مقارنة بقيود المراقبة، جرّاء الجمع بين عاملي الرسائل التذكيرية والتثقيف الموجّهيْن إلى الأطباء المعالجين والمرضى (كاستنر وستراوس، 2008). وكانت نتيجة توزيع كتيّبات إرشادية قائمة على توجيهات للوقاية من مرض هشاشة العظام في المراكز الصحية في البلديات، أن ازدادت كمية إعتماد الأغذية الغنية بالكالسيوم بالنسبة إلى النساء ما بعد سن اليأس وازداد إقبال المسنين على القيام بالتمارين الرياضية مقارنة بما قبل السير بهذا التدخل (ناكاتاني وآخرون، 2012). وبالمقارنة بأساليب الرعاية المعتادة، أفضت توجيهات الدليل المخصص للمرضى في العيادات الموجهة إلى مقدم الرعاية الأولية بواسطة الرسالة الإلكترونية الطبية المسجلة أو الرسالة التذكيرية الإلكترونية، إلى ارتفاع عدد المرضى الذين خضعوا لفحص قياس الكثافة المعدنية للعظام بعد إصابتهم بكسور، أو تلقوا علاج هشاشة العظام، عشرة أضعاف (فيلدستاين وآخرون، 2006). كما تبين التأثير الإيجابي الكبير على التكلفة وعلى مسألة التوفير في التكاليف، بسبب تبني الإرشادات الصحية (شوسبو وآخرون، 2005).

أما بالنسبة إلى نماذج تقديم الرعاية، فهناك دراستان أفادتا بأنّ تطبيق برامج إدارة الأمراض التي تستهدف المرضى المعرّضين للإصابة بهشاشة العظام قد أفضى إلى زيادة ملحوظة في إعتماد صورة قياس كثافة العظام،وعدد المرضى الذين يتلقون أدوية مضادة لهذا المرض، بالإضافة إلى انخفاض ملحوظ في نسبة كسور الورك، مقارنة بما قبل السير بهذا التدخل (نيومان وآخرون، 2003؛ غرين وديل، 2010). وارتبطت هذه العوامل بانخفاض كبير في تكاليف الرعاية الصحية (نيومان وآخرون، 2003). كما تبيّن أن اعتماد الأسلوب القائم على إدارة الحالات قد أفضى إلى زيادة ملحوظة في الكشف عن مقدار الكثافة المعدنية للعظام والبدء بالعلاج والإحالات إلى العيادات المختصة، إضافة إلى انخفاض نسبة معاودة الإصابة بالكسور، مقارنة بقيود المراقبة (بيل، ستراند واندر، 2014؛ ماجومدار، 2018).

أدّت عملية إدارة الحالات تحت إشراف ممرضين في العيادة إثر الخضوع لعملية جراحية في المعصم تحديداًإلى احتمال أكبر لازدياد عدد المرضى الذين يجرون اختبار جهاز قياس الكثافة المعدنية للعظام ويتلقون العناية الصائبة، مقارنة بالمرضى الذين يتلقون تدخلات متعددة الأوجه (ماجومدار وآخرون، a2011). وتراوحت كلفة إدارة الحالات ما بين 44 دولاراً كندياً لكل مريض (ماجومدار وآخرون، a2011) و56 دولاراً كندياً (ماجومدار وآخرون، 2009)؛ وأظهرت دراستان وجود فعالية عالية للكلفة بسبب إدارة الحالات (ساندر وآخرون، 2008؛ ماجومدار وآخرون، 2009؛ ماجومدار، 2018). وبالنسبة إلى تحويل المهام، فقد كشفت إحدى المراجعات المنهجية أنه، بالمقارنة بقيود المراقبة، أدت عملية تحويل المهام عبر استشارة واحدة أو أكثر على المستوى الفردي مع أحد ممتهني الرعاية الصحية، إلى تحسين نوعية الحياة والالتزام بتناول الدواء وكمية الكالسيوم الغذائية (لاي شووا وتشان، 2010). وأظهرت مراجعة منهجية أخرى أنه، ومقارنة بقيود المراقبة، عززت التدخلات الصيدلانية المنفذة والمطبقة في مواقع متنوعة، اختبارات قياس الكثافة المعدنية للعظام وكمية تناول الكالسيوم في أوساط المرضى المعرضين للإصابة بهشاشة العظام بدرجة عالية (الياس، بيردن وكاداريت، 2011)؛ كما أسهم اعتماد دائرة اتصال للكسور في المستشفى في تحسين عمليتي تقييم المرضى و معالجتهم (ماكليلان، 2003؛ بوغوش وآخرون، 2006؛ كاربنتيرو وآخرون، 2009؛ والاس كالشاند ، اليوت وغاردنر، 2011) والإحالة (بوغوش وآخرون، 2006) والتقيد بالعلاج (شيفالي وآخرون 2002؛ بودو وآخرون 2011)، إضافة إلى خفض نسبة الكسور (ديل 2011، سولومون وآخرون 2014؛ ييتس وآخرون 2015) وتحسين مقاييس جودة سنوات الحياة المعدلة (QALY)، مقارنة بما قبل السير بهذا التدخل (سولومون وآخرون، 2014؛ ييتس وآخرون، 2015). وفي هذا الصدد، كشفت دراسات متعددة أنّ استخدام دائرة اتصال للكسور كان أمراً فعالاً بالنسبة إلى التكلفة (ماكليلان وآخرون، 2011؛ كوبر ، بالمر وسايبل، 2012؛ أحمد وآخرون، 2012؛ سولومون وآخرون، 2014؛ ييتس وآخرون، 2015)، بحيث وصلت نسبة فعالية التكاليف إلى 31,749 دولاراً كنديّا (ييتس وآخرون، 2015). ولدى تنفيذ عمليات دائرة الاتصال للكسور من قبل أحد مديري الحالات، أمكن تحقيق أعلى درجة من الفعالية من حيث التكلفة (ماجومدار وآخرون، 2019). وأخيراً، كشفت دراسة مقارنة حول الأسلوب التقريري للتبليغ عن نتائج اختبارات أجهزة قياس الكثافة المعدنية للعظام، أنّ المرضى الذين تلقوا تقريراً «تشاورياً»، قد حظوا بقدر أكبر من الوصفات الطبية للعلاج مقارنة بالمرضى الذين تلقوا نموذج «النتائج فقط» (أوبرمان وآخرون، 2010).

ثمة دراسات سعى واضعوها أيضاً إلى مقارنة النتائج التي تم الحصول عليها من خلال استخدام أجهزة مختلفة لقياس الكثافة المعدنية للعظام. تشابهت الآلتان هولوجيك ونورلاند في ما يتعلق بالإتقان والدقة والاستقامة فيالإجابة وكفاءة في الكشف (لاي وآخرون، 1992)؛ ولكن ثمة ثلاث دراسات كشفت أنه، وبالرغم من أوجه الترابط الكبير بينهما، توجد تباينات في النتائج (جينانت وآخرون، 1994، بوكوك وآخرون، 1997؛ جيليتغويون وآخرون، 2003). فكلما ازداد المحتوى المعدني للعظام، طرأ تغيير طفيف في الكثافة المعدنية للعظام؛ إلا أن التغيير الطارئ في جهاز قياس الكثافة المعدنية للعظام قدّر أقل من اللازم بدرجة أكبر من قبل آلة هولوجيك مقارنة بالآلة "لونر" (بيل وايستيل، 1995). كما ظهر تعارض النتائج لدى الحصول على تقديرات أعلى عبر جهاز تشالنجر بالمقارنة بجهاز هولوجيك (عربي وسلمون وبلوط والحاج فليحان، 2005). وفي الدراسة ذاتها، تم الحصول على التقديرات باستخدام أجهزة بأسعار معقولة لقياس الكثافة، غير معتمدة أو شائعة الاستعمال في الدول المتقدمة؛ نتيجة لذلك، ووفقاً لدراسات متعددة، فإنّ توحيد المقاييس وتحديد المعايير أمران أساسيان لتقليل مثل هذه الفوارق بين أجهزة قياس الكثافة المتعددة والمتنوعة (جينانت وآخرون، 1994؛ فولكنر وروبرتس وماكلونغ، 1996). أضف أنّ معظم الدراسات حذّرت من استخدام أجهزة لقياس الكثافة غير معتمدة ومن شأنها أن تؤدي إلى الإفراط في تشخيص الحالة المرضية، وإلى اللجوء إلى استخدام استراتيجيات علاجية غير صائبة (عربي وسلمون وبلوط والحاج فليحان، 2005). كما حذّرت دراسات أخرى من جمع البيانات المتعلقة بنسبة فقدان العظام التي يتم الحصول عليها باستخدام أجهزة قياس للكثافة من صنع شركات مختلفة ومتعددة (بيل وإيستل، 1995) أو من مقارنة قياسات فحوص امتصاص الأشعة السينية مزدوجة الطاقة باستخدام آلات مختلفة (جيليت- غويون وآخرون 2003).

أما بالنسبة إلى تبني مقاييس مراقبة الجودة، فقد شدّدت إحدى الدراسات على أنّ مراقبة جودة قياس كثافة العظام حسّنت نوعية الفحوص وزادت عدد الصور الشعاعية الصالحة للاستخدام وأسهمت بقدر كبير في تقليل الفرق في الصور المزدوجة (واهنر وآخرون، 1994). وخلصت دراسة أخرى إلى أنّ وضع بروتوكول لمراقبة الجودة، يمكّننا من كشف التغيّرات في أداء الآلة وتعديل تغيّرات الأداء (أوروول وأوفيات وبيدل، 1993).

كما أظهرت إحدى الدراسات أنّ عملية التثقيف الطبي المستمر التي تستهدف الأطباء المعالجين، أدت إلى تحسّن ملحوظ في استخدام أداة تقييم مخاطر الإصابة بالكسور وتقييم مخاطر السقوط بمستويات الكالسيوم ومستويات فيتامين «د» ودرجة الالتزام بتناول الدواء، مقارنة بما قبل السير بهذا التدخل (غرينسبان وآخرون، 2013). وكشفت دراسة أخرى عن وجود برنامج تثقيفي عن هشاشة العظام أعطي للممرضين أسفر عن زيادة ملحوظة في المعرفة المتعلقة بهشاشة العظام وإقبال للممرضين على الانخراط في السلوكيات الوقائية لهشاشة العظام وخوضهم في الحديث عن هذا المرض مع العائلة والأصدقاء والمرضى ومقدم الرعاية الأولية (بيراردوتشي ولينغاتشر وكيللر، 2002). كما اعتُبر أمر هام ومجد تنفيذ تدخلات تثقيفية مبكرة. وكما أدى برنامج تثقيفي عن هشاشة العظام في أحد معاهد التمريض التي تستهدف طلبة التمريض من الإناث في مرحلة ما قبل التدريب، إلى تعزيز المعارف والمعتقدات الصحية المتعلقة بهشاشة العظام والكفاءة الذاتية على نحو ملحوظ (تشانغ وآخرون، 2012).

