



# THE ASIA-PACIFIC REGIONAL AUDIT

Epidemiology, costs & burden of osteoporosis in 2013

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 International Osteoporosis  
Foundation

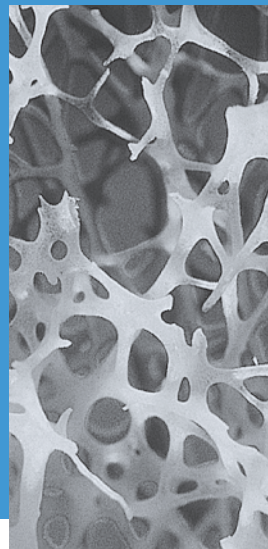


## What is osteoporosis?

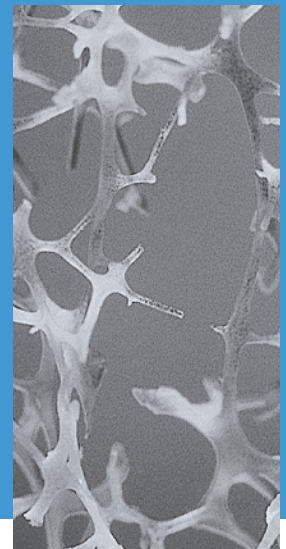
Osteoporosis is a disease in which the density and quality of bone are reduced, leading to weakness of the skeleton and increased risk of fracture, particularly of the spine, wrist, hip, pelvis and upper arm. Osteoporosis and associated fractures are an important cause of mortality and morbidity.

Worldwide, approximately one in three women and one in five men over the age of 50 will suffer an osteoporotic fracture in their remaining lifetime. In women aged over 45 years, osteoporosis accounts for more days spent in hospital than many other diseases, including diabetes, myocardial infarction and breast cancer.

Osteoporosis may be asymptomatic until the patient presents with a fracture, and even then it is estimated that only one out of three vertebral fractures come to clinical attention.



Normal bone



Osteoporotic bone

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# FOREWORD

Fragility fractures due to osteoporosis currently pose a major public health burden throughout the Asia Pacific. Sadly, this burden is set to rise. Due in large part to the dramatic ageing of the region's population we can expect, without any doubt, an exorbitant increase in the number of fracture patients in the coming decades.

A worrying trend too is the lower peak bone density and inadequate vitamin D levels present in younger populations. Facilitated by the growth in sedentary, urban lifestyles, these factors put the younger generation at risk for osteoporosis later in life.

Are the countries of the Asia-Pacific region ready to meet the enormous social and health-economic challenge posed by osteoporosis and related musculoskeletal diseases?

In 2009, IOF and its member societies in the region attempted to respond to this question by publishing the acclaimed Asian Audit, the first report to examine the epidemiology, costs and burden of osteoporosis in individual countries as well as collectively across Asia. The 2009 report effectively raised a warning flag by quantifying the immense and growing burden of osteoporosis. It also highlighted worrying gaps in care, the scarcity of data and the recommendations that would help health care authorities tackle this serious issue.

Now, in 2013, this Asia-Pacific Audit provides new and updated information about the status of osteoporosis. In addition to the 14 countries covered in 2009, we have added Australia and New Zealand to this Audit, giving more complete coverage of the region.

Information for the report was gathered from a survey of IOF's member societies in the Asia Pacific (Committee of National Societies – CNS) as well as through an extensive literature search. Responses from the country surveys, complemented by the literature search, are embedded in the narrative of each chapter and are compared in the **Key Comparisons** section of the Audit.

Input from the national societies was extremely valuable as it provided grassroots perspectives and



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listed recommendations for the respective countries. In addition, the members also gathered information about management and accessibility to diagnosis and treatment that is not otherwise captured by official sources, namely: waiting times, costs and reimbursement levels for dual-energy X-ray absorptiometry (DXA) and hip surgery; availability, coverage and reimbursement level of drug treatments; and implementation of fracture registries and fracture liaison services. The literature search, which was conducted across approximately 200 publications published between 2009—2013, revealed, as it did in the previous report, that there is a dearth of data and research from several countries of the region. Therefore, due to the lack of more current research, we have, at times, had to reference pre-2009 data.

## A CALL TO ACTION BY IOF AND ITS MEMBERS IN THE ASIA PACIFIC

The issues and problems revealed in this report are not just found in the Asia-Pacific region, osteoporosis is a disease that remains under-diagnosed and under-treated worldwide and a substantial increase in fracture incidence is expected in all parts of the world where the populations are ageing. However, by 2050 it is expected that more than 50% of the world's fractures will occur in Asia. Evidently, in this region more than in any other, there is an urgent need for action to reduce the projected human impact and socio-economic costs of fractures.

The data compiled in this report not only underscores the care gaps and future burden of osteoporosis, it also makes important recommendations. It is intended to serve as a useful tool to promote action at the national health policy level.

Together with its member societies throughout the Asia Pacific, IOF urges health authorities to take the necessary steps to reduce the immense and growing burden of osteoporosis and fractures.

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Malaysia	Malaysian Osteoporosis Society (MOS) <a href="http://www.osteoporosis.my">www.osteoporosis.my</a> Osteoporosis Awareness Society of Kuala Lumpur
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Pakistan	Pakistan Society for the Rehabilitation of the Disabled <a href="http://www.psr.org.pk">www.psr.org.pk</a> Gujranwala Osteoporosis Patient Society Osteoporosis Society of Pakistan
Philippines	Osteoporosis Society of the Philippines Foundation, Inc.
Republic of Korea	Korean Society for Bone and Mineral Research (KSBMR) Korean Society of Osteoporosis <a href="http://www.koreanosteoporosis.or.kr/eng">www.koreanosteoporosis.or.kr/eng</a>
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# TABLE OF CONTENTS

EXECUTIVE SUMMARY	7
THE AUDIT REGION	10
KEY FINDINGS IN THE ASIA-PACIFIC REGION IN 2013	11
KEY COMPARISONS	17
VITAMIN D STATUS IN THE ASIA PACIFIC	26
AUSTRALIA	31
CHINA	36
HONG KONG	43
INDIA	49
INDONESIA	56
JAPAN	61
MALAYSIA	68
NEW ZEALAND	74
PAKISTAN	81
PHILIPPINES	86
REPUBLIC OF KOREA	91
SINGAPORE	97
SRI LANKA	102
CHINESE TAIPEI	107
THAILAND	114
VIETNAM	119
CONCLUSIONS AND RECOMMENDATIONS	124

