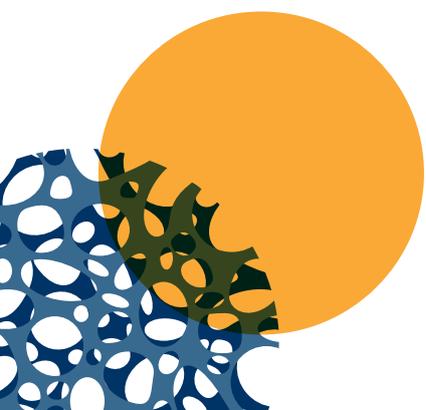




CLOSING THE GAP

**Between Orthopaedic Surgeons and
Physicians in Secondary Fracture Prevention:
A Call to Action**

An Asia-Pacific Initiative from the International Osteoporosis
Foundation and Asia Pacific Orthopaedic Association





A MESSAGE FROM IOF AND APOA

Osteoporosis, a condition where bones become weak and fragile, silently affects millions of people in the Asia-Pacific region. Today, medical practitioners armed with a better understanding of the disease, from its pathophysiology, risk assessment, diagnosis, to pharmacological treatments and monitoring, aim to prevent further deterioration of bone density and quality thereby minimizing the incidence of consequent fractures. Despite this progress, many challenges and gaps still remain with many of the diagnostic tools and pharmacological treatments only available in some countries.

Professional organizations have been raising the awareness of this condition amongst medical practitioners with the development of clinical practice guidelines and programs. They have also engaged with patients through public awareness campaigns. However, there is still an apparent lack of attention to the critical area of fragility fracture management with the initiation of secondary fracture prevention measures. Orthopaedic surgeons are the first point of contact for patients presenting with osteoporosis related fragility fractures. The surgeons provide fracture care, which may be operative or nonoperative in its nature. However, subsequent to the acute management of the fracture, there is often little follow-up for post fracture management, despite an awareness of the concept that “Fracture begets fracture”. Patients presenting with an index fragility fracture are at higher risk of subsequent fractures.

The risk is particularly high in the first two years after the first fracture. However, there is a lack of timely assessment and management of the underlying reasons leading to the fracture, with patients only seen again when they present with a subsequent fracture. There is a lack of attention to the assessment of clinical risk of further fracture, the measurement of bone density for the identification of the presence of osteopenia or osteoporosis, and the instigation of measures managing the underlying bone fragility. Whilst this may be perceived as a lack of interest, it may also be due to a lack of awareness and confidence in the post-fracture management of fragility fractures related to osteoporosis.

There is a “Missing Link” between the medical experts in the management of osteoporosis, the physicians and the orthopaedic surgeons, who manage fragility fractures in their daily practice. This is the basis and the whole purpose of establishing this collaboration between International Osteoporosis Foundation Asia Pacific (IOF AP) and Asia Pacific Orthopaedic Association (APOA). With increased understanding and collaborations between physicians (across all specialties) and orthopaedic surgeons, a “Link” will be formed to close the gap in managing patients with osteoporosis and related fractures. The Capture the Fracture® Partnership, a global initiative to advance the implementation of Post-Fracture Care Coordination Programmes, including Fracture Liaison Services, lends its full support to the collaborative efforts of IOF and APOA in achieving this important mission.

This document provides a new platform and collaborative efforts for all members of IOF Asia Pacific and APOA to guide us and to promote interest and confidence in managing osteoporosis and fragility fractures as a TEAM.

Best wishes to ALL from IOF Asia Pacific and APOA.

Dato' Dr. Joon-Kiong Lee

*Chair of the IOF Asia Pacific
Regional Advisory
Council (RAC)*

Prof. Cyrus Cooper

*International Osteoporosis
Foundation (IOF)
President*

Dr. David Siew-Kit Choon

*Past President of Asia Pacific
Orthopaedic Association
(APOA)*



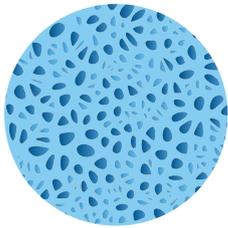
“As orthopaedic surgeons we are uniquely placed to play an important role in secondary fracture prevention. Let’s do our part.”

Dato’ Dr. Joon-Kiong Lee

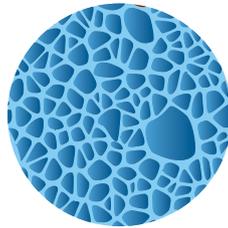


ABOUT OSTEOPOROSIS

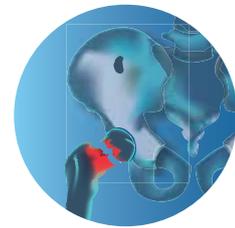
- Osteoporosis is a disease where bone becomes porous, with low bone mineral density, structural deterioration of its microarchitecture and decreased strength.



Normal Bone



Osteoporotic Bone



Broken Bone

- Osteoporosis is defined operationally as bone mineral density (BMD) of 2.5 standard deviations (SD) or more below the young female adult mean ^[1].
- The disease is more common amongst women than men, as bone loss increases rapidly after menopause, when estrogen levels drop sharply.
- Osteoporosis has no obvious symptoms until a bone breaks.
- The treatment gap is huge in osteoporosis as 60–85% of women are not receiving treatment following a fracture, despite the availability of effective therapies and management approaches for fragility fractures.
- Clinical guidelines on the management of osteoporosis have been published for most of the countries or regions in Asia Pacific, including Australia ^[2], China ^[3], Hong Kong ^[4], India ^[5], Indonesia ^[6], Japan ^[7], Malaysia ^[8], New Zealand ^[9], Singapore ^[10], Philippines ^[11], South Korea ^[12], Taiwan ^[13], Thailand ^[14] and Vietnam ^[15].





EPIDEMIOLOGY OF OSTEOPOROSIS AND FRAGILITY FRACTURES

AGEING OF THE POPULATION IN ASIA PACIFIC

- In 2017, 4.6 billion people lived in the Asia-Pacific region ^[16].
- In 2016, it was estimated that the proportion of the population aged 80 years or older will increase from 12% in 2016 to 20% in 2050 ^[17].



POPULATION
+80

WILL INCREASE
FROM

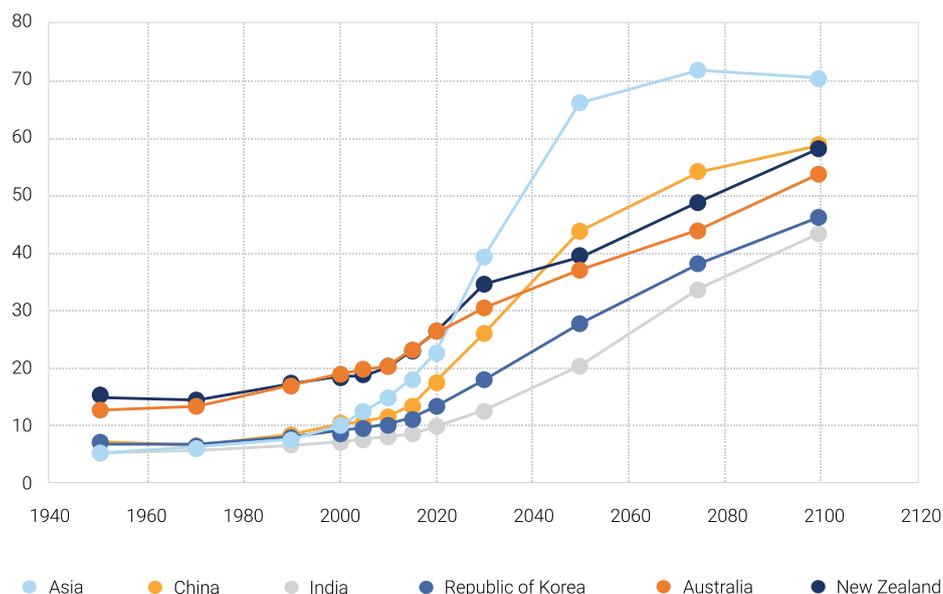
2016
12%



2050
20%

- China has the largest aged population in the world, the population aged > 60 years will reach 400 million (approximately 30% of the total population) by 2050 ^[18].
- In Japan, the percentage of the population aged >65 years rose from 10.3% in 1985 to 20.1% in 2005; this percentage is expected to double by 2050 ^[18].
- The Republic of Korea will be one of the countries of the region with the most rapid ageing of its population, from 10 seniors per 100 people of working age in 2000 to 66.3 seniors per 100 workers in 2050 ^[16].
- In Taiwan, the percentage of the population aged >65 years rose from 4.3% in 1980 to 10.74% in 2010 ^[16].
- In Indonesia, data from a survey in 1990 showed that proportion of population with age of 55 or more is 9.2% ^[6].