كما تم تطبيق تدخلات لتحسين الممارسات وتقييمها، بوصفها جزءا من التدخلات المتعددة الأوجه. وكشفت احدى المراجعات المنهجية عن ازدياد ملحوظ في عدد اختبارات اجهزة فحص الكثافة المعدنية للعظام واستخدام دواء هشاشة العظام في أوساط المرضى المعرّضين لخطر الاصابة بالمرض بشكل كبير، جراء الجمع بين عاملي الرسائل التذكارية والتثقيف الموجهين للاطباء المعالجين والمرضى في العيادات (كاستنر واستراوس، 2008). وبحسب مراجعة منهجية اخرى، كان اثرالتداخلات المصممة لتغيير سلوكيات مهنيي الرعاية الصحية او احداث تغييرات في ما يتعلق بتقديم الخدمات، ايجابيا بالنسبة الى نسب استخدام اجهزة فحص الكثافة المعدنية للعظام وعلاج هشاشة العظام مقارنة بقيود المراقبة (ليتل واكليس، 2010). وكشفت مراجعة منهجية اخرى ان التدخلات المتعددة الاوجه المعنية بتبليغ الطبيب المعالج وتثقيفه وتثقيف المريض أدت الى تزايد نسبة المرضى المعرّضين لخطر كبير للاصابة بهشاشة العظام الذين بدأوا في تلقي علاج هشاشة العظام واجراء فحص الكثافة المعدنية للعظام، مقارنةً بما قبل السير بهذه التدخلات (لا لبيرتي واخرون،2011). وخلصت مراجعتان منهجيتان ايضا الى انه نتيجة مراقبة علامات تغير عظام المرضى في العيادات، إضافة الى تثقيفهم وتثقيف الاطباء المعالجين، طرأ تحسن من ناحية تقيد المرضى بالعلاج مقارنة بقيود المراقبة (غليسون واخرون، 2009؛ وايت واخرون، 2010) ، مع ان درجة الاستخدام الحصري لعلامات تغير العظام في العمل السريري تظل غير مؤكدة (فاسيكران واخرون 2011).اضف انه، وفقا لإحدى المراجعات المنهجية، حسنت عملية الجمع بين دق جرس الانذار للمرضى المعرضين لخطر الاصابة بهشاشة العظام، من قبل الاطباء العامّين، وبين التدخل الموجه الى المرضى، سلوك هؤلاء الاطباء من الناحية التشخيصية من خلال إعتماد فحص الكثافة المعدنية للعظام واعطاء الوصفات العلاجية، مقارنة باساليب الرعاية المعتادة (تزورتزيو و اخرون، 2016). وكشفت مراجعة منهجية اخرى ايضا ان تبسيط الجرعات العلاجية والوصفات الطبية الالكترونية وتدخل الصيدلي عوامل عززت عملية التقيد بالعلاج والمثابرة على متابعته مقارنة بقيود المراقبة (هيليغزمان واخرون، 2013). كما كشفت احدى المراجعات المنهجية ان الجدولة الذاتية لمواعيد اجراء فحص كثافة العظام من قبل المريض بالإضافة الى عامل الالمام بالمرض، أسهما في تعزيز إستخدام اختبارات اجهزة فحص الكثافة المعدنية للعظام (نایاك و غرين سبان، 2018). اضافة الى ذلك، ثمة دراستان أظهرتا فعالية من ناحية التكلفة لدى اللجوء الى مزيج من التدخلات المتعددة الاوجه (بوكل مان واخرون، 2010؛ ماجومدار واخرون، b2011)

العنصر الثاني> الثقافة والتوعية العامة بهدف تعزيز المعارف وتغيير السلوكيات .

كشفت احدى المراجعات المنهجية ان البرامج التثقيفية الجماعية المتعلقة بهشاشة العظام المطبقة في مواقع متنوعة قد عمقت معرفة المريض بهشاشة العظام، كما حسنت نوعية الحياة المتعلقة بالصحة وزادت نسبة التمارين الرياضية لدى المريض وعززت اداءه الاجتماعي والنفسي مقارنة بما قبل عملية التدخل هذه(جنسن و اخرون، 2014). وهناك مراجعة منهجية اخرى بيّنت وجود تحسن في أداء المصابين بمرض هشاشة العظام أو المعرضين لخطر كبير للإصابة به، من ناحية التقيد بتوصيات العلاج جرّاء تثقيفهم تحت إشراف مختصين في الرعاية الصحية (سميث، 2010).كما تبين أن البرامج التثقيفية العامة التي تتناول الوقاية من الأمراض من شأنها رفع مستوى معارف المشاركين (سيدلاك، دوهيني و جونز، 2000). بالمقابل، ذكرت دراسات أخرى

عديدة أن مستوى فعالية التدخلات التثقيفية منخفض في ما يتعلق بنتائج معينة مثل الإمتثال للعلاج (هيليغزمان و آخرون، 2013) والمعتقدات الصحية (سيدلاك، دوهيني و جونز، 2000) والكفاءة الذاتية (نييتو- فازكويز و آخرون، 2009) . وقد افتُرضت نظريات متعددة ومتنوعة بشأن مثل هذه النتائج، ومن ضمنها تلك التي تقول إنه من غير المرجح أن يُسفر تدخل واحد عن نتائج تُذكر. وبحسب هذه الدراسات تعد الثقافة العامة هدرًا للموارد على الرغم من غياب أدلة على إحداث أضرار مباشرة.

كما تم تقييم التدخلات الثقافية التوعوية الموجهة للمرضى،و التي تستهدف فئات سكانية معينة، حيث كشفت إحدى الدراسات أن عملية تثقيف المريض التي طبقت في أطر سريرية متنوعة والتي استهدفت النساء ما بعد سن اليأس، قد أدت إلى زيادة ملحوظة في نسبة إجراء فحص هشاشة العظام (وورينر و آخرون، 2012). وكشفت دراسة أخرى أنّ تنفيذ برامج تثقيف النساء ممن هنّ في سن الستين وما فوق، وفي أوساط مجتمعية مختلفة، حول الوقاية من مرض هشاشة العظام وسبل تشخيصه وعلاجه، قد أحدث تغييرات ملحوظة في أوساط غالبية المشاركات ومنها: ازدياد مادة الكالسيوم في الغذاء ومناقشة مقدم الرعاية الصحية المعني بهن في موضوع هشاشة العظام والتحقق من سلامة بيئتهن المنزلية ومناقشة الآخرين في المعارف المكتسبة (كوري وآخرون، 2002). علاوة على ذلك، أقيمت ورشة عمل تثقيفية استهدفت النساء كانت نتيجتها أن ازدادت، وعلى نحو ملحوظ، معارف المشاركات في ما يتعلق بمرض هشاشة العظام وبأهمية تناول الكالسيوم (ريبييرو و بلايكلي، 2001). كما تبين التأثير الإيجابي على التكلفة للتدخلات التي تستهدف النساء المصابات بهشاشة العظام ممن تزيد أعمارهن عن السبعين عامًا، والتي تحسّن عملية البدء بالعلاج والتقيد به (بينتون و آخرون، 2016). وبالنسبة إلى التدخلات التي تستهدف الرجال، ثمة دراسة إحصائية كشفت عن زيادة ملحوظة في المعارف والمعتقدات الصحية بشأن هشاشة العظام والسلوكيات الوقائية، مقارنة بمجموعة قيود المراقبة (تونغ و لي، 2006). كما بينت ثلاث دراسات أنه، ونتيجة تنفيذ أحد البرامج التثقيفية الوقائية بشأن هشاشة العظام الموجهة إلى الشباب في المدرسة أو الجامعة، سُجّلت، وبحسب الإحصاءات، نسب متزايدة في النتائج المتعلقة بالإلمام بمرض هشاشة العظام (تشان و آخرون، 2007 ؛ بنييتو- فاسكويز و آخرون، 2009، براون وشوينلي، 2004). أما بالنسبة إلى السكان المسنين، فقد أظهرت دراستان أنه نتيجة تنفيذ أحد البرامج التثقيفية حول هشاشة العظام الموجهة إلى المسنين في أحد الأماكن السكنية أو أجنحة التأهيل أو دور الرعاية للمسنين، تعمقت معرفتهم بالمرض (دايفيس ووايت 2000، بن ناتان، هايمان وبن ازرائيل، 2014) ومعتقداتهم الصحية؛ وعقدوا النية على التقيّد بالعلاج والعقاقير، مقارنة بما قبل السير بالتدخلات (بن-ناتان، هايمن، وبن ازرائيل، 2014).

العنصر الثالث> تأمين التغطية المالية لتشخيص مرض هشاشة العظام ومعالجته

كشفت إحدى الدراسات أن عملية إدخال التغيّرات موضع التنفيذ في السياسة الصحية الوطنية من خلال إجراء تغييرات في نظام التعويضات المالية الهادفة إلى رفع مستوى استخدام فحص كثافة العظام لدى الرجال والنساء الذين هم في السبعين وما فوق، قد أدت إلى ارتفاع نسبة الإحالات إلى هذه الفحوصات ضعفين لدى الرجال وثلاثة أضعاف لدى النساء (برينان و آخرون، 2013). وكشفت دراسة أخرى أنه نتيجة تقديم الدعم المالي لشراء العقاقير المضادة لهشاشة

العظام، سُجلت زيادة بقدر ضعفين تقريبًا في نسبة صرف عقاقير هشاشة العظام و1.6 أضعاف في نسبة المرضى الذين يتعالجون (لايل، كاسل و بونيه، 2003). وحسب تقدير إحدى المراجعات المنهجية، ستنخفض نسبة الكسور إلى 7 % ونسبة التكاليف إلى 8%، أي ما قيمته 6.8 مليون دولارأميركي، في حال تم تنفيذ إحدى خطط التأمين القائمة عبر حذف الإشتراك في دفع تكاليف أدوية هشاشة العظام التالية: اليندرونات وريزدرونات و تيريباراتايد (شامبرز و آخرون، 2014).

تبين حدوث تأثيرات ضارة بالصحة على النتائج المتعلقة بهشاشة العظام بسبب تدخلات متعددة؛ إذ أظهرت إحدى الدراسات تسبّب خفض نسبة التعويضات المالية للتأمين الصحي في انخفاض طفيف في نسبة النساء اللواتي خضعن لفحص مقدار الكثافة المعدنية للعظام (ماك ادم - ماركس وآخرون، 2012). وفي دراسة أخرى أشار ثلث الأطباء المعالجين تقريبًا إلى أنهم نتيجة خفض التعويضات المالية للتأمين الصحي، لجأوا الى تقليل عدد فحوص كثافة العظام التي أجروها أو رفضوا عقود الخدمات أو إجراء تحديثات على برامج ومعدات الحاسوب (هايز و آخرون، 2010). ونتيجة لهذه الحسومات، أكدت دراسة ثالثة أنه تم إجراء حوالي 800.000 فحص أقل من المتوقع بالنسبة إلى المستفيدين من التأمين الصحي على مدى ثلاث سنوات (كينغ و فيورنتيني، 2011).