# EXECUTIVE SUMMARY

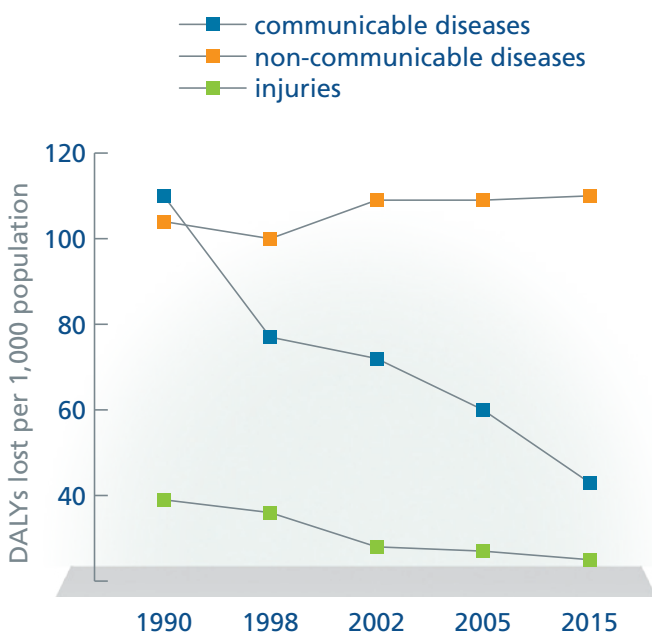
Over the past few decades, Asia has had one of the strongest overall improvements in health and prosperity of any region in the world. As a result, Asian populations now enjoy longer life-expectancy and improved quality of life. China is a shining example – per capita income has increased 21-fold over the last four decades and life expectancy has grown from 64 years in 1971 to 75 years in 2013 – with projections to 81 years by 2050.

However, as shown in this report, the hard-won gains in health and well-being throughout Asia threaten to be undermined by an ageing population which will contribute to an enormous rise in musculoskeletal diseases and the looming epidemic of fragility fractures.

## NON-COMMUNICABLE DISEASES ON THE RISE

New data from the Global Burden of Disease 2010 Study has shown that disability due to musculoskeletal disorders has increased by 45% from 1990 to 2010 compared with a

**FIGURE 1** Trends in disability-adjusted life years lost (per 1000 population) due to the major group of conditions in the Asia-Pacific region, 1990-2015



33% average across all other chronic, non-communicable disease (NCD) areas. Musculoskeletal diseases are now the second greatest cause of disability worldwide and in most regions of the world. The graph below (*Figure 1*), which only projects to 2015, shows the beginning of an upward curve for NCDs in the region<sup>1</sup>. Given the projected demographic changes we can expect a far more dramatic rise in age-related NCDs in the coming decades, particularly in Asia.

In terms of future prognosis of the burden of musculoskeletal diseases, and specifically osteoporosis and fractures, the three most important trends shown in this report are the ageing of the population, urbanization, and widespread vitamin D insufficiency.

The greatest challenge is the ageing of the population. Demographic changes alone can be expected to cause the number of hip fractures to increase dramatically. In Asia, a 7.6-fold increase in the elderly people is predicted between the years 2000 and 2050. In 2000, approximately 46% of men and 41% of women aged 80 years and older worldwide were from Asia – this proportion is expected to rise to 60% and 59% respectively by 2050<sup>1</sup>.

As in the West, secular trends indicate some signs of stabilization in the incidence of hip fracture in certain countries. However, although hip fracture incidence has seen a plateau in Australia, Hong Kong, Japan, and Chinese Taipei – this trend will be greatly offset by the ageing population.

Some of the most populous countries in the region are already highly urbanized and this trend is rapidly on the increase – in China 50% of the population live in cities, in Indonesia 51%, in Japan 66% and in the Philippines 65%. Urban, westernized lifestyles are largely sedentary and there is broad epidemiological evidence linking inactivity to the risk of hip fracture incidence, through lower bone mineral density (BMD), risk of falls or a combination of both.

In urban settings little time is spent outdoors partaking in physical activity and pollution often blocks much of

the sun's rays; these are among the many factors which contribute to the widespread problem of vitamin D insufficiency. As shown in this report low levels of vitamin D are seen region-wide, but more so in South Asia (the Indian subcontinent) and are highly prevalent even in young people. One concern is that vitamin D insufficiency in young women of child-bearing age may affect the next generation: some, but not all, studies have demonstrated that maternal vitamin D insufficiency during late pregnancy influences the bone mass of the offspring in later childhood.

### **FRAGILITY FRACTURES: AN ENORMOUS HUMAN AND SOCIO-ECONOMIC BURDEN**

The looming explosion in the incidence of fragility fractures due to osteoporosis poses a serious challenge to the health-care systems of all countries in this report. As a result of fractures – particularly vertebral and hip fractures – millions of older adults suffer pain and disability, often losing their ability to lead active, productive, and independent lives.

The World Health Assembly has aimed to reduce preventable deaths from NCDs by 25 per cent by 2025. Fracture prevention is an important step in achieving this aim. Deaths causally related to

hip fractures take a significant toll on the senior population. Even in sophisticated health-care systems where timely surgery after hip fracture is available, approximately 25% of people who sustain a hip fracture die within twelve months and less than half of those who survive regain their previous level of function. In specific countries or urban areas where rates of surgery after hip fracture are low, the burden of mortality and disability are thought to be substantially higher. This report shows that in Pakistan, Philippines, Sri Lanka, and Vietnam, only 50% (or fewer) of hip fracture patients receive surgery.

### **LACK OF CONCERTED ACTION DESPITE SPIRALING COST OF FRACTURES**

The direct costs of osteoporosis-related fractures to health-care systems are enormous – as shown, almost 5 billion USD is spent in Japan alone for hospital care of hip fractures. Hip fractures account for a majority of medical costs and morbidity in the community. Patients require a long duration of hospitalization and there is a frequent need for longer-term care and rehabilitation. Other costs resulting from fractures are not captured by statistics and are not easily quantifiable. An enormous hidden burden exists, where costs are borne by families, particularly in countries lacking specialized health services.





The prevention of secondary fractures is another area which demands increased attention. A prior fracture at any site is associated with a doubling of future fracture risk. This is reflected in the fact that about half of all patients who suffer a hip fracture have previously broken another bone. This Audit shows that with the exception of Singapore where great progress has been made, clinics in Asia are not setting up fracture liaison services, effective systems of care which help identify and treat these high-risk fracture patients.

A dearth of current epidemiological data in many countries indicates that not enough has been invested in large-scale research or fracture registries. Around the world, and especially in developing countries, musculoskeletal diseases must compete against infectious diseases and more high-profile communicable diseases for limited health-care budgets. Without being able to quantify the scope of the problem it will be difficult to convince health-care providers to direct resources to fracture prevention.

While progress seems to have been made in raising awareness among the public and health professionals, there is still a vast need for improvement. Public awareness campaigns must empower patients to identify risk factors and take preventive action for better bone health at all ages. In addition to increasing awareness of the need for exercise and calcium and vitamin D nutrition, smoking must also be targeted. Smoking is a risk factor for osteoporosis and a study by the George Institute of Global Health in 2010 revealed that the Asia-Pacific region is home to 30% of the world's smokers. In many Asian countries, for example China, men in particular smoke at high rates.