The old-age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64. They are presented as number of dependants per 100 persons of working age (15-64).



United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Volume II: Demographic Profiles (ST/ESA/SER.A/400). https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_Volume-II-Demographic-Profiles.pdf

EPIDEMIOLOGY OF OSTEOPOROSIS

- By 2022, it is estimated that there will be 6.2 million Australians over the age of 50 with osteoporosis or osteopenia. That is a 31% increase from 2012 ^[19].

AUSTRALIA



BY 2022
6.2 MILLION

AGED +50
WITH OSTEOPOROSIS OR OSTEOPENIA

AN INCREASE OF 31%
FROM 2012

- In China, the prevalence of osteoporosis rose from 14.9% prior to 2008 to 28% for the period 2012-2015 ^[20].
- In India, estimates suggest that of the 230 million Indians expected to be over the age of 50 years in 2015, 20%, or approximately 46 million, are women with osteoporosis ^[21].
- In Japan, the estimated number of patients with osteoporosis at the lumbar spine and femoral neck was approximately 6.4, and 11 million, respectively ^[22].
- In Philippines, based on the National Nutrition Health Survey (NNHeS), the reported overall prevalence of osteoporosis in adult Filipinos 60 to 69 years of age was 0.8% while those beyond 70 years old was 2.5% in 2003 ^[11].
- In Singapore, the prevalence of elderly at risk of osteoporosis was 52%, which translates to about 278,000 older adults in 2011 ^[23].

SINGAPORE

52%
ELDERLY AT RISK



WHICH
TRANSLATES
TO ABOUT

278,000
SENIORS

IN
2011

- In South Korea, estimates suggest that osteoporosis is present in 2.51 million people or, approximately 19.3% of people over 50 years of age ^[24].
- In Taiwan, the National Nutrition Survey reported that prevalence of osteoporosis was 23.9% and 38.3% for men and women respectively in 2008 ^[13].
- The Thai Osteoporosis Foundation reports that an estimated 13–21% of females aged more than 40 years have osteoporosis either at the lumbar spine or femoral neck ^[14].
- In Vietnam, estimates indicate that approximately 29% of women aged 50 + years had osteoporosis ^[25].

VIETNAM

29%
OF WOMEN



AGED
+50

HAD
OSTEOPOROSIS

ABOUT FRAGILITY FRACTURES

- The clinical relevance of osteoporosis is the associated fragility fractures.
- 1 in 3 women and 1 in 5 men above 50 years of age will fracture during their remaining life-time, one fracture occurs every 3 seconds worldwide ^[26].
- A prior fragility fracture is a warning sign and is associated with an 86% risk of any fracture ^[27].
- Evidence suggest that many patients who sustain a fragility fracture are not appropriately diagnosed and treated ^[28].
- The majority of individuals at high risk of fracture, who have already had at least one osteoporosis fracture, are neither identified nor treated ^[29].
- Fractures at the hip, vertebrae and wrist are among the most common and serious sites of osteoporotic fracture.



EPIDEMIOLOGY OF FRAGILITY FRACTURES IN ASIA PACIFIC

- In absolute terms, Asian countries will face the most marked increase of fractures globally, with projections suggesting that by 2050, 50% of hip fractures will occur in Asia ^[30], the majority of which will happen in China ^[31]. The number of individuals at high fracture risk in the region is expected to double from 2010-2030 ^[32].

BY THE YEAR
2050



50%
OF ALL HIP FRACTURES

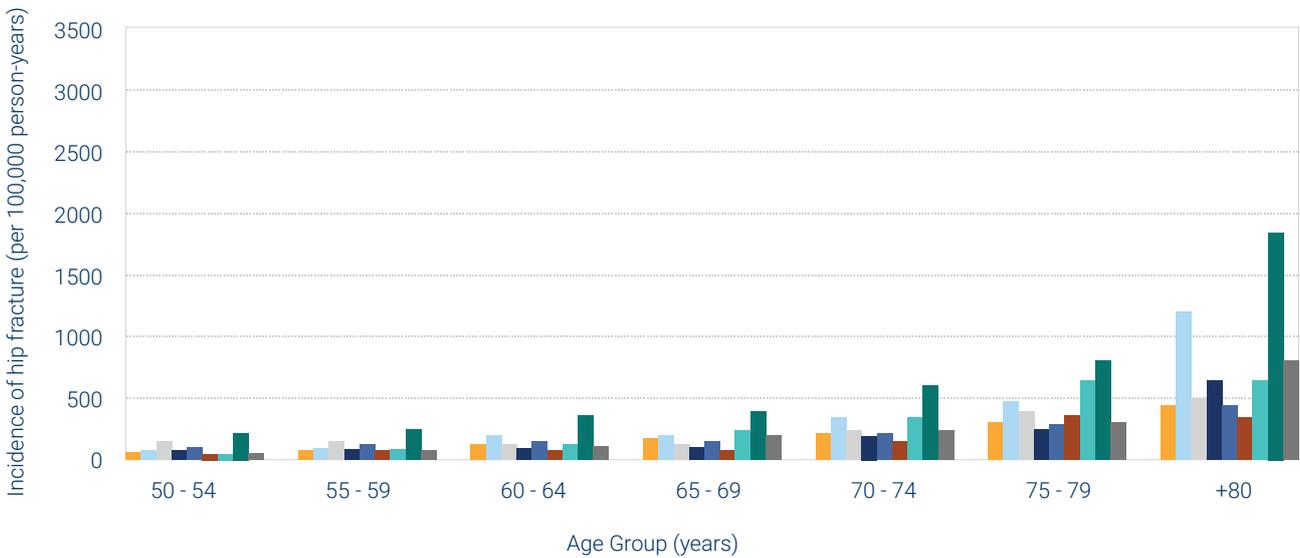
WILL OCCUR

IN ASIA

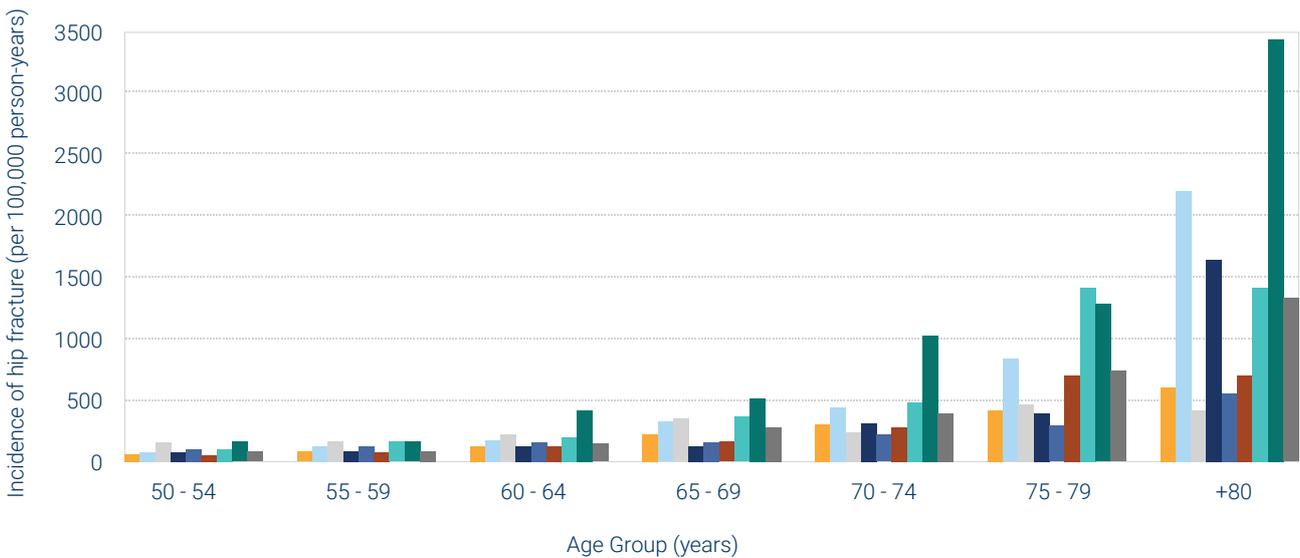
- In 9 Asian countries (China, Hong Kong, India, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand), the number of hip fracture will increase from 1.12 million in 2018 to 2.56 million in 2050, a 2.3-fold increase ^[33].