و في المقابل، انخفضت نسبة التزام المريض بالإرشادات العلاجية من 80% إلى 57% و ذلك بسبب زيادة المشاركة في دفع تكاليف العقاقير بنسبة 10%، ولكن لم يُحدث هذا الأمر أثرًا يذكر في التزام الأطباء المعالجين بالتوصيات العلاجية (كانوبواترين و آخرون، 2010) .ومن باب المفارقة، وبالتعارض مع نتائج الدراسة التي أعدها برينان وآخرون، بينت إحدى الدراسات أنه نتيجة التعويض المالي عن اختبار جهاز فحص الكثافة المعدنية للعظام، وتأمين العلاجات المضادة لهشاشة العظام، حصل انخفاض ملحوظ في عدد فحوص أجهزة الكثافة المعدنية للعظام. وافتُرض أن يكون سبب ذلك الإحتمال إن النساء المعرضات لخطر الإصابة بالمرض قد أجرين سلفًا الفحص الذي عوضت كلفته لاحقا" مؤسسة الضمان الصحي الوطني (كانوي – بواترين وآخرون، 2010). ووفقًا للدراسة ذاتها، لم تتم معالجة اللواتي خضعن لفحص أولي لجهاز الكثافة المعدنية للعظام لاحقًا بدواء مضاد لهشاشة العظام سوى لنسبة قليلة منهن بلغت 25%

اعتبارات التنفيذ

بالإمكان تخطي عوائق التنفيذ على مستوى المريض والنظام الصحي العام كما على الصعيدين المهني والتنظيمي.

Full Report

K2P Policy Brief- Full report

The Problem

Osteoporosis constitutes a major burden on the Lebanese healthcare system, inflicting a large proportion of the population, particularly among the elderly. Osteoporosis and its complications have significant toll in terms of morbidity. The annual hip fracture crude incidence rates for those over 50 years of age have been reported between 164 and 188/100 000 persons per year for females and between 88 and 107/100000 persons per year for males (Sibai et al, 2011). In a more recent comparative study, the annual overall hip fracture incidence ratios, per 100,000, ranged from 126.6 in 2014 to 213.2 in 2017 in women and 61.4 in 2015 to 111.7 in 2017 in men (Saad et al, 2019). The socioeconomic burden is also substantial whereby the average hospital bed days per year of a hip fracture corresponds to almost 1.5 times that of breast cancer or ovarian cancer (MOPH and National Cancer Registry, 2004). Nonetheless, despite the gravity of the disease, the effective screening of at risk populations, diagnosis and treatment of osteoporosis are increasingly challenged by gaps and constraints in the existing health system arrangements.

Osteoporosis is defined by the World Health Organization as a disease of low bone mineral density (BMD). A BMD more than 2.5 standard deviations (SD) below that of the young adult mean is an indication of osteoporosis (WHO 1994).

Osteoporosis is also defined by the National Institutes of Health as a skeletal disorder characterized by compromised bone strength predisposing to an increased risk of fracture. Fragility fracture is one component of osteoporosis, regardless of BMD (NIH, 2000).

Size of the Problem

In Lebanon, the most recent estimate on the prevalence of osteoporosis, using the WHO DXA- based operational definition, dates back to 2007, and showed that osteoporosis inflicts 33% of women and 23% of men aged 65 to 84 years (Baddoura et al, 2007). A recent study comparing the prevalence of osteoporosis to other more feared non-communicable diseases (NCDs) demonstrated that up to 80% of elderly Lebanese above the age of 65 years had osteoporosis, depending on how osteoporosis is defined. Prevalence of osteoporosis by far exceeded the prevalence of other NCDs, such as hypertension (53%), diabetes (21%), dyslipidemia (31%) and cardiovascular diseases (30%) (Bassatne et al., 2020). Prevalence of osteoporosis among those older than 50 years, as compared to other NCDs is presented in Figure 1.

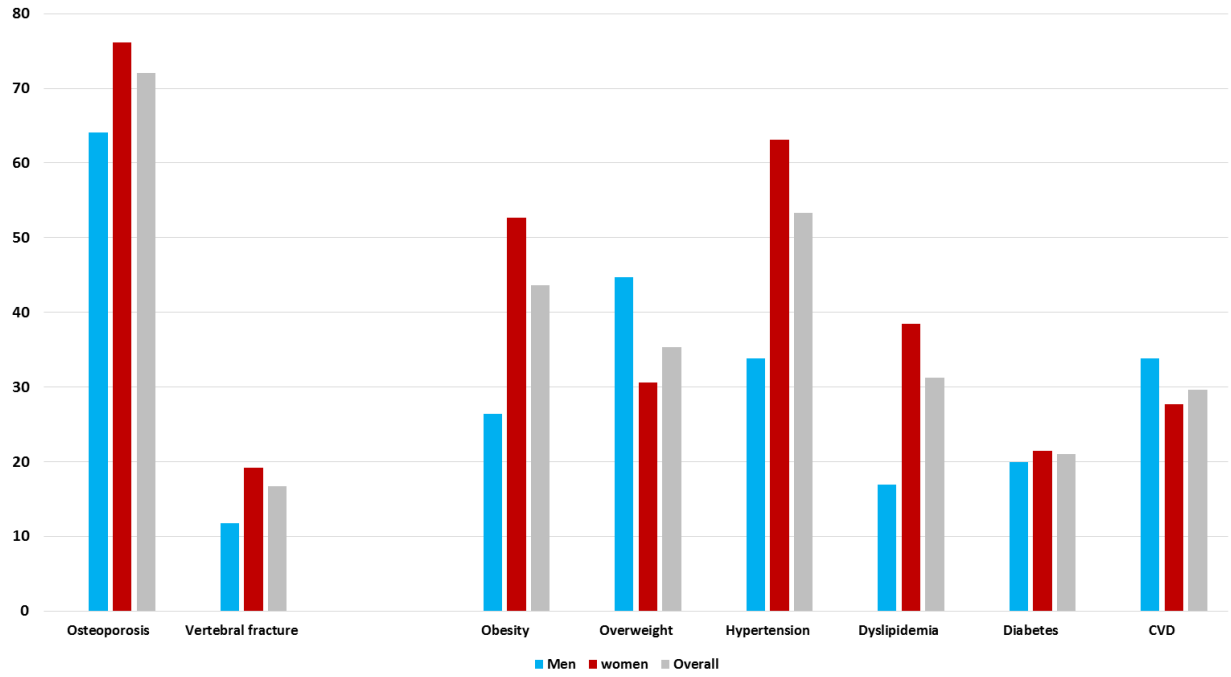

Figure 1 **Prevalence of Osteoporosis, Vertebral Fractures, and Other Non-Communicable Diseases in Lebanon**
(source: Bassatne et al, 2020; used with permission)

As for the complications of osteoporosis, morphometric fractures were identified in 20% of women and 12% of men in the greater Beirut area (Baddoura et al, 2007). Regarding hip fractures, according to the national hip fracture registry data, an average of 1200-1400 fractures occurred per year in individuals over the age of 50 years in 2007. Moreover, based on data provided by the MOPH, hip fracture rates for patients covered by the MOPH are expected to be on the rise over the upcoming few decades (MOPH, 2018). In addition, it is expected that by year 2050, approximately 27.4% of the population will be aged 65 years and older (Saxena, 2008). In line with these records, hip fracture rates are expected to witness dramatic increases in the upcoming decades (Baddoura et al, 2007; Sibai et al, 2011; Maalouf et al, 2013). Incidence and estimates of hip fractures are listed in Table 1.

Table 1 **Indicidence and estimates for hip fractures per 100,000**
(Sibai et al, 2011)

	2011	2030 estimate	2050 estimate
Women	164 - 188	179	193
Men	88 - 107	124	143

The financial burden of osteoporosis in Lebanon is not yet precisely quantified. However, annual and projected costs of hip fractures have been calculated and are expected to reach around 18 million dollars in 2050 (El Hajj Fuleihan et al, 2011) (Table 2). Despite the large projected financial burden, these

numbers do not take into account costs due to work absenteeism, medications use, and other less tangible costs, nor do they take into account the risk of fracture recurrence in the first few years after an index fracture (Saad, Beydoun, & El Hajj Fuleihan, 2019). Loss of productivity is estimated to be around 6 months in the workplace; and while 79% of hip fracture patients regain the capacity to walk normally, an 18% will continue to require help to do so (Maalouf et al, 1997).

Table 2 **Annual and projected costs of hip fractures**
(El Hajj Fuleihan et al, 2011)

Year	Cost USD
2011	7,716,775
2020 estimate	10,186,143
2050 estimate	17,902,918

As for risk factors for osteoporosis, aside from traditional factors, such as age, estrogen deficiency, and medication use, vitamin D deficiency maybe a significant contributing factor to the growing problem of osteoporosis in Lebanon. In this regard, several local reports have assessed the prevalence of vitamin D deficiency in Lebanon and the region. In one recent review on vitamin D level in the Middle East and North Africa, the prevalence of hypovitaminosis D, defined as a 25-hydroxyvitamin D level below the desirable level of 20 ng/ml, ranged between 12–96% in children and adolescents, and 54–90% in pregnant women. In adults, it ranged between 44 and 96%, and the mean 25-hydroxyvitamin D level varied between 11 and 20 ng/ml (Chakhtoura, Rahme, Chamoun, & El Hajj Fuleihan, 2018). In addition, experts have pointed out that follow up of patients with conditions that predispose them to osteoporosis such as cancer and diabetes, does not regularly involve screening or management of osteoporosis (K2P center stakeholders consultation, 2019).

Despite the evidence on the growing burden of osteoporosis, the management of osteoporosis in Lebanon beholds significant challenges and deficiencies. In one study conducted in a tertiary care center, it was found that during the hospitalization of patients admitted for the management of hip fractures, vitamin D level was assessed in only 39% of patients; a dietary and an osteoporosis consult were requested on only 32% and 22% of the cases, respectively. Only one fourth to a third of patients were discharged on calcium or vitamin D, and less than 5% on bisphosphonates. One-third of the women had BMD measurements prior to the index fracture, and only 12% of the total cohort had a BMD at the hospital post the index fracture (Saad, Beydoun, & El Hajj Fuleihan, 2019). These figures point to a very large gap between scientific evidence and clinical practice. Regrettably, a national comprehensive action plan to reduce the gap and improve the diagnosis and management of the disease is still lacking.

Global Context

Osteoporosis is considered a major public health problem worldwide as well as in the Middle East. Worldwide, an osteoporotic fracture occurs every 3 seconds, and a vertebral fracture every 22 seconds (IOF, 2017). Data on osteoporosis prevalence in countries from the region, as compared to those in Lebanon, is presented in Table 3.