Doctors and allied health professionals must be kept informed, and specifically, receive specialized training and certification where applicable. New

opportunities arise with multi-channel systems and online communications. A good example of progress made since 2009 is seen in China, where the China Ministry of Health implemented the national project, 'Win Over Osteoporosis (WOO)' in 2009 and launched the project nationwide via the China Medical Doctors Association. Since its launch, 431 osteoporosis centres have been established and by the end of 2012, the number of dedicated osteoporosis specialists had rapidly expanded to 1,659 – who subsequently reached 3.8 million patients through multichannel avenues including nurse recommendations, cross-department referrals, educational seminars and public relationship programmes. Project WOO has an official website and an iPhone application for public and clinician education.

Osteoporosis remains a neglected disease on many levels. Only 4 of the 16 countries analyzed in this Audit have officially designated osteoporosis as a national health priority in their country. Osteoporosis, which is managed by a range of physicians, is often not part of the medical curriculum and osteoporosis specialists are generally still scarce. Management guidelines are increasingly available, but they are often not government endorsed, current, or widely disseminated.

The **Key Findings** outline the areas where progress is needed and where advances have been made, while the **Conclusions and Recommendations** list clear points of action.

We encourage national health authorities to take note, and to take action.

## REFERENCE

1. Kanis J; on behalf of the World Health Organization Scientific Group. *Assessment of osteoporosis at the primary health-care level*. Technical Report WHO Collaborating Centre, University of Sheffield, Sheffield. 2007.

# THE AUDIT REGION



# KEY FINDINGS IN THE ASIA-PACIFIC REGION IN 2013

## AN AGEING POPULATION: A CHALLENGE IN THE COMING DECADES

- As in much of the world, the population of Asia is ageing rapidly. Although the overall population of the 16 countries in this audit will grow an average of 24% between 2013 and 2050, the population of those aged over 50 years is expected to grow an average of 144% by the year 2050<sup>1</sup>.
- Largely as a result of the ageing population, it has been projected that over half of all hip fractures in the world will occur in Asia by 2050<sup>2</sup>.
- In 6 of the countries participating in this Audit, one-third of the population was aged over 50 years in 2013. By 2050 nearly all 16 countries included in this Audit will have at least one-third of their population aged over 50 years, and 5 countries will have at least half of their population aged over 50 years (*Figure 2 of Key Comparisons, Percentage of population aged 50 years and over by country, 2013, 2025, 2050*)<sup>1</sup>.
- Of the audited countries, India will have the greatest total increase in people aged over 50 years, from 120 million in 2013 to 620 million in 2050, which represents growth of 416%. Japan is expected to see the smallest increase at 8%, with 56 million people aged over 50 years in 2013 and 61 million aged over 50 years in 2050. However, Japan's current population is more aged than India's with almost half of the population aged over 50 years (*Table 1 of Key Comparisons, Population increase in aged 50 years and over by country, 2013, 2025, 2050*)<sup>1</sup>.
- The Chinese National Committee on Ageing declared in 2013 that China had reached 200 million people aged older than 60 years.
- As people are living longer, growth in the population aged over 70 years is expected to increase exponentially from 2013 to 2050, with increases as high as 400% in Malaysia and Singapore (*Table 2 of Key Comparisons, Population increase in aged 70 years and over by country, 2013, 2025, 2050*)<sup>1</sup>.

- Life expectancy will increase over the coming decades. In 2013, the life expectancy in India and Pakistan was the lowest of the 16 countries at 67 years, but is expected to increase 15% to 77 years by 2050. In Japan and Singapore, life expectancy in 2013 was already 84 years and is expected to increase by 10% to reach 92 years in 2050<sup>1</sup>.

## HIGH FRACTURE RATES WITH MAJOR INCREASES PREDICTED BY 2050

- It is projected that by 2050, 50% of hip fractures will occur in Asia, with the majority occurring in China, where the age-specific rate of hip fractures in those aged over 50 years has already increased 58% in women and 49% in men from 2002–2006.
- Most Asian countries have seen a 2–3 fold increase in the incidence of hip fractures over the past 30 years<sup>2</sup>.
- The highest incidence of hip fractures from Asia has been reported in Singapore. Hip fracture rates increased 4- to 5-fold over a period of 30 years.
- While findings indicate that the prevalence of hip and other fragility fractures in Hong Kong is low, studies show that the prevalence of vertebral fractures is actually equal to if not higher than Caucasian counterparts, and is much higher than those in Mainland China.
- Hip fracture risk in Chinese Taipei men ranks as one of the highest in Asia and may be higher than the world average at 196/100,000 per year.
- It has been suggested that in India, hip fractures occur at an earlier age in comparison with Western populations, with the peak age for hip fractures in Indians being their sixties, and vertebral fractures in India may be as common as in Western populations.

## **BURDEN OF OSTEOPOROSIS AND FRACTURES IS SEVERELY UNDERESTIMATED**

- In the 2009 IOF Asian Audit, it was projected that the number of Indians with osteoporosis would reach 36 million by 2013. Now, in 2013, sources actually estimate that 50 million people in India are either osteoporotic (T-score lower than  $-2.5$ ) or osteopenic (T-score between  $-1.0$  and  $-2.5$ ).
- In New Zealand, it is estimated that the actual prevalence of osteoporosis may be higher than reported, due to the high cost of dual-energy X-ray absorptiometry (DXA) and low reimbursement.
- The most current estimation of osteoporosis prevalence in Thailand is from the 1999–2000 nationwide survey, which is more than 13-years old.
- Detecting the prevalence of osteoporosis has been difficult in Vietnam, partially due to the lack of ethnic-specific criteria for diagnosis, and in many cases it is based on reference levels from Western populations.

## **FRACTURES REPRESENT A SERIOUS HUMAN, SOCIAL AND ECONOMIC BURDEN IN ALL COUNTRIES**

- Fractures, particularly of the hip and spine, are associated with high morbidity and increased mortality. For example, a study following Japanese women 10 years after fracture found the survival rate was 69% compared with 86% in those who had not fractured.
- The cost of treating fractures is a substantial drain on health-care resources. Hip fractures are the most costly to treat as they usually require surgery. Costs are highest in Japan which has annual expenditures of more than 4.9 billion USD per year for hip fracture care alone.
- In Singapore the incidence of hip fracture has increased 1.5 times in men and 5 times in women since the 1960s. One study found the total cost of managing hip fractures within the first year after fracture in Singapore to be 17 million USD in 1998, and estimates that costs will reach 145 million USD in 2050.