Incidence of hip fracture in male (A) and female (B) in 9 studied countries/regions.

Graphic A



Graphic B



China Hong Kong India Japan Korea Malaysia Singapore Taiwan Thailand

Redrawn from: Cheung et al. An updated hip fracture projection in Asia: The Asian Federation of Osteoporosis Societies Study. Osteoporosis and Sarcopenia 4 (2018) 16-21

- In China, the incidence of hip fracture will rise from 411,000 in 2015 to >1 million in 2050^[34].
- In Australia, estimates indicate that 160,000 fragility fractures occurred in 2016, and this number will increase to 180,000 in 2022^[19].
- In Vietnam, estimates indicate that 26% of women aged 50 years or older have experienced symptomatic vertebral fractures^[35].
- In Japan, the annual number of hip fractures was estimated to be 190,000 in 2012, and is expected to be 300,000 in 2040^[36].

SOCIO-ECONOMIC BURDEN OF OSTEOPOROSIS AND FRAGILITY FRACTURES

- Fragility fractures are the fourth most burdensome non-communicable disease ^[28].
- Fractures affect quality of life, functional decline, loss of independence, loss of self-esteem, depression, morbidity and mortality and are associated with significant healthcare costs ^[37].
- Hip fractures are particularly debilitating, with a functional decline at discharge, which remained in some patients at 1 year, institutionalization of 20% of patients over 1 year and mortality over 19% ^[38, 39].

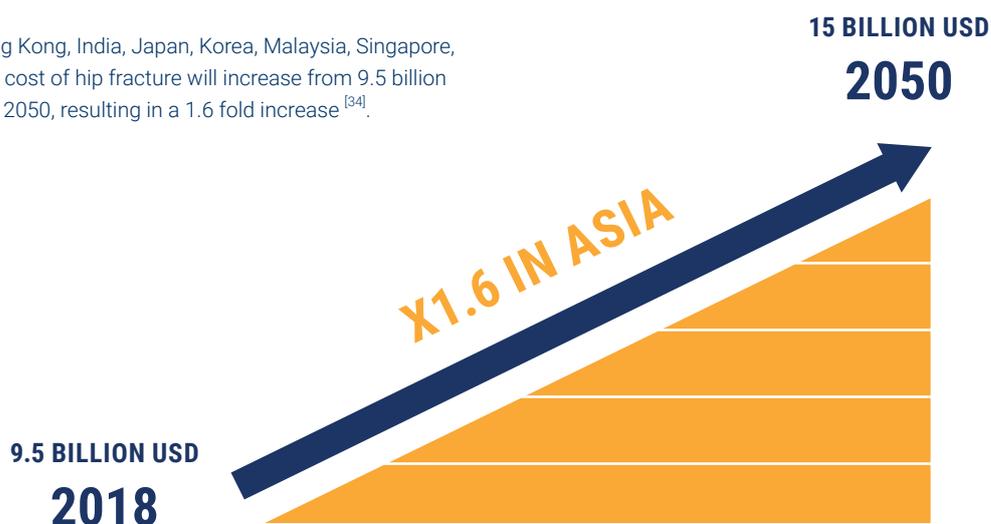
**HIP FRACTURES
ARE DEBILITATING**



**20% WILL BE
INSTITUTIONALIZED**

- In 9 Asian countries (China, Hong Kong, India, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand), the direct cost of hip fracture will increase from 9.5 billion USD in 2018 to 15 billion USD in 2050, resulting in a 1.6-fold increase ^[33].
- One simulation model projects that the costs of osteoporosis-related fracture in China will double by 2035 and will increase to 25.43 billion USD for 5.99 million fractures by 2050 ^[34].
- In Australia, the total annual cost of osteoporosis and osteopenia in 2012 was estimated to be AUS \$2.8 billion, projected to increase to AUS \$3.84 billion in 2022 ^[19].
- In New Zealand, the overall cost of treatment and management associated with osteoporosis is expected to increase from \$NZ330 million in 2007 to \$NZ391 million in 2013 and \$NZ458 million in 2020 ^[40].
- In Japan, the total costs were estimated to be close to 8 billion USD ^[41].

In 9 Asian countries (China, Hong Kong, India, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand), the direct cost of hip fracture will increase from 9.5 billion USD in 2018 to 15 billion USD in 2050, resulting in a 1.6 fold increase ^[34].