Table 3 **Osteoporosis prevalence by country and gender** *(El Hajj Fuleihan et al, 2011)*.

Country	*Prevalence*	
	Women	**Men**
Egypt	28.4%	21.9%
Lebanon	33%	22.7%
Morocco	44.6%	13.4%

As for hip fractures, the number of hip fractures in Lebanon was 1500 cases in 2010 and is expected to increase to 2200 cases by 2020. Larger surges are also projected with countries of higher population densities, such as Iran and Turkey, whereby an increase by almost 12000 new cases is expected by 2020 (El Hajj Fuleihan et al, 2011). Despite the pronounced increase in hip fractures rates in the Middle East, epidemiological reports remain scarce (Hreybe et al, 2004; Badra et al, 2009; Maalouf et al, 2013; Kreidieh et al, 2014). Available studies reported that mortality rates post hip fracture in the region is 2-3 folds higher than those in Western populations (Baddoura, Hoteit, & El Hajj Fuleihan, 2011). Wide variations in hip fracture rates have been noted worldwide. Correlations, however, have been made between rising rates of urbanization and hip fractures across disparate geographic locations and cultures. Table 4 provides a snapshot of annual change in age-standardized hip fracture rates across many regions of the world. The secular trend in incidence designates a decrease until 2015 and then an increase afterwards, without specifying numbers. This is because these percent changes by far exceed those reported in the literature and exceed the expected even with 100% adherence with potent drugs (Saad et al., 2019).

Table 4 **Percent Annual Change in Age-Standardized Hip Fracture Rates in Women and Men Worldwide** (Ballane et al, 2014)

	Annual Change in Women (%)	**Annual Change in Men (%)**
Lebanon (2007-2008)	0	0
United States (1995-2005)	-2.45	-1.9
Netherlands (1993-2002)	-0.52	-0.21

Australia (1997-2007)	-2	-1.3
Japan (2001-2006)	3	3.5

Osteoporotic fractures constitute a major economic burden globally. This burden is expressed in the health and social service expenditures incurred, particularly with the increasing proportion of the elderly population. According to one systematic review that assessed the direct costs of osteoporotic fractures in the US, it was found that in the year following a fracture, medical and hospitalization costs were 1.6–6.2 times higher than pre-fracture costs and 2.2–3.5 times higher than those for matched controls. Analysis of the hospitalization costs by osteoporotic fracture type resulted in hip fractures identified as the most expensive fracture type with a unit cost ranging between 8,358 and 32,195 US dollars (Budhia et al, 2012). Moreover, a hip fracture is considered to be a serious consequence of falls in the elderly, with high reported mortality rates (Conley et al, 2019). As for Europe, one report estimated the economic burden of incident and prior fragility fractures in the countries of the European Union at € 37 billion. Incident fractures represented 66% of this cost, long-term fracture care 29% and pharmacological prevention 5%. Previous and incident fractures also accounted for 1,180,000 quality-adjusted life years lost during the year 2010 (Hernlund et al, 2013). There is also significant morbidity associated with hip fractures, with only 50% returning to their previous level of mobility and 10-20% of patients being discharged to a residential or nursing care placement (NHS Institute of innovation and improvement).

Osteoporosis remains globally under-recognized. According to the Women's Health Initiative, the projected number of women who will experience a clinical fracture in 1 year exceeded the combined number of women who would experience incident breast cancer, myocardial infarction, or stroke (Cauley et al., 2008). Despite this, osteoporosis still fails to be cited by the World Health Organization among its list of non-communicable diseases (WHO, 2019). This has probably further contributed to the problem of osteoporosis misdiagnosis. As for treatment, gaps in treatment continue to exist despite calls for adoption of effective evidence-based interventions such as the fracture liaison service (Akesson et al, 2014).

Underlying Factors

The following section focuses on the underlying factors at the governance, financial, and delivery level that may have contributed to the burden of osteoporosis and osteoporotic fractures in Lebanon. A systematic local assessment was undertaken to uncover such arrangements.

Governance

Efforts have been made by the MOPH to optimize osteoporosis care. In 2002, the CaMOP at AUBMC and members of the OSTEOS society developed the Lebanese guidelines for osteoporosis assessment and treatment. These guidelines were updated in 2007 and then in 2013 with the incorporation of the FRAX calculator. The guidelines were endorsed by the MOPH and presented at national meetings (El Hajj Fuleihan et al, 2008; Chakhtoura et al, 2017). However, not all guideline recommendations, such as the use of a western normative database to derive T-scores, are fully implemented.

The MOPH approved the multidisciplinary approach to the management of fragility fractures published by Maalouf et al, 2012, but have not adopted or disseminated them as national guidelines across all the Lebanese territories (El Hajj Fuleihan et al, 2011; Rizkallah et al, 2016).

The FLS is one of the recommended models by the guidelines and multiple osteoporosis organizations worldwide (IOF, 2019) that is not properly introduced in Lebanese hospitals yet. So far, neither the MOPH, nor the Lebanese Order of Physicians, nor the Lebanese Orthopedic Society has officially adopted this model (Rizkallah et al, 2016). However, the FLS has been proposed by the CaMOP since 2018, approved and launched as a quality care measure by the medical practice committee at AUBMC since January 2019. With the newly applied Health Information System, completing the FLS form will become mandatory upon admission of patients with hip fractures. This form includes requests for DXA scan, laboratory testing, endocrinology consultation, dietician consultation, physical therapy, and scheduled follow up visits (CaMOP, 2017).

As for the formation of registries, in 2008, the MOPH issued a decree requiring all hospitals to complete a form for each patient admitted for hip fracture during the year 2007. Requested data included patient name, age, gender, contact, admission and discharge dates, and surgery code (Maalouf et al, 2013). However, this national hip registry captures information exclusively on patient cared for by the MOPH, thus accounting for only around 50% of the Lebanese population. Despite such limitation, it constitutes the most robust and thorough registry in the region (Saad et al, 2019).

Following the launching of the Lebanese fracture risk assessment tool (FRAX) in 2009 (Kreidieh et al, 2014; IOF, 2014; Chakhtoura et al, 2017), the corresponding FRAX-based Lebanese osteoporosis treatment guidelines were initiated in 2012 and completed early 2014 (Chakhtoura et al, 2017). This linkage between the FRAX tool and guidelines was expected to have a great impact on its application and subsequently patient care (IOF, 2014). In Lebanon, the intense dissemination of the FRAX based Lebanese Guidelines substantially increased the number of FRAX hits between 2013 and 2019. The decline thereafter probably reflects a decrease in the number of outpatient visits incurred by the COVID-19 pandemic. FRAX hits per 100,000 population above age 50 varied between 40-

78/100,000 in years 2017, 2019, and 2020 compared to less than 5-10/1000,000 for the same periods for each of Jordan, Turkey and Iran (raw data obtained from E.V. McCloskey WHO CC Sheffield group). The number of FRAX hits/1,000 population in Lebanon exceeds that of France, Italy, and is 6-100 folds higher than that registered by other countries in this region (Chotiyarnwong et al., 2019).

In 2010, through a ministerial decree, the MOPH established the Lebanese National Task force for Osteoporosis and Metabolic Bone Disorders. This task force included members of various specialties caring for patients with osteoporosis including Endocrinology, Rheumatology, Orthopedics, Radiology and Obstetrics and Gynecology and societies such as the OSTEOS. The aim of this task force was to establish national programs for osteoporosis, revise and disseminate the current Lebanese Osteoporosis Guidelines, develop national quality assurance measures for densitometry testing, develop guidelines for the use of FRAX Lebanon and vitamin D assays, collect national data on non-hip fractures, and assess the social and economic burden of osteoporosis in Lebanon (El Hajj Fuleihan et al, 2011). Despite explicit support at the governmental level to endorse societal agendas, improvement in diagnosis and management of osteoporosis is still lagging behind. An inter-sectorial multidisciplinary concerted action plan is still much needed to pave the way to realize advances in osteoporosis care in Lebanon.

Financing

Third party payers reimburse most diagnostic tests and osteoporosis treatments, with variations depending on the guarantor coverage scheme or the premium purchased by patients (El Hajj Fuleihan et al, 2011). The MOPH and third party payers such as NSSF, COOP, Army, and Internal Security cover the cost of some bisphophonates, calcitonin, denosumab, and parathyroid hormone but not raloxifene. If generic drugs exist, they are given coverage preference over branded medicines (El Hajj Fuleihan et al, 2011).

The cost of a DXA scan ranges between 50,000 LBP and 800,000 LBP depending on factors such as the number of sites tested by scan and geographic location of the testing center. The DXA scan, blood tests, and treatments are 80 to 100% covered or reimbursed by several health plans, not including the MOPH, provided justification for testing is available. However, in some cases, decision for financial coverage is not scientifically based but rather dependent on the personal judgment of the staff responsible for approvals. Such staff, in selective cases, may choose to withhold approvals for investigations or treatments despite medical eligibility; or alternatively, may choose to financially cover DXA scans and osteoporosis treatments for ineligible patients. As such, not all guarantors abide by the MOPH-endorsed national Lebanese guidelines on ‘who to test and who to

treat' (El-Hajj Fuleihan et al, 2007). Driven by considerations of cost-effectiveness, the screening policy in Lebanon is based on "targeting high risk population" instead of "mass screening", (El Hajj Fuleihan et al, 2005).

Delivery

There is a huge care gap between scientific evidence and clinical practice regarding osteoporosis in Lebanon, as in countries worldwide (El Hajj Fuleihan et al, 2005; IOF, 2017). Regarding the diagnostic equipment used, Lebanon has the highest rate of DXA machines per million population in the region (›20 per million), exceeding the recommended average of 11 DXA machines per million population in Europe. DXA machines include different types of instruments such as Hologic, Norland, and Lunar machines (El Hajj Fuleihan et al, 2011). However, the latest estimates showed that out of the 130 DXA machines in Lebanon, only 82 are FDA approved. In addition, there is a lack of national quality assurance measures for densitometry testing and reading which consequently affects the detection of osteoporosis and the accuracy of results (El Hajj Fuleihan et al, 2011). Furthermore, the MOPH does not have a list of all the centers across Lebanon that perform BMD testing (K2P center stakeholder's consultation, 2019), nor is the activity of such centers monitored; thus paving the way for poor quality of performance.