- According to the Clinical Data Analysis & Reporting System (CDARS) of the Hospital Authority in Hong Kong, there have been approximately 4,500 cases of hip fracture every year amounting to 52 million USD in annual hospital expenditure.
- In 2007–2008, almost 82,000 individuals in Australia were hospitalized with fragility fractures, including more than 17,000 cases of hip fracture.

## **OSTEOPOROSIS – A NEGLECTED DISEASE**

- Osteoporosis remains a greatly under-diagnosed and under-treated disease in the region, even in the case of high-risk patients who have already fractured.
- With the exception of Singapore, fracture liaison services (FLS), coordinated, post-fracture models of care for secondary fracture prevention, are very uncommon in the Asia-Pacific region. Less than 10–25% of hospitals in each country have implemented FLS, except Singapore where approximately 50% of hospitals operate an FLS.
- New Zealand is currently behind the international developments in fracture prevention and the associated ‘bone health’ infrastructure, and osteoporosis remains an under-appreciated, undervalued, under-treated and under-resourced disorder of high prevalence.
- Studies show that Thai patients who do not receive surgery have almost double the risk of dying post-hip fracture than do those who do not undergo an operation. This is a concern in Thailand because just 53% of hip fracture patients are treated surgically.
- Only between 10–25% of hip fractures in Vietnam are managed surgically, and the average wait-time for hip surgery is more than 3 days.

## **WIDESPREAD VITAMIN D DEFICIENCY AND LOW CALCIUM INTAKE**

- In Malaysia and the Philippines, calcium intake remains low with daily calcium intakes of below 500 mg and 440 mg respectively.
- The National Nutrition Survey in New Zealand found that 1 in 4 women did not have an adequate intake of calcium.

- The Indian population consumes much lower amounts of calcium (300–500 mg/day), and the mean calcium intake in Pakistan was found to be 346 mg/day.
- Inadequate calcium intake is found throughout Asia with daily intake well below the World Health Organization (WHO) general recommended levels of 1000–1300 mg/day.
- The literature has indicated that the high rate of vitamin D insufficiency may be due to several causes such as urbanization, low sun exposure, inadequate dietary vitamin D intake, lack of food fortification with vitamin D, pigmented skin, environmental pollution, and traditional dress code.
- A worldwide systematic review of the literature on vitamin D status indicated that the majority of the countries in Asia have average vitamin D levels between 25–49 nmol/L. The levels in Japan and Australia are reported to be slightly better at 50–74 nmol/L, and in Chinese Taipei, Thailand and Vietnam vitamin D levels are at optimal levels of above 75 nmol/L.
- Widespread vitamin D deficiency has been shown unequivocally across all ages from all over India. More than 80% of urban Indians have serum 25(OH)D levels below 20 ng/mL.
- Vitamin D insufficiency and deficiency are being reported in children and adolescents which suggest that peak bone mass may not be achieved, thus predisposing them to osteoporosis later in life. Vitamin D insufficiency/deficiency was found in: 40–90% of Chinese children (<25 nmol/L); younger Pakistani women (<50 nmol/L); almost 100% of Vietnamese boys and girls (<75 nmol/L); and almost all younger Thai women living in the cities (<75 nmol/L).

### **SIGNIFICANT RURAL AND URBAN DIFFERENCES**

- Rural areas have less access to diagnostics and treatment as compared to urban areas. This suggests that the number of people with osteoporosis may be underestimated in rural areas throughout the Audit countries.
- The increase in urban living is contributing to an increased prevalence of osteoporosis through:

increased time spent indoors equating to less sunlight exposure and more sedentary lifestyles. In China, urban living increased from 33% in 2000 to 50% in 2013.

- In Australia the diagnosis of osteoporosis was more prevalent among those who live in major cities than in the 12% living in rural and remote locations.
- Access to health care in Indonesia can be challenging due to the geographical dispersion of the islands, the low ratio of health-care providers to population, and to the fact that the distribution of health-care services is concentrated in the urban areas. Forty-nine per cent of the population live in rural areas.
- Koreans living outside of Seoul had a higher risk of dying within the first year after hip fracture than those living within the capital.
- The countries with the highest percentage of urban populations are Singapore, Hong Kong, New Zealand, Republic of Korea, Chinese Taipei and Malaysia.

### **ACCESS TO TREATMENT LIMITED BY LACK OF REIMBURSEMENT OR OTHER RESTRICTIONS**

- Reimbursement varies greatly across the region – ranging from zero to 100% reimbursement for the most commonly prescribed medications. However in many cases there are differences between public and private insurance, only partial reimbursement being offered, or restrictive criteria applied – such as age or prior fracture.
- In the Hong Kong public sector, history of prior fracture is required for reimbursement of osteoporosis treatment and the private sector does not offer reimbursement at all.
- The Australian guidelines on osteoporosis care and treatment are robust; however not all of the recommended treatments are reimbursed.
- In the Philippines osteoporosis is seen as a natural part of ageing and diagnostics or treatment is not reimbursed.
- In Sri Lanka, access and cost do not appear to be an issue for osteoporosis treatment. However,

adherence to therapy and disease management are an issue, especially in the area of secondary fracture prevention.

#### LIMITED ACCESS TO DIAGNOSTIC TOOLS

- An inadequate number of DXA machines, poor accessibility/lack of availability in rural areas, and lack of reimbursement are barriers to the identification of people with osteoporosis.
- Republic of Korea, Japan, Hong Kong, Australia, Singapore and New Zealand have from 12–24 DXA machines per million. In contrast, China, India, Indonesia, Pakistan, Philippines, Sri Lanka and Vietnam are severely under-resourced with less than 1 machine per million population.
- DXA is not reimbursed in Indonesia, New Zealand, Philippines, or Singapore. However in some countries it is reimbursed only by public health care (Hong Kong, Malaysia), or reimbursement is partial, limited, or depends on local health-care authorities.

- In New Zealand, DXA is not reimbursed despite being frequently required as a prerequisite to access funded medication.
- In Chinese Taipei, only 3 bone mineral density (BMD) examinations can be performed within the lifetime of a patient, and the interval between these examinations must exceed one year.
- FRAX models (or surrogate models) are available for all countries included in the Audit, with the exception of Pakistan, Malaysia and Vietnam.

#### GUIDELINES, GOVERNMENT ENDORSEMENT AND GOVERNMENT POLICY

- The governments of just 4 of the 16 countries represented in this Audit have designated osteoporosis as a national health priority: Australia (2002), Chinese Taipei (2005), Singapore (2009) and most recently, China (2011).



- Management guidelines were reported as available for all countries except Pakistan. However, not all guidelines are current, government endorsed, or have been rolled out at the national level.