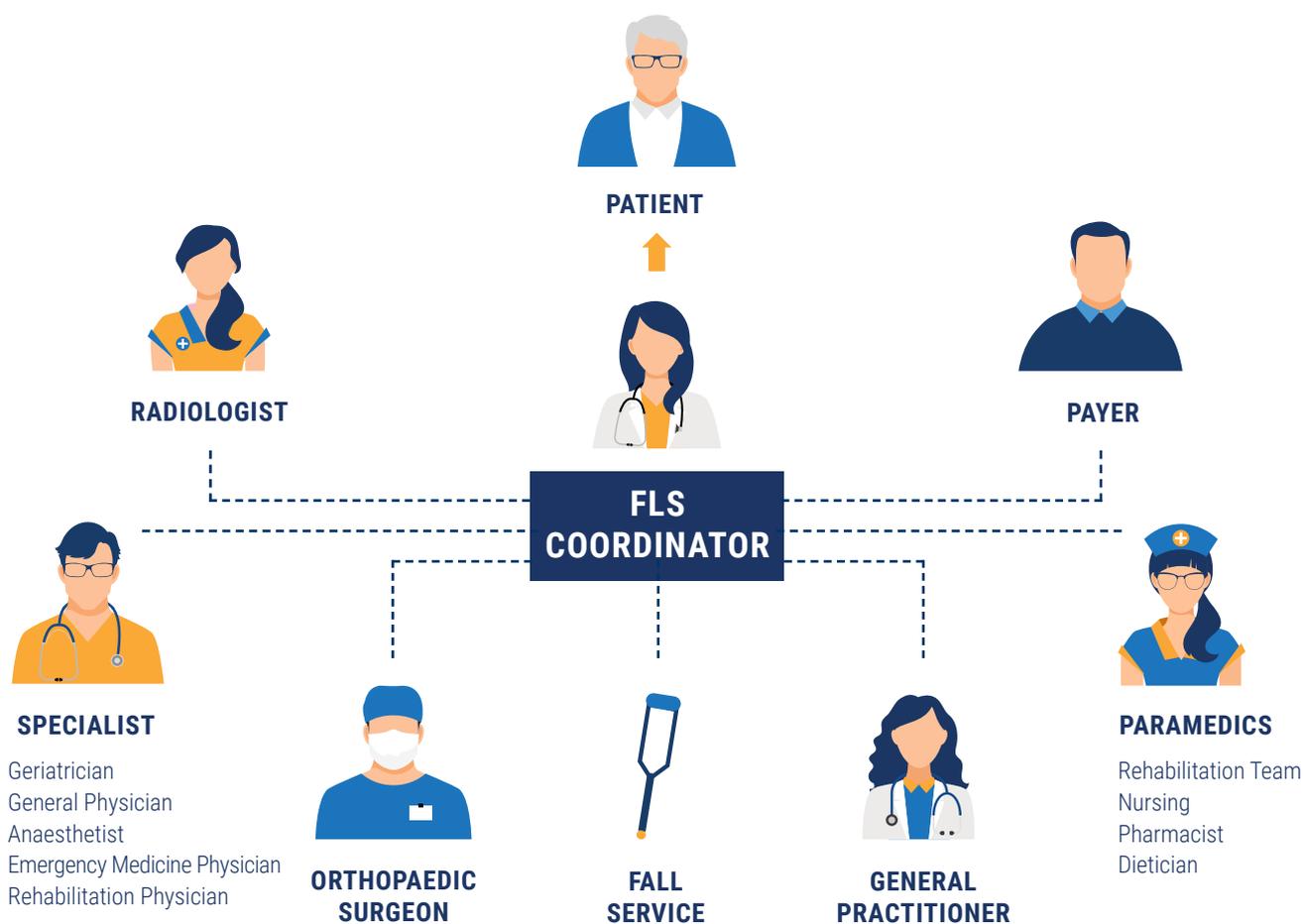






SECONDARY FRACTURE PREVENTION AND FRACTURE LIAISON SERVICE (FLS) MODEL OF CARE

- A Fracture Liaison Service (FLS) is a coordinator-based, secondary fracture prevention service with a multi-disciplinary approach to fracture patient care ^[42].
- FLS offers the most clinically and cost-effective secondary preventive care ^[43].
- FLS helps to close the care gap for fracture patients.
- FLS enhances communication between health care providers.
- FLS multi-disciplinary team can include a lead clinician/local champion, a fracture coordinator, orthopaedic surgeon, radiologist, secondary care clinicians, rehabilitation specialist-physiatrist, fall prevention service, nurse specialists, primary care physicians, allied health professionals, public health consultants, service manager, administrator, pharmacist.



- Capture the Fracture®, an International Osteoporosis International (IOF) initiative, supports this systematic approach to secondary fracture prevention by establishing standards of best practice (<https://www.capturethefracture.org/>) ^[44-46].
- 105 FLS from Asia-Pacific are part of the IOF Capture the Fracture Network (as of June 2020) FLS are shown on the Capture the Fracture Map of Best Practice at <https://www.capturethefracture.org/map-of-best-practice>.



“The International Osteoporosis Foundation believes that the implementation of coordinated, multidisciplinary post-fracture care is the single most important strategy to directly improve patient outcomes and reduce spiraling fracture-related healthcare costs worldwide.”

Prof. Cyrus Cooper, IOF President

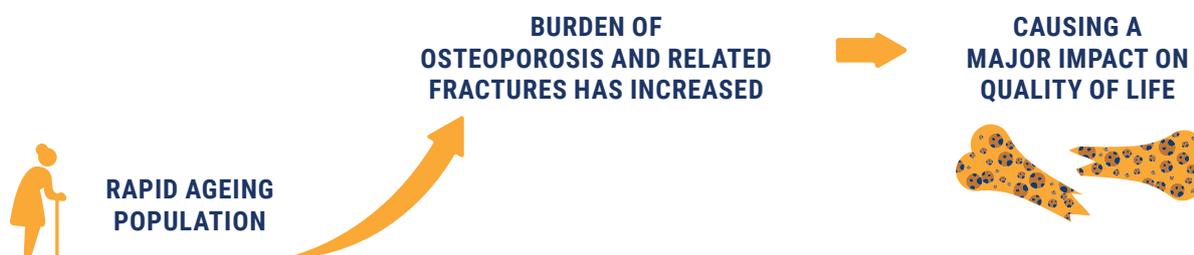


KEY MESSAGES

1.

Burden of osteoporosis and fragility fractures

With the rapid ageing of the population worldwide and the changes in lifestyle habits, the prevalence of osteoporosis and burden of related fractures has significantly increased and will continue to increase markedly in the future. These fractures have major impacts on quality of life, causing substantial pain, disability, loss of independence, morbidity and even mortality for the affected patients. However, osteoporosis is a disease that remains under-recognized, under-diagnosed and under-treated particularly in the Asia-Pacific, where the ageing population is expected to increase rapidly ^[31].



2.

Osteoporosis: diagnosis and accessibility to pharmacological treatments

The diagnosis of osteoporosis is based on BMD measurement by DXA. In Asia, the diagnosis of osteoporosis is a challenge. Many countries have large rural populations where access to healthcare structures dedicated to osteoporosis is difficult ^[31]. The availability and accessibility of pharmacological treatments remain a big challenge in many Asian countries, more so with the compliance and adherence to pharmacological treatment ^[31].

3.

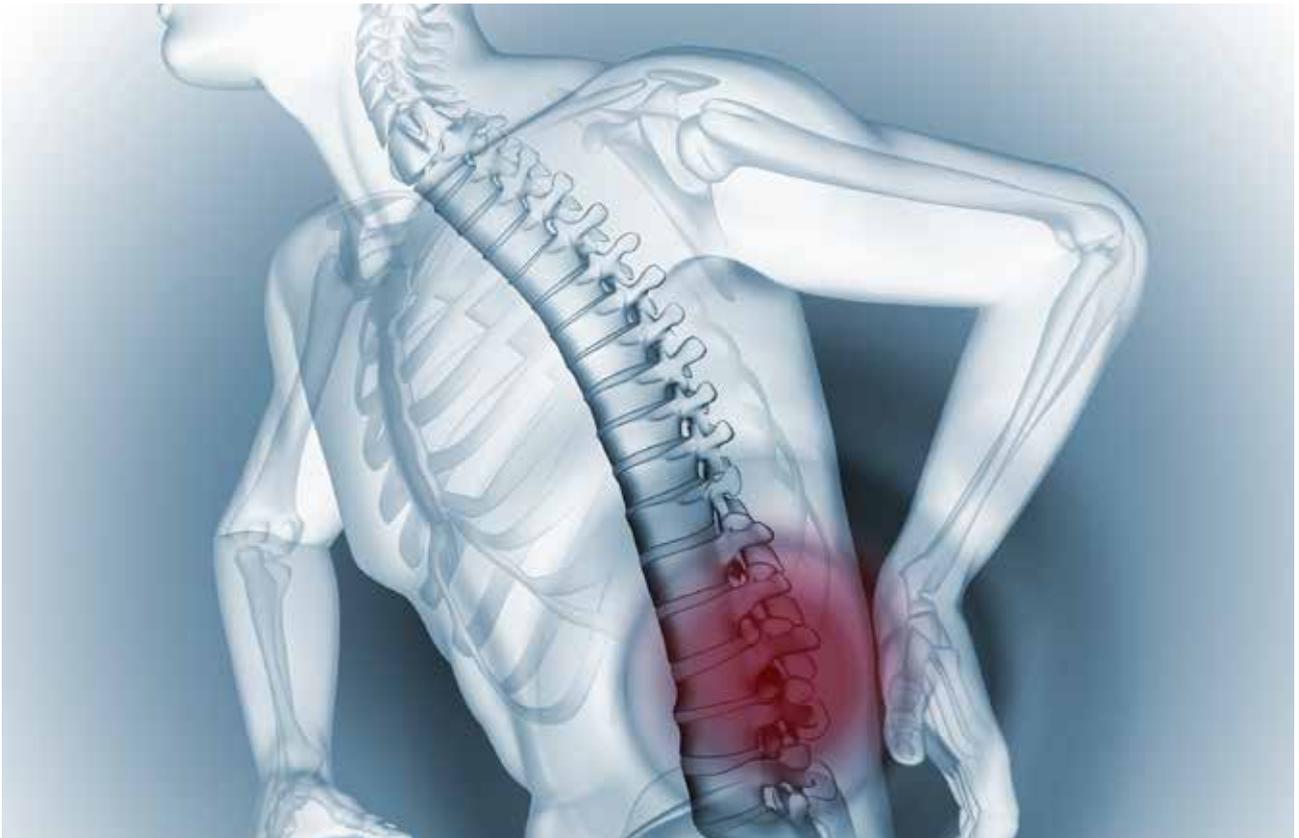
Role of the orthopaedic surgeon in the management of osteoporosis: From prevention to surgical treatment

In general, many orthopaedic surgeons in Asia Pacific countries are managing osteoporosis related fractures and the underlying osteoporosis independently. Orthopaedic surgeons are often the first point of contact for patients with osteoporosis related fractures. Stable, anatomical fixations of fractures to allow early ambulation and functional recovery should be the primary objective of treatment. It is of paramount importance that the underlying osteoporosis is managed promptly to prevent the very high risk of secondary fractures. This includes risk assessment, diagnosis, pharmacological intervention and monitoring to ensure good compliance and adherence to treatment. Falls prevention assessment is equally important. All these measures can certainly be carried out by orthopaedic surgeons who are proactive, well trained and equipped with both knowledge and experience on managing fragility fractures and underlying osteoporosis.