Centers across Lebanon also depend on different BMD reference databases to extract their T-scores and Z-scores, adding to the problem of inconsistent results (El Hajj Fuleihan et al, 2007). Some centers use a local database, others use a Spanish, French or a universal western database, despite recommendations of the Lebanese guidelines, the ISCD, and the IOF to use the NHANES database (El Hajj Fuleihan et al, 2005; El Hajj Fuleihan et al, 2007; El Hajj Fuleihan et al, 2008; ISCD, 2019a). This in turn causes major discrepancies in test results across centers and leads to erroneous diagnosis and treatment of osteoporosis (El Hajj Fuleihan et al, 2005; El Hajj Fuleihan et al, 2007; El Hajj Fuleihan et al, 2008; Badra et al, 2009). With regards to quality control of bone density measurements, this is unfortunately not mandated neither by the state nor insurers. Thus, the quality and reliability of scan images and reports is often doubtful, potentially leading to misdiagnosis and mismanagement, and contributing to the care gap. As such, only one center in Lebanon has its faculty and staff rigorously abide by quality assurance measures and are all certified by the International Society for Clinical Densitometry. It is also the only International Society for Clinical Densitometry (ISCD) accredited facility outside the United States (ISCD, 2019b).

(ISCDb, 2019).

As for the availability of tools, the Lebanese fracture risk assessment tool (FRAX) was launched in 2009, becoming an essential tool for physicians in Lebanon and set the stage as a model for the region (Kreidieh et al, 2014; IOF,

2014; Chakhtoura et al, 2017). Physicians became able to target high-risk individuals more efficiently, therefore enhancing the allocation of the limited healthcare resources (Al-Azar, 2009). Despite the cited benefits of the FRAX tool, there is still limited familiarity about the tool's scoring system and its clinical application especially in primary healthcare settings (Rizkallah et al, 2016; Beshyah, Al-Saleh, El Hajj Fuleihan, 2019). In addition, several challenges regarding the use of the tool were identified. In a recent survey assessing osteoporosis care gaps in the Middle East and North Africa, only 42% of participating clinicians reported using FRAX despite that two thirds were aware of this tool. Among the Lebanese subpopulation, 87% of respondents reported using FRAX in their practice. Among those who did not use FRAX, being 'too busy to do it' was the most common reported barrier to use (Beshyah, Al-Saleh, El Hajj Fuleihan, 2019).

Public awareness regarding osteoporosis has also been assessed. One study found out that due to the limited awareness about osteoporosis, especially among Lebanese women aged 50 years and older, delays in diagnosis and treatment may incur, eventually resulting in a high socioeconomic burden (Ahmadieh et al, 2018).

As for professional training, there are few certified osteoporosis training courses in the region, provided by both the IOF and the ISCD (El Hajj Fuleihan et al, 2011). However, very few centers have personnel who attend these trainings or have obtained ISCD certificates. In Lebanon, courses used to be regularly held each year, but less frequently recently due to decreasing attendance rates and financial challenges (K2P center stakeholder's consultation, 2019). Such courses are hosted by the Calcium Metabolism and Osteoporosis Program and OSTEOS, and endorsed by the MOPH (El Hajj Fuleihan et al, 2011). Courses aim at increasing knowledge and enhancing quality in diagnosis and care. In addition, with further studies and after passing an examination, courses pave the way for two optional certificates of attestation, namely the International Society for Clinical Densitometry Certified Clinical Densitometrist (ISCD CCD) and the International Society for Clinical Densitometry Certified Densitometry Technologist (ISCD CDT). These certifications are valid for five years only and are renewable upon further testing or collection of Continued Medical Education credits (IOF, 2015). Certification and its renewal can be completed online (ISCD, 2019c). Furthermore, these training courses and certifications are not mandatory for healthcare providers managing osteoporosis cases in Lebanon (K2P center stakeholder's consultation, 2019).

Elements of a policy approach to address the problem

The following three elements form a comprehensive approach for reducing the treatment gap and public health burden of osteoporotic fractures.

Element 1› Practice improvement aiming at enhancing the delivery of services and improving osteoporosis-related outcomes.

Element 2› Public Education and Awareness Aiming at Enhancing Knowledge and Changing Behaviors.

Element 3› Securing Financial Coverage for Osteoporosis Diagnosis and Management.

Elements

Policy Elements and Implementation Considerations

Three elements to address the problem of osteoporosis in Lebanon through enhancing osteoporosis diagnosis and management are proposed.

The methodology for formulation of elements consisted of three phases:

Phase 1, through which a comprehensive search of the literature was undertaken to identify articles -systematic reviews and single studies- addressing public health practices targeting osteoporosis. Search strategy consisted of reviewing the following databases: Medline/Pubmed (MeSH term: osteoporosis; limits: systematic reviews, English Language, humans), IMEMR (keyword: osteoporosis), ProQuest Health Management (keyword: osteoporosis, limits: peer-reviewed, scholarly articles, reviews/literature reviews/evidence based healthcare), Health Evidence (keyword: osteoporosis), Health Systems Evidence (keyword: osteoporosis), WHO global health library (keyword: osteoporosis, limits: evaluated systematic reviews/health technology assessment/overview/health economic evaluation, English), Cochrane Library (keyword: osteoporosis), and Embase (keyword: osteoporosis; limits: systematic reviews). Last search was done on September 2019. Only articles published in English, and from the year 1990 and forward were included. Articles with purely clinical scope, such as those assessing a specific medical treatment for osteoporosis, were also excluded. Based on research conducted during this phase, 5709 articles were retrieved. Articles were then reviewed and segregated into themes. Themes included: physician support tools, care delivery models, quality control measures, public and provider education, and osteoporosis financing.

Phase 2 consisted of exploring the identified themes and mapping them with the problems and gaps identified through the exploration of the local context. As a result of this mapping process, three options (elements of a solution) were formulated based on the relevant themes identified.

Phase 3 consisted of fine searches addressing the formulated elements and their components. Last search was done on September 2019. Only articles published in English, and from the year 1990 and forward were included. As a result of this fine search, 195 additional articles were reviewed.

Through this triphasic methodology, a total of 5904 articles were reviewed, with the retrieval of 70 relevant articles used in the synthesis of elements. These articles consisted of 14 systematic reviews and 56 individual studies. The vast majority of the retrieved studies were conducted in high-income

SUMMARY

Element 1
Practice improvement aiming at enhancing the delivery of services and improving osteoporosis-related outcomes

Element 2
Public Education and Awareness Aiming at Enhancing Knowledge and Changing Behaviors.

Element 3
Securing Financial Coverage for Osteoporosis Diagnosis and Management

countries. Results on benefits, harms, cost, cost-effectiveness, and uncertainty of interventions are presented below. Stakeholders interviewed during preparation of this policy brief commended the proposed elements.

Element 1

Practice improvement aiming at enhancing the delivery of services and improving osteoporosis-related outcomes

This element explored several approaches aiming at enhancing osteoporosis-targeted clinical practice. These approaches included the use of physician support tools, implementation of changes in the care delivery model, quality control, use of established (FDA-approved) equipment, healthcare workers training, and other multifaceted interventions.

Practice improvement through the use of **physician support tools** is known to have a positive impact on the utilization of diagnostic approaches and medications and the adoption of healthy habits. One systematic review revealed that combining physicians' digital reminders and a patient risk assessment strategy resulted in a significant reduction in fractures incidence and increased use of osteoporosis therapy among high risk patients (Kastner & Straus, 2008). Another study revealed that distributing an evidence-based guideline for prevention of osteoporosis on health educational programs at municipal health centers resulted in increased dietary calcium intake for postmenopausal women and increased use of exercise for elderly persons, as compared to pre-intervention (Nakatani et al, 2012). One study demonstrated that patient-specific clinical guideline advice delivered to the primary care provider by electronic medical record message or electronic reminder resulted in around 10-fold increase in the number of patients receiving post-fracture BMD measurement or osteoporosis medication as compared to usual care (Feldstein et al, 2006). With regard to the cost-effectiveness of the adoption of guidelines, one study revealed that the cost per QALY gained for the screen-and-treat strategy (universal bone densitometry in women aged 65 and older combined with alendronate treatment for those diagnosed with osteoporosis) was $43,000 per QALY gained for 65-year-old women and $5,600 per QALY gained for 75-year-old women. For 85- and 95-year-old women, the screen-and-treat strategy was cost saving (Schousboe et al, 2005).

Several **care delivery models** demonstrated clear success in improving a wide spectrum of outcomes related to osteoporosis. According to two studies, implementation of disease management programs targeting patients at risk for osteoporosis resulted in a significant increase in the number of screening DXA scans performed and the number of patients receiving anti-osteoporosis medications; along with a significant decrease in the hip fracture rate, as compared to pre-intervention (Newman et al, 2003; Greene & Dell, 2010).

Moreover, in a predictive model, the disease management program, as compared to no intervention, resulted in an overall reduction in health care costs of around US$7.8 million over a 5-year period (Newman et al, 2003). As compared to controls, adoption of the case management model of care has also been shown to significantly increase BMD screening and treatment initiation with antiresorptive with or without vitamin D therapy in outpatients presenting with acute low trauma non-hip fracture, according to one systematic review (Bell, Strand, & Inder, 2014). The same study revealed evidence of reduced fracture recurrence and a significant increase in the number of referrals to a specialist bone clinic. Specifically, nurse-led case management following wrist surgery resulted in a higher likelihood of patients undergoing BMD testing and receiving appropriate care as compared to patients receiving a multifaceted intervention that includes patients education and physicians reminders only delivered at the clinic (Majumdar et al, 2011a). Another study revealed that case-management led to substantially greater improvements in bisphosphonate treatment and appropriate care within 6 months of fracture than the active control (Majumdar et al, 2018). Cost for case management ranged between 44 (Majumdar et al, 2011a) and 56 (Majumdar et al, 2009) Canadian dollars per patient, according to two studies. As for cost-effectiveness, two studies demonstrated that case-management is highly cost-effective (Sander et al, 2008; Majumdar et al, 2009; Majumdar, 2018), particularly when considering the fractures prevented through adoption of this model. Two systematic reviews uncovered the effect of task shifting in the management of osteoporosis. One systematic review revealed that as compared to controls, task shifting through one-to-one consultation(s) with a healthcare professional who delivered a variety of services resulted in improved quality of life, medication compliance, and calcium intake of patients (Lai, Chua, & Chan, 2010). Another systematic review demonstrated that as compared to controls, pharmacist delivered interventions applied at various settings improved BMD testing and calcium intake among patients at high risk for osteoporosis (Elias, Burden, & Cadarette, 2011). Another care delivery model evaluated included the implementation of a fracture liaison service. According to several studies, a fracture liaison service applied at the hospital setting improved patient evaluation and management (McLellan, 2003; Bogoch et al, 2006; Carpintero et al, 2009; Wallace, Callachand, Elliott, & Gardiner, 2011), referral (Bogoch et al, 2006), adherence to treatment (Chevalley et al 2002; Boudou et al, 2011), and resulted in fewer fractures (Dell, 2011; Solomon et al, 2014; Yates et al, 2015) and improved QALYs, as compared to pre-intervention (Solomon et al, 2014; Yates et al, 2015). In this regard also, several studies revealed that a fracture liaison service was cost-effective (Mclellan et al, 2011; Cooper, Palmer, & Seibel, 2012; Ahmed et al, 2012; Solomon et al, 2014; Yates et al, 2015), with incremental cost-effectiveness ratio reaching up to $31,749 (Yates et al, 2015). Fracture liaison service was mostly cost-effective when delivered by a case-manager (Majumdar et

al, 2019). Finally, comparing BMD study reporting style revealed that patients receiving 'consultative' report received more prescription treatment according to guidelines as compared with those receiving the 'results only' format (Oppermann et al, 2010).