## LOW LEVELS OF PUBLIC AND HEALTH PROFESSIONAL AWARENESS

- Together with the high costs of medication, the lack of awareness amongst physicians and patients about the disease is considered to be one of the biggest barriers to osteoporosis care in the Asia-Pacific region.
- Chinese nursing students did not know key osteoporosis facts such as increased bone loss after menopause, prevalence in women, race differences, or drug therapy benefits; and 33% of Chinese physicians did not know that there were published guidelines for BMD testing.
- The Taiwanese Osteoporosis Association recently released a report stating that as many as 74% of the public is unaware that a loss of body height is a possible sign of osteoporosis in women.
- In Pakistan, and many other countries surveyed, osteoporosis is not a component of medical training. In addition, the lack of practice guidelines and standards, the low number of physicians specializing in osteoporosis and the lack of fracture data contribute to the low level of awareness about osteoporosis.
- Awareness of osteoporosis is low in India with a number of small-scale surveys indicating that in urban areas only approximately 10–15% of the population are familiar with the disease.

## COMPETITION WITH OTHER DISEASES

- In countries where infectious diseases are a major cause of morbidity and mortality, chronic diseases such as osteoporosis tend to receive less priority and fewer health-care resources. For example, in Pakistan, the priority of international donor agencies is on diseases such as HIV/AIDS, Polio, maternal and child health etc., in line with the Millennium Development Goals.
- In Sri Lanka approximately 35% of deaths are from communicable diseases and infections such

as dengue and leptospirosis. Due to the large impact of these diseases, fewer health-care resources are allocated to chronic diseases such as osteoporosis.

- As in many other parts of the world, high-profile non-communicable diseases such as diabetes mellitus, hypertension, and heart or cerebrovascular diseases are prioritized. This is, for example, the case in Malaysia and Hong Kong.

## INSUFFICIENT EPIDEMIOLOGICAL RESEARCH AND DATA

- There is an urgent need at the national level to accurately quantify osteoporosis and fracture prevalence in many countries of the region.
- In Malaysia there is a serious lack of fragility fracture data underscoring the need for large-scale epidemiological fracture studies to be funded and conducted. The most current data are from analyses done in 1997. There are also no reference databases on BMD and bone turnover markers of the different ethnic groups in Malaysia.
- Fracture data are lacking in Pakistan and accurate numbers are not available for the prevalence of hip and other fractures.
- In Sri Lanka, Thailand and Vietnam there is a limited amount of osteoporosis related epidemiologic data.

## SOME POSITIVE TRENDS

- Mandated by the Ministry of Health, China recently documented osteoporosis as a national health priority (NHP) on May 9, 2011, and several guidelines on the management and treatment for osteoporosis were published in 2011 and 2013.
- Australia and New Zealand are jointly developing a hip fracture registry that will run on a national level and collect data from individual Australian states as well as from New Zealand.
- In a study of almost 800 Singaporean osteoporosis patients, it was indicated that adherence to bisphosphonate therapy is higher than in Europeans and Americans.

- More than half of the hospitals in Singapore have implemented an FLS through the secondary fracture prevention programme, *Osteoporosis Patient Targeted and Integrated Management for Active Living (OPTIMAL)*, which is instituted in the public hospitals of Singapore. This represents the highest implementation of FLS in the Asia-Pacific region.
- Japan and the Republic of Korea have one of the highest availability of DXA machines in the world<sup>3</sup>.
- The vast majority of countries in this Audit have FRAX calculators, representing an important new tool to facilitate the identification of individuals at high risk of fracture.
- Albeit limited, fracture data has become available for India, and vitamin D fortification of edible oil and milk is in early stages of implementation in some states of India.
- The level of awareness in Malaysia is high. Responding to a questionnaire, 87.1% of Malaysians had heard of osteoporosis, 97.1% identified low calcium intake as a risk factor and 75.8% knew postmenopausal status increased the incidence of osteoporosis in women.
- While the last 50 years has seen a sharp increase in hip fractures in Hong Kong, studies over the past decade are showing a reversal in this trend. Hong Kong is now experiencing a decrease in the incidence of age-adjusted hip fractures in women and men as well as a lower prevalence of osteoporosis and osteopenia.
- According to the Taiwanese Osteoporosis Association, as of May 2013, there were 148 osteoporosis specialists in Chinese Taipei.
- The Ministry of Health in Japan mandates that osteoporosis population screenings are conducted and has implemented nationwide educational programmes for falls prevention and exercise as they pertain to osteoporosis.
- The Republic of Korea also has a government run system that regularly screens the population for osteoporosis, among other diseases.

#### REFERENCES\*

1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/information-Gateway.php>>.
2. Lau, EMC, Cooper C 1996, 'The epidemiology of osteoporosis: the oriental perspective in a world context,' *Clin Orthop Relat Res*, vol. 323, pp. 65-74.
3. Mithal, A, Kaur, P 2012 'Osteoporosis in Asia: A Call to Action,' *Current Osteoporosis Reports*, vol. 10, no. 4, pp. 245-247.

\*References for country specific data can be found within the individual country chapters.