4.

Management of vertebral fractures – non-surgical and surgical treatment

Vertebral compression fractures (VFs) are highly prevalent in patients with osteoporosis and can result in acute and chronic pain with significant disability and impaired quality of life. Pain from vertebral compression fractures may be managed through both vertebral augmentation with either percutaneous vertebroplasty^[47] or kyphoplasty^[48] and non-pharmacological approaches with brace and strengthening exercises^[49, 50].



5.

Management of Atypical Femoral Fracture

Atypical Femoral Fracture (AFF) is a rare event which has been reported in patients treated with antiresorptive therapy such as bisphosphonates and denosumab, but also in patients who have never received antiosteoporosis therapy. The incidence ranges from 32 to 59 per 1 million person-years based on examination of radiographs^[52, 53]. Factors which have been associated with increased risk of AFF include higher body mass index^[54, 55], Asian ethnicity, varus femur^[54, 56], younger age^[57, 58], vitamin D3 deficiency^[59], diabetes mellitus^[57] and chronic kidney disease^[57] and treatment with steroids and proton pump inhibitors^[53]. However, whether any of these factors causally increase the risk of this outcome in patients with long term antiresorptive treatment, or are simply markers of underlying fracture risk, remains to be investigated. Intramedullary, with dynamic interlocking nailing is the preferred choice of fixation for Atypical Femoral Fracture. Consideration should be given to detecting early changes in the contralateral femur, and the potential need for prophylactic intervention.

6.

Management of non-spine non-hip fracture from non-surgical to surgical treatment

Non-spine, non-hip fractures make a substantial contribution to the overall burden of osteoporosis fractures leading to a high number of total hospital days, total rehabilitation days, and total nursing home days ^[51]. Treatment of osteoporotic fractures, either surgically or non-surgically is often a great challenge for orthopaedic surgeons. Patients often do not tolerate prolonged immobilization of fractures treated non-surgically which will result in loss of muscle and bone, joint stiffness and further loss of function.

Osteoporotic patients with poor bone quality and density might require open reduction internal fixation of fractures. Proper planning, selection of the appropriate approach, implants type, careful soft tissue and fracture handling intraoperatively and postoperative rehabilitation program will allow patients to regain their maximum functional status possible. This is only possible with a multidisciplinary approach from a team work consist of acute patient care, orthopaedic surgeon, anaesthesia, geriatrician/physicians and rehabilitation personnel.

7.

Management of hip fracture – non-surgical and surgical treatment

Osteoporosis related hip fractures carry the highest morbidity and mortality ^[37]. Nonsurgical treatment is only selected for some patients with severe comorbidities who are not fit for surgery. However, these patients tend to have severe complications from immobilization including pneumonia and death within a short period of time. Surgery should be considered as the treatment of choice to allow early mobilization and ambulation. Appropriate management for hip fracture is really important and it should be done by multidisciplinary team from patient admission until discharge, including prevention for the second fracture.



8.

Principles of fracture fixation in osteoporotic bone

Fractures fixation is always the biggest challenge for orthopaedic surgeons when dealing with osteoporosis related fractures. Locking Compression Plate (LCP) System with variable angle fixation and with pre-shaped implants which provide higher holding power and stability are available for osteoporosis related fractures ^[60]. This is in contrast with the conventional Dynamic Compression Plate and Screw fixation which depends on the degree of compression between the plate and bone, inter-digitation of bony fragments and inter-fragmental compression ^[61]. Additional bone augmentation with controlled bone impactions promote fracture healing. Joint replacement might be a better treatment of choice in very comminuted fractures involving proximal humerus. The ultimate goal of fixing the fracture correctly is to allow patients with osteoporosis to regain functional recovery as early as possible and a better quality of life.

9.

Post fracture rehabilitation

Patients with a hip fracture need early mobilization after surgery to recover the declining physical function due to the fracture. It is especially important to include rehabilitation so that the patient may regain the ability for self-care. Post fracture rehabilitation program consist of muscle strengthening, joint mobilization, assisted and supervised ambulations are of paramount important. Prevention of further bone loss and muscle wasting, prevention of deep vein thrombosis from prolonged immobilization, improving coordination and balance are crucial to allow early return to maximal functional status possible ^[62, 63].



10.

Fracture Liaison Service (FLS)

Fracture Liaison Services (FLS) constitute coordinated programs whereby all patients aged 50 years or over presenting with an index fragility fracture are assessed (with subsequent treatment recommended as appropriate) to prevent further fractures. Patients will undergo fracture risk assessment and receive treatment in accordance with prevailing national clinical guidelines for osteoporosis. FLS have been shown to dramatically improve treatment rates for fragility fracture patients, while reducing secondary fracture incidence. FLS also ensures that falls risk is addressed among older patients through referral to appropriate local falls prevention service^[64]. Fracture Liaison Services offer a solution to spiraling healthcare costs.



11.

Fracture healing in osteoporosis

There is no evidence that fracture healing is impaired in osteoporosis^[65]. Vitamin D and its analogues are essential for callus mineralization and may also play a role in callus formation and remodelling that enhances biomechanical strength. Currently used antiresorptive drugs do not interfere with fracture healing and, in fact, may lead to more robust biomechanical properties in the callus. The timing of administration of a single bolus dose of intravenous zoledronic acid should be delayed until 2 weeks after the fracture for optimising outcomes^[66]. In animal studies, PTH accelerates fracture healing with more rapid callus mineralization, and clinical studies suggest there may be effects of PTH to accelerate fracture healing of distal radius and pelvic fractures and to improve functional outcomes after hip fractures^[67].

12.

Hip Fracture Registry

By 2050, the majority of hip fractures in the world will occur in Asia. The creation of national hip fracture registries recording hip fracture cases and their care in different countries improves knowledge about hip fracture care and its quality, while at the same time aiming to reduce variability of care, optimizing efficiency, improving outcomes, and reducing costs and reducing the personal and economic burdens of subsequent falls and fractures^[68].



“The Asia-Pacific region is facing an exponential rise in fragility fractures due to osteoporosis, yet approximately 80% of fracture patients are not diagnosed and treated for the underlying disease. As outlined in this Call to Action, we urge all orthopaedic surgeons to take the necessary steps to help their patients prevent recurrent fractures.”

Dr David Siew-Kit Choon, Past President, Asia-Pacific Orthopaedic Association



CALL TO ACTION

The International Osteoporosis Foundation Asia Pacific (IOF AP) and Asia Pacific Orthopaedic Association (APOA) call on the medical community, and the orthopaedic community specifically, to take rapid action to prevent fragility fractures. The following recommendations should be enacted urgently:

a.

Recognize that the burden of osteoporosis and related fragility fractures has substantially increased and will continue to increase markedly in the future in the Asia Pacific region.

b.

Recognize that osteoporosis is a disease that remains under-diagnosed and under-treated, and work towards increased awareness of the disease and of the need for fracture prevention among medical practitioners and the public.

c.

Physicians and orthopaedic surgeons should work together to ensure effective management of the disease, including early diagnosis, fracture risk assessment, early and appropriate pharmacological treatment and monitoring, fracture prevention (both primary and secondary).



PHYSICIANS AND ORTHOPAEDIC SURGEONS SHOULD WORK TOGETHER

TO ENSURE EFFECTIVE MANAGEMENT OF THE DISEASE



d.

Physicians should recognize the importance of appropriate fracture fixation, post fracture rehabilitation and care to allow patients to achieve maximal functional recovery.