Studies have also attempted to compare results obtained through using different BMD measuring devices. Both Hologic and Norland systems were comparable in terms of precision, accuracy, linearity of response, and exposure efficiency (Lai et al, 1992). However, three studies reported that despite significant correlations, the agreement between the results of the Lunar and Hologic instruments was not high (Genant et al, 1994; Pocock et al, 1997; Gillette-Guyonne et al, 2003). As bone mineral content increased, an underestimate of change in bone mineral density occurs, with the change in BMD underestimated to a greater extent by the Hologic instrument as compared to the Lunar instrument (Peel & Eastell, 1995). Discordance in the results was also demonstrated with higher BMD values obtained through the use of the Challenger device as compared to the Hologic device (Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005). In the same study, values were obtained using affordable densitometry devices that were not approved nor commonly used in developed countries. As a result, and according to several studies, **standardization and calibration** are essential for minimizing such discrepancies between various densitometers (Genant et al, 1994; Faulkner, Roberts, & McClung, 1996). Furthermore, most studies advocated for caution against the use of non-established densitometers that potentially lead to over or under diagnosis of patients and inappropriate treatment strategies (Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005). Studies also cautioned against combining data on the rate of bone loss acquired using different manufacturers' densitometers (Peel & Eastell, 1995) or comparing DXA measurements using different machines (Gillette-Guyonne et al, 2003).

As for the adoption of **quality control measures**, one study emphasized that quality control of bone densitometry improved scan quality, increased the number of usable scans, and reduced significantly the difference in the duplicate scans (Wahner et al, 1994). Another study concluded that the development of quality control protocols enables detection of changes in machine function and adjustment for alterations in performance during the course of longitudinal evaluations (Orwoll, Oviatt, & Biddle, 1993).

Studies have demonstrated effectiveness of several approaches aiming at enhancing the **knowledge of healthcare providers**. One study revealed that continuing medical education targeting physicians resulted in significant improvement in the use of FRAX, fall risk assessment, calcium levels, vitamin D levels, and medication adherence, as compared to pre-intervention (Greenspan et al, 2013). Another study revealed that an osteoporosis educational program presented to nurses as part of a continuing education symposium resulted in significantly higher osteoporosis-related knowledge along with increased

willingness to engage in osteoporosis preventive behaviors and to discuss osteoporosis with their family, friends, patients, and primary care provider (Berarducci, Lengacher, & Keller, 2002). Delivery of an early educational intervention was also deemed valuable as according to one study, an osteoporosis educational program at a nursing educational institute targeting female pre-internship nursing students significantly increased osteoporosis knowledge, osteoporosis health beliefs, and self-efficacy (Zhang et al, 2012).

Practice improvement interventions were also implemented and evaluated as part of **multifaceted interventions**. One systematic review revealed that combining reminders and education targeted to physicians and patients at the clinical setting significantly increased BMD testing and osteoporosis medication use among high risk patients (Kastner & Straus, 2008). In another systematic review, implementation of various interventions designed to modify the behavior of healthcare professionals or implement a service delivery change resulted in positive effects on the outcomes of rates of BMD scanning and osteoporosis treatment, as compared to controls (Little & Eccles, 2010). In addition, one systematic review revealed that multifaceted interventions involving physician notification, physician education, and patient education resulted in an increased incidence of osteoporosis treatment initiation and BMD testing for high-risk patients, as compared to pre-intervention (Laliberte et al, 2011). Nonetheless, two systematic reviews concluded that monitoring subjects' bone turnover markers at the clinical setting along with patients' and physicians' education resulted in improvement in treatment adherence (Gleeson et al, 2009; White et al, 2010), though the value of the isolated use of bone turnover markers in clinical practice remains uncertain (Vasikaran et la, 2011). Moreover, one systematic review demonstrated that compared to usual care, combination of a general practitioner alerting system on a patient's increased risk of osteoporosis along with a patient-directed intervention educating patients and reminding them to visit their general practitioner improved the general practitioner's behavior with regard to diagnostic BMD testing and osteoporosis medication prescribing (Tzortziou et al, 2016). One systematic review also revealed that simplification of dosing regimens (with and without patient support programs), electronic prescription, and pharmacist intervention increased medication adherence or persistence as compared to controls (Hiligsmann et al, 2013). Another systematic review revealed that patient self-scheduling of DXA plus education increased the outcome of BMD testing (Nayak & Greenspan, 2018). As for cost-effectiveness, in one Markov simulation model, a multifaceted intervention consisting of case-based modules, audit and feedback of physicians' management compared with their peers, and printed physician and patient-targeted educational materials resulted in an incremental cost-effectiveness ratios of 298,000 per QALY and 206,000 per hip fracture averted, with such ratios

Task shifting is the rational redistribution of tasks among health workforce teams (WHO, 2008).

increasing significantly when the proportion of prescriptions for generic bisphosphonates was increased to 75% (Beukelman et al, 2010). One study also estimated the cost of a multifaceted intervention directed at patients with fragility fractures of the wrist through education and counseling and their primary care physicians through reminders and opinion leader based treatment guidelines to be $12 per patient. For every 100 patients receiving the intervention, three fractures would be prevented, 1.1 quality-adjusted life years gained, and $26,800 saved by the healthcare system over their remaining lifetime (Majumdar et al, 2011b).

Table 5 **Key findings from systematic reviews and single studies**

Category of finding	**Element 1**
Benefits	**Practice Improvement through the Use of Physician Support Tools** One systematic review revealed that combining physicians' digital reminders and a patient risk assessment strategy resulted in a significant reduction in fractures incidence and increased use of osteoporosis therapy among high risk patients, as compared to controls (Kastner & Straus, 2008). One study revealed that distributing an evidence-based guideline for prevention of osteoporosis increased dietary calcium intake for postmenopausal women and increased use of exercise for elderly persons, as compared to pre-intervention (Nakatani et al, 2012). One study demonstrated that patient-specific clinical guideline advice delivered by electronic medical record message or electronic reminder resulted in around 10-fold increase in the number of patients receiving post-fracture BMD measurement or osteoporosis medication as compared to usual care (Feldstein et al, 2006). **Practice Improvement through Changes in Care Delivery Model** a. Disease Management Programs Two studies revealed that a disease management program targeting patients at risk for osteoporosis resulted in a significant increase in the number of screening DXA scans done and the number of patients receiving anti-osteoporosis medications; along with a significant decrease in the hip fracture rate, as compared to pre-intervention (Newman et al, 2003; Greene & Dell, 2010). b. Case Management One systematic review revealed that, as compared to controls, case management resulted in a significant increase in BMD screening and treatment initiation with antiresorptive with or without vitamin D therapy in outpatients presenting with

Category of finding	Element 1
	acute low trauma non-hip fracture. There was also evidence of reduced fracture recurrence and a significant increase in the number of referrals to a specialist bone clinic (Bell, Strand, & Inder, 2014). Another study revealed that case-management led to substantially greater improvements in bisphosphonate treatment and appropriate care within 6 months of fracture than the active control (Majumdar et al, 2018). One study demonstrated that osteoporotic patients receiving nurse-led case management were more likely to undergo BMD testing and receive appropriate care as compared to patients receiving a multifaceted intervention that includes patients education and physicians reminders (Majumdar et al, 2011a). c. Task Shifting One systematic review revealed that as compared to controls, task shifting resulted in improved quality of life, medication compliance, and calcium intake of patients (Lai, Chua, & Chan, 2010). One systematic review demonstrated that as compared to controls, pharmacist delivered interventions improved BMD testing and calcium intake among patients at high risk for osteoporosis (Elias, Burden, & Cadarette, 2011). d. Changes in BMD study reporting One study revealed that patients receiving 'consultative' report received more prescription treatment according to guidelines as compared with those receiving the 'results only' format (Oppermann et al, 2010). e. Fracture liaison service Several studies concluded that a fracture liaison service applied at the hospital setting improved patient evaluation and management (McLellan, 2003; Bogoch et al, 2006; Carpintero et al, 2009; Wallace, Callachand, Elliott, & Gardiner, 2011), referral (Bogoch et al, 2006), adherence to treatment (Chevalley et al 2002; Boudou et al, 2011), and resulted in fewer fractures (Dell, 2011; Solomon et al, 2014; Yates et al, 2015) and improved QALYs, as compared to pre-intervention (Solomon et al, 2014; Yates et al, 2015). **Practice Improvement through Quality Control and the Use of Established Equipment** Several studies reported discordance in results (Peel & Eastell, 1995; Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005), correlation but with poor agreement (Genant et al, 1994; Pocock et al, 1997; Gillette-Guyonne et al, 2003), and occasionally comparability in results (Lai et al, 1992) among different BMD devices; and hence the need to perform initial and follow up measurement on the same FDA-approved

Category of finding	Element 1
	machine, with the application of rigorous quality assurance protocols. According to several studies, standardization and calibration may aid in the elimination of discrepancies between results of Hologic and Lunar devices (Faulkner, Roberts, & McClung, 1996), and among Hologic, Lunar, and Norland devices (Genant et al, 1994). Most studies advocated for caution against the use of non-established densitometers that potentially leads to over or under diagnosis of patients and inappropriate treatment strategies (Arabi, Salamoun, Ballout, & El Hajj Fuleihan, 2005). Studies also cautioned against combining data on the rate of bone loss acquired using different manufacturers' densitometers (Peel & Eastell, 1995) or comparing DXA measurements using different machines (Gillette-Guyonne et al, 2003). One study emphasized that quality control of bone densitometry improved scan quality, increased the number of usable scans, and reduced significantly the difference in the duplicate scans (Wahner et al, 1994). One study concluded that the development of quality control protocols enables detection of changes in machine function and adjustment for alterations in performance during the course of longitudinal evaluations (Orwoll, Oviatt, & Biddle, 1993). **Practice Improvement through Healthcare Workers Training** One study revealed that continuing medical education targeting physicians resulted in significant improvement in the use of FRAX, fall risk assessment, calcium levels, vitamin D levels, and medication adherence, as compared to pre-intervention (Greenspan et al, 2013). Two studies revealed that a nursing osteoporosis educational program resulted in significantly higher osteoporosis-related knowledge (Berarducci, Lengacher, & Keller, 2002; Zhang et al, 2012), improved self-efficacy (Zhang et al, 2012), and increased nurses' willingness to engage in osteoporosis preventive behaviors and discussions (Berarducci, Lengacher, & Keller, 2002). **Practice Improvement as Part of Multifaceted Interventions** One systematic review revealed that combining reminders and education targeted to physicians and patients significantly increased BMD testing and osteoporosis medication use among high risk patients (Kastner & Straus, 2008). In one systematic review, implementation of various interventions designed to modify the behavior of healthcare