# KEY COMPARISONS

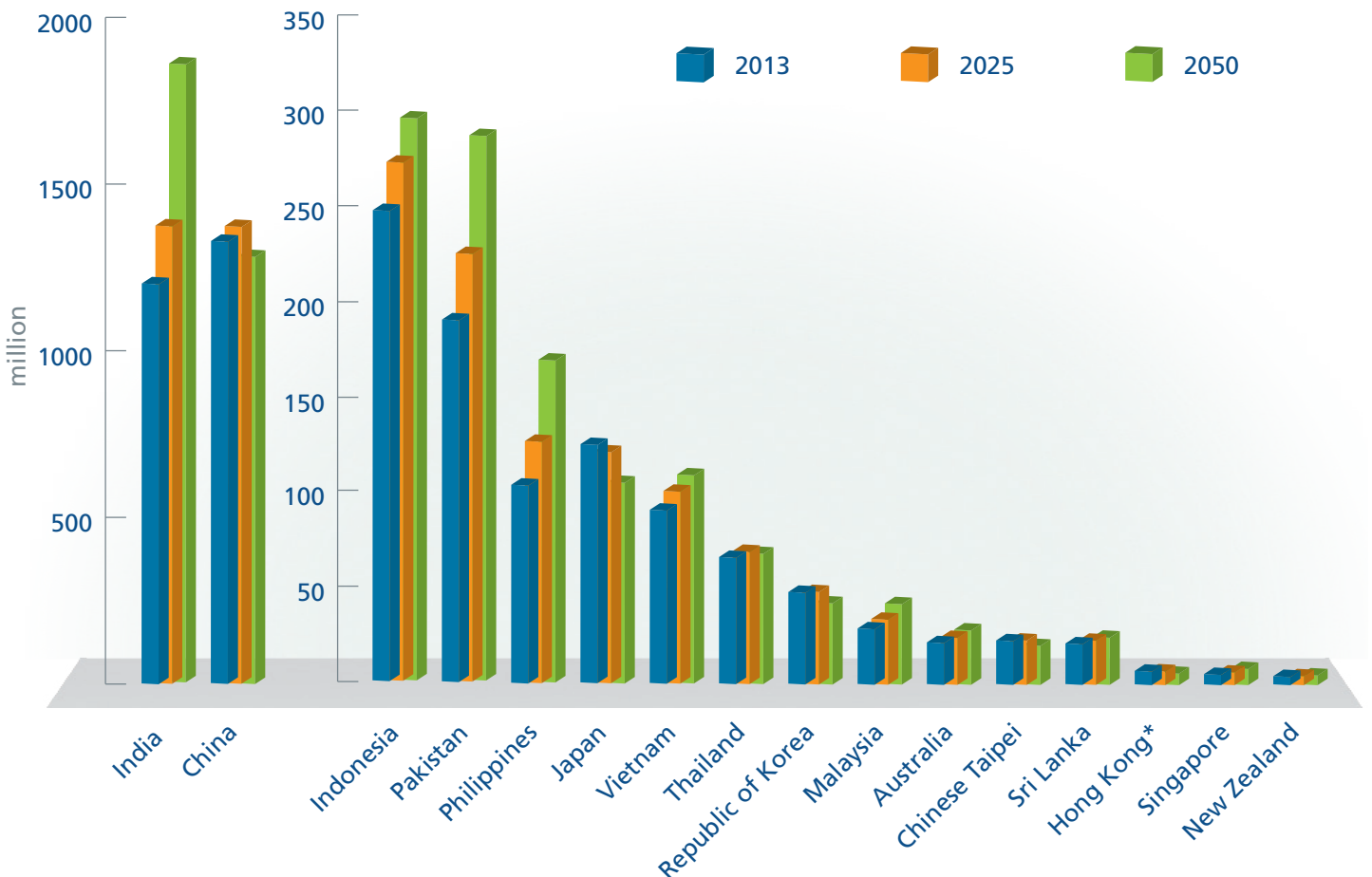
## DEMOGRAPHIC DATA

The 16 countries represented in this audit region have a total population of 3.6 billion people with an expected increase to 3.9 billion and 4.4 billion by 2025 and 2050 respectively. The most populous country in 2013 was China with 1.3 billion people, followed closely by India with 1.2 billion people (Figure 1). However, in just over a decade by 2025, India's population is projected to surpass China's and take the lead as the world's most populous country with 1.4 billion people in 2025 and 1.8 billion people in 2050.

Five countries represented in this audit are projected to experience a decrease in total population by the year 2050 (China (-3%), Hong Kong (-14%), Japan (-16%), Republic of Korea (-11%) and Chinese Taipei (-11%)); however *all* countries have ageing populations and will experience an increase in those aged over 50 years in the coming decades (Table 1).

India will see the largest increase with a 416% growth in its citizens aged over 50 years rising from 120 million in 2013 to 620 million in 2050, at which time the proportion of those aged over 50 years will be 33% (Figure 2).

**FIGURE 1** Population size by country in 2013 and projected in 2025 and 2050



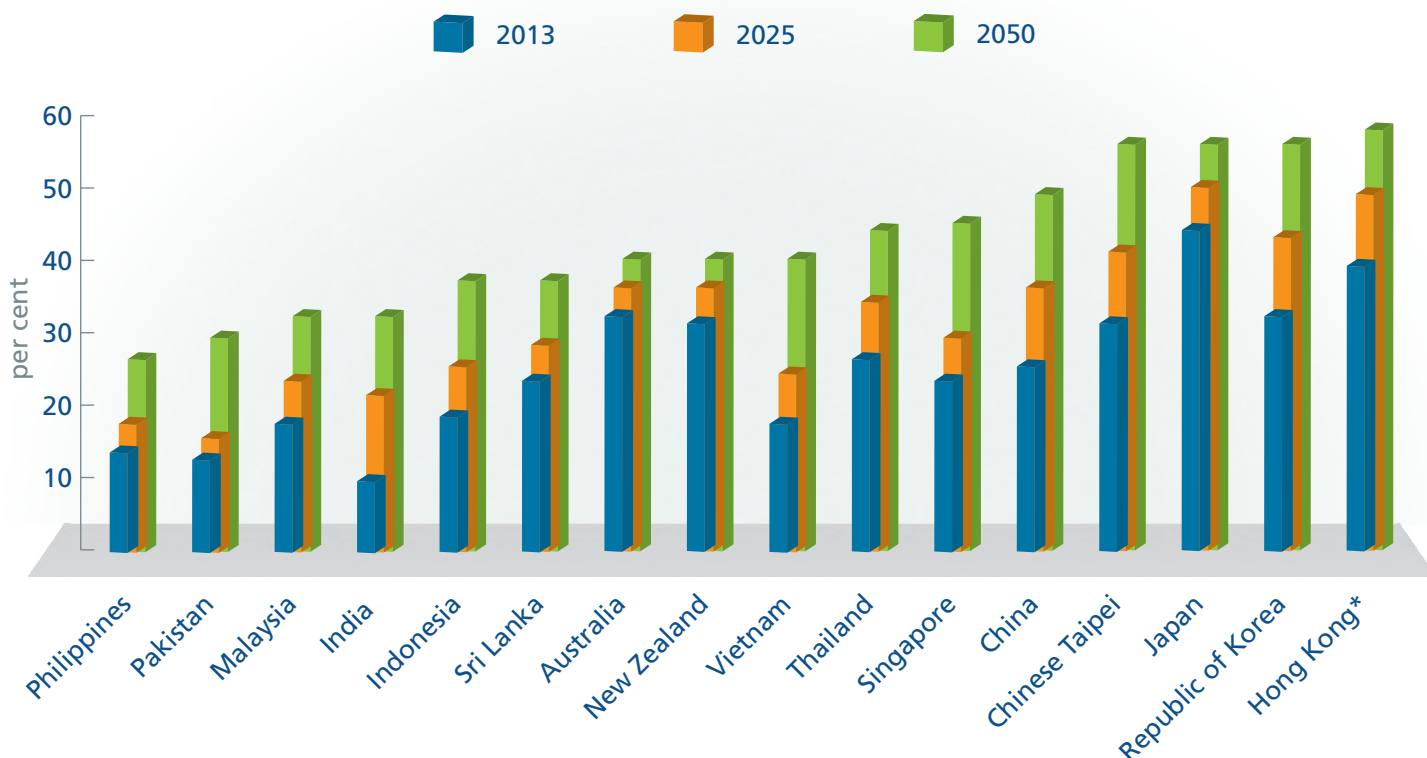
\* Population and projections may differ from those provided in the Hong Kong census SOURCE United States Census Bureau 2013