RECOGNIZE THE IMPORTANCE OF FRACTURE FIXATION

POST FRACTURE REHABILITATION AND CARE



e.

Orthopaedic surgeons should recognize the challenge in fragility fracture management, in particular surgical treatment of these fractures.

f.

Orthopaedic surgeons must always equip themselves to fix fractures in the best way possible, with proper preoperative planning, selection of the appropriate implants and approach, and with the possible use of augmentation to promote fracture healing.

g.

Orthopaedic surgeons should perform risk assessment, appropriate pharmacological management and treatment monitoring to promote compliance and adherence, and provide proper rehabilitative care to prevent subsequent fractures.

h.

Orthopaedic surgeons must be equipped with the necessary knowledge, interest and confidence in initiating and continuing pharmacological treatments for osteoporosis.

i.

Promote orthogeriatric care and services in combination with occupational and physiotherapists in handling elderly with fragility fractures presenting with concomitant dementia.

j.

Orthopaedic surgeons are encouraged to take a leading role in the development and implementation of Fracture Liaison Services or Orthogeriatric Services in their hospitals and clinics.

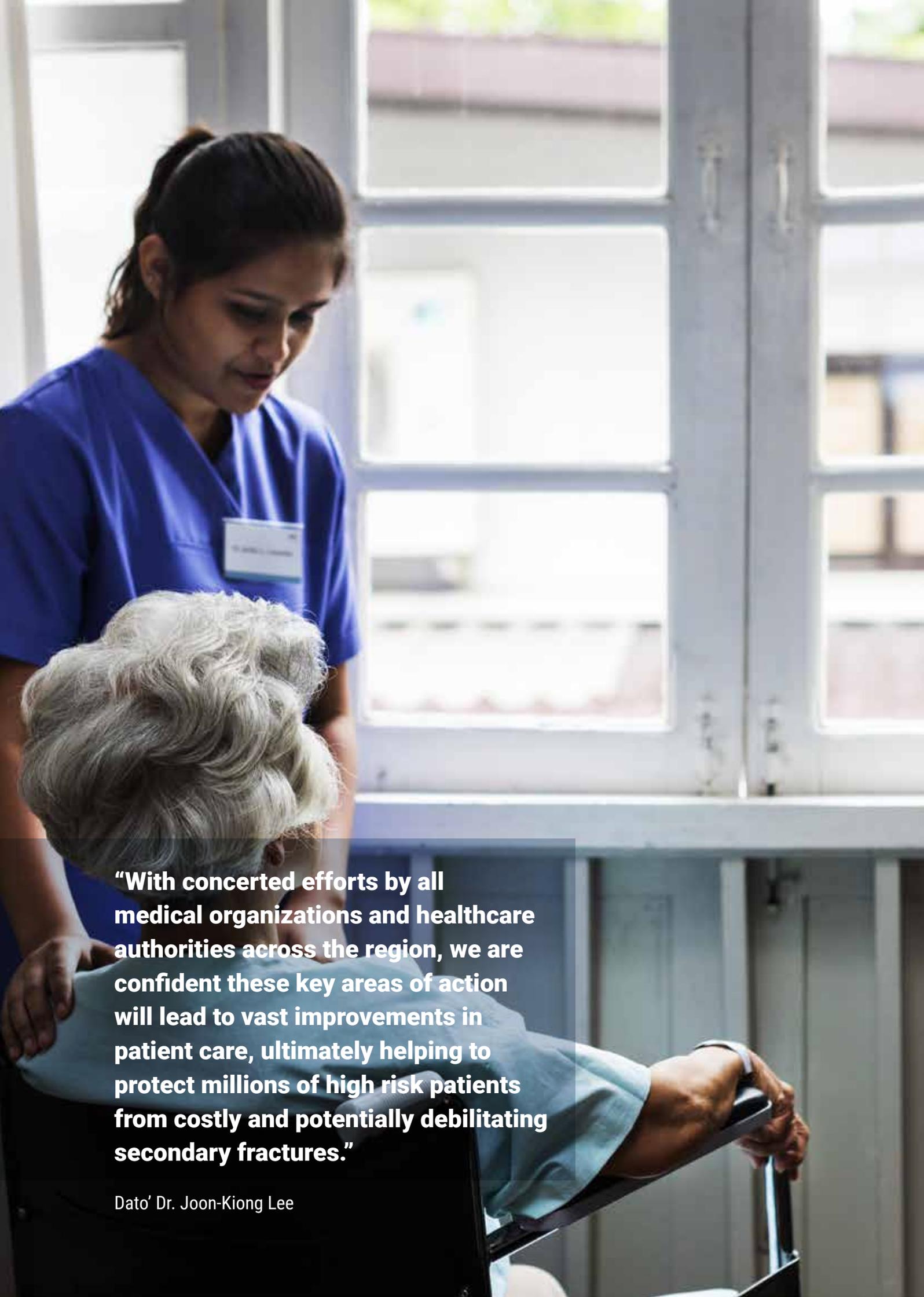


**TAKE A LEADING ROLE IN
DEVELOPING & IMPLEMENTING**



**A FRACTURE LIAISON SERVICE OR
ORTHOGERIATRIC SERVICES
IN YOUR HOSPITAL AND CLINIC**



A healthcare worker in blue scrubs is assisting an elderly patient in a wheelchair. The patient has white hair and is wearing a light blue hospital gown. They are in a room with large windows in the background. The healthcare worker is looking down at the patient with a focused expression.

“With concerted efforts by all medical organizations and healthcare authorities across the region, we are confident these key areas of action will lead to vast improvements in patient care, ultimately helping to protect millions of high risk patients from costly and potentially debilitating secondary fractures.”