Category of finding	Element 1
	professionals or implement a service delivery change resulted in positive effects on the outcomes of rates of BMD scanning and osteoporosis treatment, as compared to controls (Little & Eccles, 2010). One systematic review revealed that multifaceted interventions involving physician notification, physician education, and patient education resulted in an increased incidence of osteoporosis treatment initiation and BMD testing for high-risk patients, as compared to pre-intervention (Laliberte et al, 2011). Two systematic reviews concluded that monitoring subjects' bone turnover markers along with patients and physicians education resulted in improvement in treatment adherence (Gleeson et al, 2009; White et al, 2010). One systematic review revealed that compared to usual care, combination of a general practitioner alerting system on a patient's increased risk of osteoporosis and a patient-directed intervention improves the general practitioner's behavior with regard to diagnostic BMD testing and osteoporosis medication prescribing (Tzortziou et al, 2016). One systematic review revealed that simplification of dosing regimens (with and without patient support programs), electronic prescription, and pharmacist intervention increased medication adherence or persistence as compared to controls (Hiligsmann et al, 2013). One systematic review revealed that patient self-scheduling of DXA plus education increased the outcome of BMD testing (Nayak & Greenspan, 2018).
Potential harms	Literature review did not reveal any potential direct harms
Cost and/ or cost effectiveness in relation to the status quo	One study revealed that the cost per QALY gained for the screen-and-treat strategy (universal bone densitometry in women aged 65 and older combined with alendronate treatment for those diagnosed with osteoporosis) was $43,000 per QALY gained for 65-year-old women and $5,600 per QALY gained for 75-year-old women. For 85- and 95-year-old women, the screen-and-treat strategy was cost saving (Schousboe et al, 2005). In a predictive model of no intervention, the disease management program resulted in an overall reduction in health care costs of around US$7.8 million over a 5-year period (Newman et al, 2003). One study that analyzed the cost-effectiveness of case management of patients with fragility fractures in a tertiary care center that manages 500 patients with fragility fractures found out that case management reduced the number of

Category of finding	Element 1
	subsequent hip fractures from 34 to 31 in the first year, with a net hospital cost savings of Canadian $48,950. Hiring a coordinator remains a cost-saving measure even when the coordinator manages as few as 350 patients annually. Moreover, greater savings are anticipated after the first year and when additional costs such as rehabilitation and dependency costs are considered (Sander et al, 2008). One study estimated that the cost of case-management per patient was $44 (Canadian dollar) versus $12 for the multifaceted intervention (Majumdar et al, 2011a). One study revealed that the direct cost per participant was $66 Canadian dollars for the case-manager intervention compared to $18 Canadian dollars for the control (Majumdar et al, 2018). One study estimated that case management cost for patients with hip fractures was $56 (Canadian dollars) per patient. Compared with usual care, for every 100 patients case managed, 6 fractures were prevented, 4 quality-adjusted life-years were gained, and $260000 was saved by the health care system (Majumdar et al, 2009). Many studies revealed that a fracture liaison service was cost-effective (Mclellan et al, 2011; Cooper, Palmer, & Seibel, 2012; Ahmed et al, 2012; Solomon et al, 2014; Yates et al, 2015), with incremental cost-effectiveness ratio reaching up to $31,749 (Yates et al, 2015) or 17,291 Australian Dollars per QALY gained (Cooper, Palmer, & Seibel, 2012). Fracture liaison service was mostly cost-effective when delivered by a case-manger as compared to solely encouraging patients to seek care (Majumdar et al, 2019). In one Markov simulation model, a multifaceted intervention consisting of case-based modules, audit and feedback of physicians' management compared with their peers, and printed physician and patient-targeted educational materials resulted in incremental cost-effectiveness ratios of 298000 per QALY and 206,000 per hip fracture averted, with such ratios increasing significantly when the proportion of prescriptions for generic bisphosphonates was increased to 75% (Beukelman et al, 2010). One study estimated the cost of a multifaceted intervention directed at patients with fragility fractures of the wrist through education and counseling and their primary care physicians through reminders and opinion leader based treatment guidelines to be $12 per patient. For every 100 patients receiving the intervention, three fractures (one hip fracture) would be prevented, 1.1 quality-adjusted life year gained, and

Category of finding	Element 1
	$26,800 saved by the healthcare system over their remaining lifetime (Majumdar et al, 2011b).
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the approach element were pursued)	Effect of task shifting on BMD testing, medication persistence, knowledge, and other lifestyle modifications were not conclusive (Lai, Chua, & Chan, 2010) Two of the three RCTs in the systematic review of pharmacist delivered interventions had high risk of bias, and no study examined the impact of pharmacist intervention on osteoporosis treatment adherence (Elias, Burden, & Cadarette, 2011).

Element 2

Public Education and Awareness Aiming at Enhancing Knowledge and Changing Behaviors

This element explored public educational and awareness interventions resulting in changing knowledge and behaviors towards osteoporosis. Assessed strategies included delivery of group and public educational programs, delivery of communication materials such as letters or brochures, and delivery of programs targeting special populations such as women, men, the elderly, and the young.

Several studies demonstrated effectiveness of **public educational** interventions. One systematic review revealed that group osteoporosis educational programs applied at various settings and consisting of three themes: knowledge of osteoporosis, medication and diet, and exercise increased patients' knowledge of osteoporosis as well as their health-related quality of life, physical activity and psychosocial functioning, as compared to pre-intervention (Jensen et al, 2014). Another systematic review demonstrated that healthcare professional-led education improved adherence with treatment recommendations for patients with osteoporosis or those at high risk for the disease (Smith, 2010). Public prevention educational programs were also fount to increase the level of knowledge among participants (Sedlak, Doheny, & and Jones, 2000). In contrast, several other studies reported poor effectiveness of educational interventions on outcomes such as medication adherence (Hiligsmann et al, 2013), health beliefs (Sedlak, Doheny, & and Jones, 2000), and self-efficacy (Nieto-Vázquez et al, 2009). Various hypotheses for such results were postulated, including that a single intervention alone is unlikely to yield significant results. In these studies, and despite the absence of evidence of direct harm, public education can be recognized as a waste of resources.

Educational interventions **targeting sub-populations** were also applied and assessed. One study revealed that education applied at various clinical settings and targeting postmenopausal women through a brochure and a letter explaining how to self-schedule a DXA scan resulted in a significant increase in

the rate of DXA completion (Warriner et al, 2012). Another study revealed that delivery of an educational program on the prevention, diagnosis, and treatment of osteoporosis for women aged 60 years and older at different community settings (churches, retirement homes, and senior citizen centers) resulted in significant changes among the majority of the participants including increasing calcium in their diet, discussing osteoporosis with their health care provider, checking their home environment for safety, and discussing what they had learned with others (Curry et al, 2002). Moreover, a workshop designed to educate women about osteoporosis and to encourage them to take appropriate preventive steps or to make informed treatment decisions resulted in a significant increase in participants' knowledge of osteoporosis, with persistence of effect after 6 months of intervention. There was also a significant increase in calcium intake (Ribeiro & Blakeley, 2001). As for cost-effectiveness, one study demonstrated that a patient decision aid that could improve treatment initiation rates or adherence by 20%, or a linear combination of the two, in osteoporotic women aged more than 70 years over a 3-year treatment period was found to have an incremental cost-effectiveness ratio below $50,000/QALY (Penton et la, 2016). As for interventions targeting men, one study revealed that an osteoporosis educational program resulted in a statistically significant increase in both knowledge and health beliefs about osteoporosis and preventive behaviors in comparison with the control group (Tung & Lee, 2006).

The impact of public education on the young generation and the elders was also assessed. Three studies demonstrated that an osteoporosis prevention education program targeting the young delivered at school or university settings resulted in statistically significant increases in scores related to osteoporosis knowledge (Brown & Schoenly, 2004; Chan et la, 2007; Nieto-Vázquez et al, 2009). Two studies showed that an osteoporosis educational program targeting elders delivered at a residential setting or the rehabilitation ward of a geriatric facility improved elders' knowledge (Davis and White, 2000; Ben-Natan, Heyman, & Ben Israel, 2014), health beliefs, and intention to adhere to drug therapy (Ben-Natan, Heyman, & Ben Israel, 2014) as compared to pre-intervention.

Table 6 **Key findings from systematic reviews and single studies**

Category of finding	**Element 2**
Benefits	One systematic review revealed that group osteoporosis educational programs increased patients' knowledge of osteoporosis as well as their health-related quality of life, physical activity, and psychosocial functioning, as compared to pre-intervention (Jensen et al, 2014). One systematic review demonstrated that healthcare professional-led education improved adherence with treatment recommendations for patients with osteoporosis or those at high risk for the disease (Smith, 2010).

Category of finding	Element 2
	One single study concluded that osteoporosis public prevention educational programs increased the level of knowledge among participants (Sedlak, Doheny, & and Jones, 2000). One study revealed that education targeting postmenopausal women resulted in a significant increase in the rate of DXA completion whereby 17.3% of women in the intervention group completed a DXA, compared to 5.2% in the control group (Warriner et al, 2012). One study revealed that delivery of an educational program on the prevention, diagnosis, and treatment of osteoporosis for women aged 60 years and older resulted in significant changes among the majority of the participants including increasing calcium in their diet, discussing osteoporosis with their health care provider, checking their home environment for safety, and discussing what they had learned with others (Curry et al, 2002). One study revealed that a workshop designed to educate women about osteoporosis and to encourage them to take appropriate preventive steps or to make informed treatment decisions resulted in a significant increase in participants' knowledge of osteoporosis, with persistence of effect after 6 months of intervention. There was also a significant increase in calcium intake (Ribeiro & Blakeley, 2001). One study revealed that an osteoporosis educational program targeting men resulted in a statistically significant increase in both knowledge and health beliefs about osteoporosis and preventive behaviors in comparison with the control group (Tung & Lee, 2006). Three studies demonstrated that an osteoporosis prevention education program targeting the young delivered at school or university settings resulted in statistically significant increases in scores related to osteoporosis knowledge (Brown & Schoenly, 2004; Chan et la, 2007; Nieto-Vázquez et al, 2009). Two studies showed that an osteoporosis educational program targeting elders improved elders' knowledge (Davis and White, 2000; Ben-Natan, Heyman, & Ben Israel, 2014), health beliefs, and intention to adhere to drug therapy (Ben-Natan, Heyman, & Ben Israel, 2014) as compared to pre-intervention.
Potential harms	Literature review did not reveal any potential direct harm. Several studies have reported ineffective educational interventions on outcomes such as medication adherence (Hiligsmann et al, 2013), health beliefs of behavior (Sedlak,

Category of finding	Element 2
	Doheny, & and Jones, 2000), and self-efficacy (Nieto-Vázquez et al, 2009); thereby resulting in wasted resources.
Cost and/ or cost effectiveness in relation to the status quo	One study demonstrated that a patient decision aid that could improve treatment initiation rates or adherence by 20%, or a linear combination of the two, in osteoporotic women aged more than 70 years over a 3-year treatment period was found to have an incremental cost-effectiveness ratio below $50,000/QALY (Penton et la, 2016).
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the approach element were pursued)	One systematic review revealed that although patient education improved medication adherence in four studies, two large-scale randomized studies reported no benefits (Hiligsmann et al, 2013). One single study demonstrated that despite a positive effect of public prevention educational programs on knowledge, there was no change in health beliefs or behaviors (Sedlak, Doheny, & and Jones, 2000). Two studies concluded contradictory results regarding the impact of an osteoporosis prevention education program targeting the young with one study demonstrating increased self-efficacy scores (Chan et la, 2007) and the other negating any effect on this outcome (Nieto-Vázquez et al, 2009).