**TABLE 1** Population increase in those aged 50 years or over by country, 2013, 2025, 2050

	2013	2025	2050	% INCREASE OVER AGE 50 YEARS, 2013 TO 2050
Japan	56,792,116	63,137,106	61,404,582	8%
Hong Kong*	2,848,840	3,644,555	3,653,934	28%
New Zealand	1,402,977	1,759,771	2,135,761	52%
Republic of Korea	15,981,878	21,554,573	24,853,797	56%
Chinese Taipei	7,503,694	9,848,886	11,909,723	59%
Australia	7,392,759	9,170,001	11,835,734	60%
Thailand	18,123,738	24,695,693	31,574,940	74%
China	357,533,986	518,170,847	636,407,698	78%
Sri Lanka	5,146,679	6,908,520	9,660,017	88%
Indonesia	48,190,442	71,256,230	113,099,035	135%
Malaysia	5,319,958	8,183,295	13,993,095	163%
Vietnam	16,785,640	25,905,589	45,814,245	173%
Singapore	1,331,843	2,000,987	3,943,537	196%
Philippines	14,859,530	22,581,160	46,076,066	210%
Pakistan	24,853,988	37,336,285	87,243,156	251%
India	120,207,196	309,691,746	620,424,494	416%

\* Population and projections may differ from those provided in the Hong Kong census SOURCE United States Census Bureau 2013

**FIGURE 2** Percentage of population aged 50 years or over by country, 2013, 2025, 2050



\* Population and projections may differ from those provided in the Hong Kong census SOURCE United States Census Bureau 2013

Japan is expected to see the smallest increase of just 8% in its population aged over 50 years, rising from 56 million in 2013 to 61 million in 2050. However, Japan is currently already among the countries with the highest proportion of elders with 45% of its citizens aged over 50 years in 2013 rising to 57% in 2050 (*Figure 2*).

Other countries that had relatively small populations, fewer than 50 million, but a proportionally larger demographic aged 50 years and over in 2013, and rising by 2050, include: Republic of Korea (33% rising to 57%), Australia (33% rising to 41%), New Zealand (32% rising to 41%), Chinese Taipei (32% rising to 57%), Hong Kong (40% to 59%), and Singapore (24% to 46%).

Of note, the majority of countries represented in the Audit can expect at least a doubling if not a tripling of their populations aged 70 years or over by the year 2050 (*Table 2*). Singapore is projected to have the greatest increase in its population aged over 70 years, with a percentage increase of 429%, followed closely by Malaysia with an increase of 417%.

Those aged over 70 years will comprise over 20% or more of the population by 2050 in China and Thailand

(20%), Chinese Taipei and Republic of Korea (28%), Hong Kong (31%) and Japan (33%).

## DIAGNOSTIC TOOLS AND COSTS

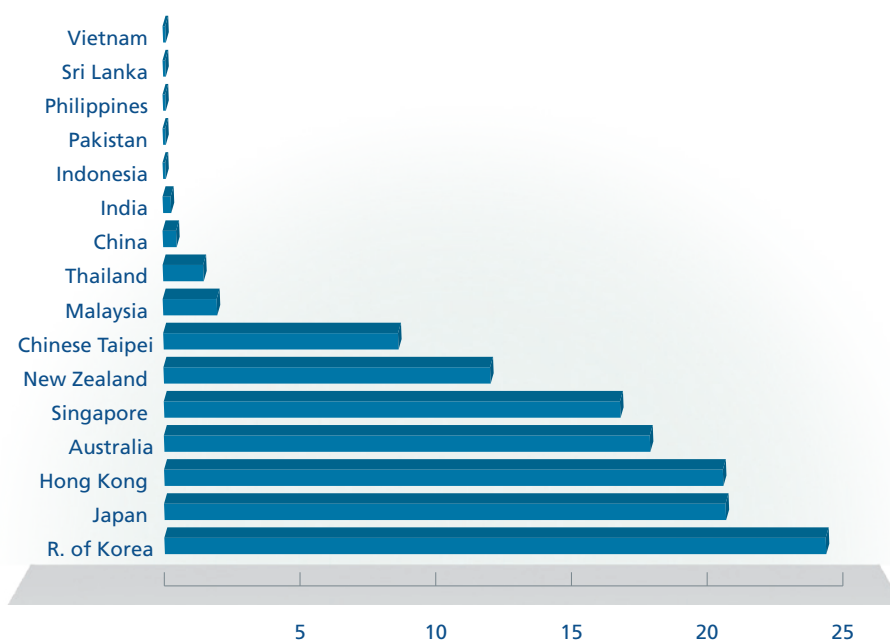
Bone mineral density (BMD) testing is available in every country represented in the Audit but availability varies from country to country. Dual-energy X-ray absorptiometry (DXA) and ultrasound are used throughout the region, although ultrasound is mainly used for population-based screening. Six of the countries in the Audit region have 12 or more DXA machines per one million of the population, which provides for sufficient diagnostic coverage. Unfortunately, the remaining 10 countries are under-resourced and have an inadequate number of DXA machines for the respective population size. Further, it is reported that in many cases access to DXA is limited to those living in the cities due to a higher concentration of medical facilities in urban areas. The number of DXA machines per million inhabitants and DXA costs are illustrated in *Figure 3* and *Table 3*.

**TABLE 2** Population increase in those aged 70 years or over by country, 2013, 2025, 2050

	2013	2025	2050	% INCREASE 2013-2025	% INCREASE 2025-2050	% INCREASE 2013-2050
Japan	23,011,747	30,640,589	35,775,911	33%	17%	55%
Australia	2,227,695	3,312,469	4,972,125	49%	50%	123%
New Zealand	414,050	603,259	927,683	46%	54%	124%
Hong Kong*	730,013	1,143,437	1,938,160	57%	70%	165%
Chinese Taipei	1,926,606	3,008,513	5,561,399	56%	85%	189%
Republic of Korea	4,093,278	6,250,386	12,222,143	53%	96%	199%
Thailand	4,328,866	6,809,826	13,647,275	57%	100%	215%
China	81,125,217	131,679,177	263,152,529	62%	100%	224%
Sri Lanka	1,145,310	1,925,891	3,883,004	68%	102%	239%
Indonesia	10,366,493	15,821,035	40,837,224	53%	158%	294%
India	41,284,460	65,150,062	165,493,550	58%	154%	301%
Pakistan	5,135,174	7,392,939	20,917,420	44%	183%	307%
Vietnam	3,593,065	5,254,769	15,876,455	46%	202%	342%
Philippines	2,859,825	4,899,490	13,489,932	71%	175%	372%
Malaysia	939,010	1,758,356	4,854,210	87%	176%	417%
Singapore	289,462	587,675	1,531,599	103%	161%	429%

\* Population and projections may differ from those provided in the Hong Kong census SOURCE United States Census Bureau 2013

**FIGURE 3** Number of DXA machines per million population, by country



**SOURCE** Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, <http://esa.un.org/unpp>, Monday, March 28, 2011; 7:14:15 AM: Kanis, JA, data on file.