Dato’ Dr. Joon-Kiong Lee





REFERENCES

1. (2003) *Prevention and management of osteoporosis: report of a WHO scientific group* WHO Technical Report Series 921, World Health Organization
2. Royal Australian College of General Practitioners (RACGP) (2020) *Osteoporosis Guideline* <https://www.racgp.org.au/clinical-resources/clinical-guidelines/key-racgp-guidelines/view-all-racgp-guidelines/osteoporosis> access date June 9, 2020
3. Lin X, Xiong D, Peng YQ, Sheng ZF, Wu XY, Wu XP, Wu F, Yuan LQ, Liao EY (2015) *Epidemiology and management of osteoporosis in the People's Republic of China: current perspectives*. *Clin Interv Aging* 10:1017-1033
4. Group OT (2013) *OSKH guideline for clinical management of postmenopausal osteoporosis* in Hong Kong Hong Kong Medical Journal 19:
5. Meeta HC, Marwah R, Sahay R, Kalra S, Babhulkar S (2013) *Cinical practice guidelines on postmenopausal osteoporosis: an executive summary and recommendations* *J Midlife Health* 4:107-126
6. Setyohadi B, Hutagalung EU, Adam JMF, et al. (2012) *Summary of the Indonesian Guidelines for Diagnosis and Management of Osteoporosis* *Journal of the ASEAN Federation of Endocrine Societies (JAFES)* 27:147-150
7. Orimo H, Nakamura T, Hosoi T, et al. (2012) *Japanese 2011 guidelines for prevention and treatment of osteoporosis--executive summary*. *Arch Osteoporos* 7:3-20
8. Yeap SS, Hew FL, Damodaran P, Chee W, Lee JK, Goh EML, Mumtaz M, Lim HH, Chan SP (2016) *A summary of the Malaysian Clinical Guidance on the management of postmenopausal and male osteoporosis*, 2015. *Osteoporos Sarcopenia* 2:1-12
9. Gilchrist N, Reid IR, Sankaran S, Kim D, Drewry A, Toop L, McClure F (2017) *Guidance on the diagnosis and management of osteoporosis in New Zealand*. *Osteoporosis New Zealand* <https://osteoporosisorgnz/clinical-guidance/> access date June 9, 2020
10. Agency for care effectiveness. *Osteoporosis – identification and management in primary care*. 2018 Jan, 2020]; Available from: <http://www.ace-hta.gov.sg/our-guidance/osteoporosis-identification-and-management-in-primary-care.html>.
11. Li-Yu J (2007) *National Nutrition Health Survey (NNHeS) 2003: Prevalence of osteoporosis and fractures among Filipino adults*. *Phil J Int Med* 45:57-63
12. Agency HIR (2010) *General guideline of pharmacological intervention for osteoporosis*. <http://www.hira.or.kr> access June 9, 2020
13. Hwang JS, Chan DC, Chen JF, Cheng TT, Wu CH, Soong YK, Tsai KS, Yang RS (2014) *Clinical practice guidelines for the prevention and treatment of osteoporosis in Taiwan: summary*. *J Bone Miner Metab* 32:10-16
14. Songpatanasilp T, Sritara C, Kittisomprayoonkul W, et al. (2016) *Thai Osteoporosis Foundation (TOPF) position statements on management of osteoporosis*. *Osteoporos Sarcopenia* 2:191-207
15. Association VR (2012) *Diagnosis and treatment of osteoporosis. Guidelines for diagnosis and treatment of common rheumatoid diseases*. Viet Nam Education Publishing House, Hanoi, 247-258
16. United Nations Department of Economic and Social Affairs Population Division (2017). *World Population Prospects : Volume II: Demographic Profiles 2017 Revision (ST/ESA/SERA/400)* New York
17. United Nations Economic and Social Commission for Asia and the Pacific (2016) *2016 ESCAP population data sheet Social Development Division, Economic and Social Commission for Asia and The Pacific (ESCAP), Bangkok, Thailand*
18. Cheung EYN, Tan KCB, Cheung CL, Kung AWC (2016) *Osteoporosis in East Asia: Current issues in assessment and management*. *Osteoporos Sarcopenia* 2:118-133
19. Watts JJ, Abimanyi-Ochom J, Sanders KM (2013) *Osteoporosis costing all Australians: A new burden of disease analysis 2012 to 2022*. Sydney: Osteoporosis Australia
20. Chen P, Li Z, Hu Y (2016) *Prevalence of osteoporosis in China: a meta-analysis and systematic review*. *BMC Public Health* 16:1039
21. Malhotra N, Mithal A. *Osteoporosis in Indians*. *Indian J Med Res*. 2008;127(3):263–268.
22. Yoshimura N, Muraki S, Oka H, et al. (2009) *Prevalence of knee osteoarthritis, lumbar spondylosis, and osteoporosis in Japanese men and women: the research on osteoarthritis/osteoporosis against disability study*. *J Bone Miner Metab* 27:620-628
23. Wang P, Abidin E, Shafie S, Chong SA, Vaingankar JA, Subramaniam M (2019) *Estimation of Prevalence of Osteoporosis Using OSTA and Its Correlation with Sociodemographic Factors, Disability and Comorbidities*. *Int J Environ Res Public Health* 16:
24. Lee YK, Yoon BH, Koo KH (2013) *Epidemiology of osteoporosis and osteoporotic fractures in South Korea*. *Endocrinol*

25. Ho-Pham LT, Nguyen UD, Pham HN, Nguyen ND, Nguyen TV (2011) *Reference ranges for bone mineral density and prevalence of osteoporosis in Vietnamese men and women*. BMC Musculoskelet Disord 12:182
26. Kanis JA, Johnell O, Oden A, Sembo I, Redlund-Johnell I, Dawson A, De Laet C, Jonsson B (2000) *Long-term risk of osteoporotic fracture in Malmo*. Osteoporos Int 11:669-674
27. Kanis JA, Johnell O, De Laet C, et al. (2004) *A meta-analysis of previous fracture and subsequent fracture risk*. Bone 35:375-382
28. Borgstrom F, Karlsson L, Ortsater G, et al. (2020) *Fragility fractures in Europe: burden, management and opportunities*. Arch Osteoporos 15:59
29. Hernlund E, Svedbom A, Ivergard M, Compston J, Cooper C, Stenmark J, McCloskey EV, Jonsson B, Kanis JA (2013) *Osteoporosis in the European Union: medical management, epidemiology and economic burden*. A report prepared in collaboration with the International Osteoporosis Foundation (IOF) and the European Federation of Pharmaceutical Industry Associations (EFPIA). Arch Osteoporos 8:136
30. Cooper C, Campion G, Melton LJ, 3rd (1992) *Hip fractures in the elderly: a world-wide projection*. Osteoporos Int 2:285-289
31. International Osteoporosis Foundation, (IOF) (2013) *The Asian-Pacific Regional Audit. Epidemiology, costs and burden of osteoporosis in 2013* <https://www.iofbonehealth.org>
32. Oden A, McCloskey EV, Kanis JA, Harvey NC, Johansson H (2015) *Burden of high fracture probability worldwide: secular increases 2010-2040*. Osteoporos Int 26:2243-2248
33. Cheung CL, Ang SB, Chadha M, et al. (2018) *An updated hip fracture projection in Asia: The Asian Federation of Osteoporosis Societies study*. Osteoporos Sarcopenia 4:16-21
34. Si L, Winzenberg TM, Jiang Q, Chen M, Palmer AJ (2015) *Projection of osteoporosis-related fractures and costs in China: 2010-2050*. Osteoporos Int 26:1929-1937
35. Ho-Pham LT, Mai LD, Pham HN, Nguyen ND, Nguyen TV (2012) *Reference ranges for vertebral heights and prevalence of asymptomatic (undiagnosed) vertebral fracture in Vietnamese men and women*. Arch Osteoporos 7:257-266
36. Hagino H (2012) *Fragility fracture prevention: review from a Japanese perspective*. Yonago Acta Med 55:21-28
37. Abrahamsen B, van Staa T, Ariely R, Olson M, Cooper C (2009) *Excess mortality following hip fracture: a systematic epidemiological review*. Osteoporos Int 20:1633-1650
38. Johnell O, Kanis JA (2004) *An estimate of the worldwide prevalence, mortality and disability associated with hip fracture*. Osteoporos Int 15:897-902
39. Boonen S, Autier P, Barette M, Vanderschueren D, Lips P, Haentjens P (2004) *Functional outcome and quality of life following hip fracture in elderly women: a prospective controlled study*. Osteoporos Int 15:87-94
40. Brown P, McNeill R, Leung W, Radwan E, Willingale J (2011) *Current and future economic burden of osteoporosis in New Zealand*. Appl Health Econ Health Policy 9:111-123
41. Japan Ministry of Health Labour and Welfare (2016) *National Medical Expenditure Survey [In Japanese]*. In Japan Ministry of Health Labour and Welfare (ed) Tokyo, Japan
42. McLellan AR, Gallacher SJ, Fraser M, McQuillan C (2003) *The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture*. Osteoporos Int 14:1028-1034
43. McLellan AR, Wolowacz SE, Zimovetz EA, Beard SM, Lock S, McCrink L, Adekunle F, Roberts D (2011) *Fracture liaison services for the evaluation and management of patients with osteoporotic fracture: a cost-effectiveness evaluation based on data collected over 8 years of service provision*. Osteoporos Int 22:2083-2098
44. Akesson K, Marsh D, Mitchell PJ, McLellan AR, Stenmark J, Pierroz DD, Kyer C, Cooper C, Group IOFFW (2013) *Capture the Fracture: a Best Practice Framework and global campaign to break the fragility fracture cycle*. Osteoporos Int 24:2135-2152
45. Javaid MK, Kyer C, Mitchell PJ, et al. (2015) *Effective secondary fracture prevention: implementation of a global benchmarking of clinical quality using the IOF Capture the Fracture(R) Best Practice Framework tool*. Osteoporos Int 26:2573-2578
46. Javaid MK, Sami A, Lems W, et al. (2020) *A patient-level key performance indicator set to measure the effectiveness of fracture liaison services and guide quality improvement: a position paper of the IOF Capture the Fracture Working Group, National Osteoporosis Foundation and Fragility Fracture Network*. Osteoporos Int 31:1193-1204
47. Buchbinder R, Golmohammadi K, Johnston RV, Owen RJ, Homik J, Jones A, Dhillon SS, Kallmes DF, Lambert RG (2015) *Percutaneous vertebroplasty for osteoporotic vertebral compression fracture*. Cochrane Database Syst Rev CD006349
48. Rodriguez AJ, Fink HA, Mirigian L, Guanabens N, Eastell R, Akesson K, Bauer DC, Ebeling PR (2017) *Pain, Quality of Life,*

and Safety Outcomes of Kyphoplasty for Vertebral Compression Fractures: Report of a Task Force of the American Society for Bone and Mineral Research. *J Bone Miner Res* 32:1935-1944