Element 3

Securing Financial Coverage for Osteoporosis Diagnosis and Management

This element explored the financial arrangements that demonstrated an impact on the coverage of services related to osteoporosis. Approaches assessed include the revision of reimbursement guidelines and subsidizing osteoporosis drugs. Several financing interventions, such as reduction in reimbursement or increased out of pocket expenditure on osteoporosis treatments, were found to have harmful effects on osteoporosis diagnosis and management.

Implementing changes in financial arrangements through policy review was found to pose a beneficial impact on utilization of osteoporosis related services. One study revealed that implementing changes to the national health policy through modification of reimbursement guidelines aiming at increasing the utilization of DXA in men and women aged 70 years and older resulted in doubling the proportions of DXA referrals for men and tripling those for women over a period of 7 years (Brennan et al, 2013). As for decreasing out-of-pocket payments, one study revealed that subsidizing antiosteoporosis drugs in patients following low-impact fractures, through inclusion in a 'health basket' resulted in approximately two-fold increase in the baseline rate of osteoporosis drug

dispensation and a 1.6 fold increase in the rate of patients treated between the pre- and post-basket periods (Liel, Castel, & Bonneh, 2003). Moreover, one systematic review estimated that implementation of a value based insurance design by removing co-payments for alendronate, risedronate, and teriparatide would result in a 7% decrease in fractures and an 8% decrease in costs, mounting to $6.8 million (Chambers et al, 2014). Paradoxically, one study demonstrated that reimbursement of BMD testing and anti-osteoporotic treatments resulted in a significant decrease in the number of BMD tests, hypothesized to be due to the possibility that women at risk had already being tested even before the test was reimbursed by the National Health Insurance (Canoui-Poitrine et al, 2010). According to the same study, only 25% of those who had an initial BMD test were subsequently treated with an anti-osteoporotic medication. As such, more studies across different settings are needed to judge the impact of reimbursement on BMD testing and medication utilization.

Interventions resulting in reductions in reimbursement or increased out of pocket expenditures were shown to have deleterious effects on outcomes related to osteoporosis. Several studies addressed reduction in Medicare reimbursement. In this regard, one study demonstrated that for office-based imaging services, reimbursement reduction resulted in a minor decrease in the proportion of women who received a BMD test (McAdam-Marx et al, 2012). Another study revealed that Medicare-initiated cuts to reimbursement for DXA payment by 60% resulted in approximately one-third of physicians indicating that they had either decreased the number of DXAs they performed or declined service contracts or hardware or software updates (Hayes et al, 2010). As a result of such cuts, a third study verified that around 800,000 fewer tests than expected were performed for Medicare beneficiaries over 3 years (King & Fiorentini, 2011). Yet, another study demonstrated that using 2002 to 2015 Medicare Part A and Part B claims for women ≥ 65 years old, hip fracture rates declined each year from 2002 to 2012 and then plateaued at levels higher than projected for years 2013, 2014, and 2015, suggesting among other explanations, a non-persistent impact of the introduction of Medicare (Lewiecki et al, 2018). Aside form Medicare cuts, one study revealed that increasing out-of-pocket drug expenditures through increasing drug copayment to 10% of total drug cost significantly decreased patient compliance with clinical practice guidelines from 80% to 57% but did not impact physician compliance (Canoui-Poitrine et al, 2010).

Table 7 **Key findings from systematic reviews & primary studies**

Category of finding	Element 3
Benefits	One study revealed that implementing changes to the national health policy through revision of reimbursement guidelines aiming at increasing the utilization of DXA in men and women aged 70 years and older resulted in doubling the proportions of

Category of finding	Element 3
	DXA referrals for men and tripling those for women over a period of 7 years (Brennan et al, 2013) One study revealed that subsidizing antiosteoporosis drugs in patients following low-impact fractures, through inclusion in a 'health basket' resulted in approximately two-fold increase in the baseline rate of osteoporosis drug dispensation and a 1.6 fold increase in the rate of patients treated between the pre- and post-basket periods (Liel, Castel, & Bonneh, 2003).
Potential harms	One study revealed that increasing out-of-pocket drug expenditures through increasing drug copayment to 10% of total drug cost significantly decreased patient compliance with clinical practice guidelines from 80% to 57% but did not impact physician compliance (Canoui-Poitrine et al, 2010).
Cost and/ or cost effectiveness in relation to the status quo	One systematic review estimated that implementation of a value based insurance design by removing co-payments for alendronate, risedronate, and teriparatide would result in a 7% decrease in fractures and an 8% decrease in costs, mounting to $6.8 millions (Chambers et al, 2014).
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the approach element were pursued)	**Uncertainty Regarding the Impact of Implementing Rebates** One systematic review revealed that assessed the impact for implementation of rebates for oral bisphosphonate (risedronate and ibandronate) and varying copayments and administration costs for intravenous zoledronate, showed that cost-effectiveness varies considerably when factors in addition to the wholesale acquisition cost are considered, with results for risedronate and ibandronate vary from cost-savings (i.e., costs less and more effective) to approximately $70,000 per QALY (Ferko et al, 2012). **Uncertainty Regarding the Impact of Reimbursement** Contrary to the recognized benefit of reimbursement, one study demonstrated that reimbursement of BMD testing and anti-osteoporotic treatments resulted in a significant decrease in the number of BMD tests, hypothesized to be as part of national health authority strategy to increase the positive predictive value and cost-effectiveness of the test. Only 25% of those who had an initial BMD test were subsequently treated with an anti-osteoporotic medication (Canoui-Poitrine et al, 2010). **Uncertainty Regarding the Impact of Medicare Reimbursement** One study demonstrated that reduction in Medicare reimbursement for office-based imaging services resulted in a reduction in the number of beneficiaries through a minor decrease in the proportion of women who received a BMD test (McAdam-Marx et al, 2012). One study revealed that Medicare-initiated cuts to reimbursement for DXA payment by 60% resulted in

Category of finding	Element 3
	approximately one-third of physicians indicating that they had either decreased the number of DXAs they performed or declined service contracts or hardware or software updates (Hayes et al, 2010). One study verified that Medicare-initiated cuts to reimbursement for DXA payment by 56% resulted in 800,000 fewer tests than expected for Medicare beneficiaries over 3 years (King & Fiorentini, 2011). One study demonstrated that using 2002 to 2015 Medicare Part A and Part B claims for women ≥ 65 years old, hip fracture rates declined each year from 2002 to 2012 and then plateaued at levels higher than projected for years 2013, 2014, and 2015 (Lewiecki et al, 2018).

Implementation considerations and counterstrategies

Barriers to implementation of the three elements are at the patient, provider, and system levels. Evidence-based counterstrategies to overcome these barriers are suggested.

Level	Barriers	Counterstrategies
Patient Level	Suboptimal compliance and persistence with treatment (Cramer JA, Gold DT, Silverman SL, Lewiecki, 2007)	Use of computerized clinical reminders and patient education (Guzman-Clark, Fang, Sehl, Traylor & Hahn, 2007)
	Patients' preference for alternative, non-prescription treatments and a fear of possible side effects (Lindsay et la, 2016)	Improve familiarity of prescribing clinicians with possible adverse effects and engagement in patient discussions before commencing or continuing on therapy (Tanvetyanon & Stiff, 2006)
	Patients' perspectives which include: -Misconceptions among patients about the causes of the disease and how it could be prevented and controlled (Baheiraei, Ritchie, Eisman, & Nguyen, 2006) - Trivializing postmenopausal osteoporosis and thus disqualify it as a legitimate disease (Alami et al, 2016)	A better and thorough understanding of women's concerns related to postmenopausal osteoporosis can improve osteoporosis management (Alami et al, 2016) Patient education (Guzman-Clark, Fang, Sehl, Traylor & Hahn, 2007)
Provider Level	Insufficient coordination of care (Solomon, Katz, La Tourette, & Coblyn, 2004)	Development of automated electronic referral system from the hospital's trauma software database for patients admitted with fragility fracture of the hip to osteoporosis services (Patel, Mathew, Raptis, Christofi, & Youngman, 2010)

Level	Barriers	Counterstrategies
	Poor compliance with osteoporosis treatment guidelines (Mountjoy, Shrader, & Ragucci, 2009)	Continuing medical education and personalized audit and feedback improved management of glucocorticoid induced osteoporosis (Curtis et al, 2007)
	Physicians' perspectives on osteoporosis which includes: - Low prioritization of osteoporosis among patients' multiple comorbidities - Trivializing postmenopausal osteoporosis and thus disqualify it as a legitimate disease (Alami et al, 2016)	A better and thorough understanding of physicians' views, practices, and concerns related to postmenopausal osteoporosis (Alami et al, 2016)
System Level	Disparities in osteoporosis awareness, diagnosis, treatment, and outcomes across gender, age, socioeconomic status and ethnic lines (Giangregorio et al, 2006; Feldstein, Elmer, Smith, 2006; Thomas, 2007; Demeter et al, 2007).	Establishment and adherence to standard admission orders regarding vitamin D, calcium, and osteoporosis therapies, improving the use of electronic medical records for osteoporosis and fracture risk assessment, and require bone health as a topic at quarterly reviews and multidisciplinary conferences (Alamri et al, 2015).

Next Steps

Next Steps

The aim of this Policy Brief is to foster dialogue informed by the best available evidence. The intention is not to advocate specific policy elements or close off discussion. Further actions will flow from the deliberations that the policy brief is intended to inform. These may include:

- Deliberation amongst policymakers and stakeholders regarding the policy elements described in this policy brief.
- Refining elements, for example by incorporating, removing or modifying some components

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Faculty of Health Sciences
American University of Beirut
Riad El Solh, Beirut 1107 2020
Beirut, Lebanon
+961 1 350 000 ext. 2942 - 2943
www.aub.edu.lb/K2P
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