49. Gibbs JC, MacIntyre NJ, Ponzano M, Templeton JA, Thabane L, Papaioannou A, Giangregorio LM (2019) *Exercise for improving outcomes after osteoporotic vertebral fracture*. *Cochrane Database Syst Rev* 7:CD008618
50. Pfeifer M, Kohlwey L, Begerow B, Minne HW (2011) *Effects of two newly developed spinal orthoses on trunk muscle strength, posture, and quality-of-life in women with postmenopausal osteoporosis: a randomized trial*. *Am J Phys Med Rehabil* 90:805-815
51. Ioannidis G, Flahive J, Pickard L, et al. (2013) *Non-hip, non-spine fractures drive healthcare utilization following a fracture: the Global Longitudinal Study of Osteoporosis in Women (GLOW)*. *Osteoporos Int* 24:59-67
52. Feldstein AC, Black D, Perrin N, et al. (2012) *Incidence and demography of femur fractures with and without atypical features*. *J Bone Miner Res* 27:977-986
53. Meier RP, Perneger TV, Stern R, Rizzoli R, Peter RE (2012) *Increasing occurrence of atypical femoral fractures associated with bisphosphonate use*. *Arch Intern Med* 172:930-936
54. Taormina DP, Marcano AI, Karia R, Egol KA, Tejwani NC (2014) *Symptomatic atypical femoral fractures are related to underlying hip geometry*. *Bone* 63:1-6
55. Velasco S, Kim S, Bleakney R, Jamal SA (2014) *The clinical characteristics of patients with hip fractures in typical locations and atypical femoral fractures*. *Arch Osteoporos* 9:171
56. Sasaki S, Miyakoshi N, Hongo M, Kasukawa Y, Shimada Y (2012) *Low-energy diaphyseal femoral fractures associated with bisphosphonate use and severe curved femur: a case series*. *J Bone Miner Metab* 30:561-567
57. Lo JC, Huang SY, Lee GA, Khandelwal S, Provus J, Ettinger B, Gonzalez JR, Hui RL, Grimsrud CD (2012) *Clinical correlates of atypical femoral fracture*. *Bone* 51:181-184
58. Shkolnikova J, Flynn J, Choong P (2013) *Burden of bisphosphonate-associated femoral fractures*. *ANZ J Surg* 83:175-181
59. Girgis CM, Seibel MJ (2010) *Atypical femur fractures: a complication of prolonged bisphosphonate therapy?* *Med J Aust* 193:196-198
60. Niemeyer P, Sudkamp NP (2006) *Principles and clinical application of the locking compression plate (LCP)*. *Acta Chir Orthop Traumatol Cech* 73:221-228
61. Schatzer J, *Principle of Internal Fixation The Rationale of Operative Fracture Care*. 3-31
62. Handoll HH, Cameron ID, Mak JC, Finnegan TP (2009) *Multidisciplinary rehabilitation for older people with hip fractures*. *Cochrane Database Syst Rev* CD007125
63. Latham NK, Harris BA, Bean JF, et al. (2014) *Effect of a home-based exercise program on functional recovery following rehabilitation after hip fracture: a randomized clinical trial*. *JAMA* 311:700-708
64. Marsh D, Akesson K, Beaton DE, et al. (2011) *Coordinator-based systems for secondary prevention in fragility fracture patients*. *Osteoporos Int* 22:2051-2065
65. Silverman SL, Kupperman ES, Bukata SV, Members of IOFFWG (2016) *Fracture healing: a consensus report from the International Osteoporosis Foundation Fracture Working Group*. *Osteoporos Int* 27:2197-2206
66. Eriksen EF, Lyles KW, Colon-Emeric CS, et al. (2009) *Antifracture efficacy and reduction of mortality in relation to timing of the first dose of zoledronic acid after hip fracture*. *J Bone Miner Res* 24:1308-1313
67. Aspenberg P, Genant HK, Johansson T, et al. (2010) *Teriparatide for acceleration of fracture repair in humans: a prospective, randomized, double-blind study of 102 postmenopausal women with distal radial fractures*. *J Bone Miner Res* 25:404-414
68. Saez-Lopez P, Branas F, Sanchez-Hernandez N, Alonso-Garcia N, Gonzalez-Montalvo JI (2017) *Hip fracture registries: utility, description, and comparison*. *Osteoporos Int* 28:1157-1166



ACKNOWLEDGEMENTS

This document is part of the International Osteoporosis Foundation-Asia Pacific Orthopaedic Association (IOF-APOA) Orthopaedic Initiative. We would like to express our thanks and appreciation to both IOF and APOA for their fullest support, and the members of the Orthopaedic Initiative for their contributions, support and guidance which have helped to make this Orthopaedic Initiative a success.

AUTHORS AND REVIEWERS ON BEHALF OF THE IOF-APOA ORTHOPAEDIC INITIATIVE

Dato' Dr. Joon-Kiong Lee, Chair of the IOF Asia Pacific Regional Advisory Council (RAC)
Dr. David Siew-Kit Choon, Past President of Asia Pacific Orthopaedic Association (APOA)
Dr. Dominique Pierroz, IOF Science Manager
Prof. Serge Ferrari, IOF CSA Vice-Chair
Prof. Nicholas Harvey, IOF CSA Chair
Dr. Philippe Halbout, IOF CEO
Prof. Cyrus Cooper, IOF President

MEMBERS OF THE IOF-APOA ORTHOPAEDIC INITIATIVE

IOF

Dato' Dr. Joon-Kiong Lee, Chair of the IOF Asia Pacific Regional Advisory Council (RAC)
Prof. Peter Ebeling, Australia
Prof. Hiroshi Hagino, Japan
Dr. Thawee Songpatanasilp, Thailand

APOA

Dr. David Siew-Kit Choon, Past President of Asia Pacific Orthopaedic Association (APOA), Malaysia
Dr. Feza Korskusuz, Turkey
Prof. Frankie Leung, Hong Kong
Dr. Jean-Claude Theis, Malawi

This initiative was supported by Amgen.



ABOUT IOF

The International Osteoporosis Foundation (IOF) is the world's largest nongovernmental organization dedicated to the prevention, diagnosis and treatment of osteoporosis and related musculoskeletal diseases. IOF members, including committees of scientific researchers as well as 260 patient, medical and research societies, work together to make fracture prevention and healthy mobility a worldwide health care priority.

<https://www.osteoporosis.foundation> @iofbonehealth

ABOUT APOA

The Asia Pacific Orthopaedic Association (APOA) is a regional organisation of orthopaedic surgeons mainly from the Asia Pacific region.

APOA has 24 member chapters and more than 59,000 members from over 40 countries. The member chapters and federations are Australia, Bangladesh, Brunei, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Myanmar, Nepal, New Zealand, Oman, Pakistan, Philippines, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Turkey and Vietnam.

APOA's core mission is to promote the education, research and fellowship amongst orthopaedic surgeons in this region. APOA's conferences and fellowships are sought after by young surgeons while established and renowned senior surgeons provide the experience and resources to assist younger fellows.

<https://www.apoaonline.com>



Our vision is a world without fragility fractures,
in which healthy mobility is a reality for all

-  facebook.com/iofbonehealth/
-  twitter.com/iofbonehealth/
-  linkedin.com/company/international-osteoporosis-foundation/
-  instagram.com/worldosteoporosisday/
-  youtube.com/iofbonehealth/
-  pinterest.com/iofbonehealth/

©2020 **International Osteoporosis Foundation**
9 rue Juste-Olivier • CH-1260 Nyon • Switzerland
T +41 22 994 01 00 • info@osteoporosis.foundation
www.osteoporosis.foundation