**TABLE 3** Diagnostics access and cost in the audited countries

	WAITING TIME FOR DXA (D)	COST (USD)	IS DXA REIMBURSED?	IS REIMBURSEMENT A BARRIER TO ACCESS TO TREATMENT?
Australia	immediate	\$80–202	yes	yes
China	immediate, urban areas only	\$27	yes	yes
Chinese Taipei	< 2 weeks	\$40	limited	yes
Hong Kong	<b>PUBLIC</b> 9 months <b>PRIVATE</b> immediate	\$40-120	<b>PUBLIC</b> free <b>PRIVATE</b> no	no
India	immediate	\$27-67	limited	yes
Indonesia	immediate	\$54	no	yes
Japan	immediate	\$16-35	yes (70%)	no
Malaysia	immediate to 1 week	<b>PUBLIC</b> free <b>PRIVATE</b> \$40-100	<b>PUBLIC</b> free <b>PRIVATE</b> no	<b>PUBLIC</b> no <b>PRIVATE</b> varies
New Zealand	<b>PUBLIC</b> weeks <b>PRIVATE</b> days	\$100-134	no	yes
Pakistan	2-3 days	\$40	depends on local governance	depends on local governance
Philippines	2-3 days	\$55-135	no	yes
Republic of Korea	immediate	\$80	yes	no
Singapore	1 week	\$87	no	varies
Sri Lanka	immediate	\$27-67	yes	no
Thailand	1 week	<b>ON SITE</b> \$70 <b>SPINE AND HIP</b> \$40	yes, with conditions	yes
Vietnam	immediate	\$10	yes (in part)	varies

**SOURCE** Data provided by IOF CNS member societies

THE IOF NATIONAL SOCIETIES IN THE ASIA-PACIFIC REGION RESPONDED TO THE QUESTION: 'WHICH OSTEOPOROSIS TREATMENTS ARE REIMBURSED IN YOUR COUNTRY, AND IF SO, AT WHAT PER CENT?' THE ANSWERS ARE SUMMARIZED IN TABLES 4A AND 4B.

**TABLE 4A Summary of reimbursement (%) for osteoporosis treatment**

	AUSTRALIA	CHINA	CHINESE TAIPEI	HONG KONG	INDIA	INDONESIA
Risedronate	yes (34 USD co-pay)	80% (variable)	no	no	< 10%	yes
Alendronate	yes (34 USD co-pay)	90%	100%	100% (if prior fracture)	< 10%	yes
Ibandronate	no	no	100%	no	< 10%	yes
Zoledronic acid	yes (34 USD co-pay)	80% (IP only)	100%	100% (if prior fracture and intolerance to alendronate)	< 10%	for metastatic bone diseases only
Clodronate	no	no	no	no	no	no
Pamidronate	no	variable	no	no	no	no
Raloxifene	yes (34 USD co-pay)	90%	100%	no	< 10%	yes
Bazedoxifene	no	no	100%	not available	no	no
Denosumab	yes (34 USD co-pay)	not available	100%	100% (if prior fracture and intolerance to alendronate)	not available	not available
Strontium Ranelate	yes (34 USD co-pay)	no	no	100% (if prior fracture and intolerance to alendronate)	< 10%	yes
Teriparatide	yes (34 USD co-pay)	no	100%	no	< 10%	no
PTH (1-84)	no	variable	no	not available	no	no
Vitamin D/Ca supplements	no	100%	10%	yes	< 10%	100%
Calcitonin	no	variable	100%	yes (for pain in acute vertebral fracture)	< 10%	yes
Hormone Replacement Therapy	no	90%	100%	yes	< 10%	yes
Testosterone	for deficiency in males only	variable	100%	yes	< 10%	yes
Alfacalcidol	no	90%	100%	no	< 10%	no
Calcitriol	yes (34 USD co-pay)	90%	no	no	< 10%	no
others		TCM - 80%				

SOURCE Data provided by IOF CNS member societies

<b>PAKISTAN</b>	most treatments are available - reimbursement varies at the local level
<b>PHILIPPINES</b>	most treatments are available - treatment is not reimbursed
<b>SINGAPORE</b>	most treatments are available - treatment is not reimbursed

**TABLE 4B** Summary of reimbursement (%) for osteoporosis treatment

	JAPAN	MALAYSIA	NEW ZEALAND	REPUBLIC OF KOREA	SRI LANKA	THAILAND	VIETNAM
Risedronate	70% (90% if > 75 years)	private only	yes (4 USD co-pay)	70%	private sector only	no	no
Alendronate	70% (90% if > 75 years)	100%	yes (4 USD co-pay)	70%	100%	no	yes
Ibandronate	yes	100%	no	70%	private sector only	no	no
Zoledronic acid	no	private only	yes (4 USD co-pay)	70%	100%	no	yes
Clodronate	no	private only	no	not available	not available	no	no
Pamidronate	no	private only	yes (4 USD co-pay)	70%	not available	no	no
Raloxifene	70% (90% if > 75 years)	private only	yes (4 USD co-pay)	70%	private sector only	with authorization	no
Bazedoxifene	70% (90% if > 75 years)	varies	no	70%	not available	no	no
Denosumab	70% (90% if > 75 years)	private only	no	not available	not available	no	not available
Strontium Ranelate	no	100%	no	not available	not available	with authorization	no
Teriparatide	70% (90% if > 75 years)	private only	yes (4 USD co-pay)	no	private sector only	with authorization	no
PTH (1-84)	no	no	no	no	not available	no	no
Vitamin D/Ca supplements	70% (90% if > 75 years) Vitamin D not reimbursed	100%	yes (4 USD co-pay)	70%	100%	100%	yes
Calcitonin	70% (90% if > 75 years)	private only	yes (4 USD co-pay)	70% Elcatonin only	private sector only	withdrawn as osteoporosis treatment	yes
Hormone Replacement Therapy	70% (90% if > 75 years)	100%	yes (4 USD co-pay)	70%	private sector only	100%	no
Testosterone	no	100%	yes (4 USD co-pay)	no	100%	100%	no
Alfacalcidol	70% (90% if > 75 years)	100%	yes (4 USD co-pay)	70%	100%	no	no
Calcitriol	70% (90% if > 75 years)	100%	yes (4 USD co-pay)	70%	private sector only	no	yes
others	Eldecalcitol, Vitamin K2, Minoronate, Ipriflavone, Nandrolone Decanoate						

SOURCE Data provided by IOF CNS member societies

## GOVERNMENT POLICY, GUIDELINES AND NATIONAL HEALTH PRIORITY

Osteoporosis has been declared a government mandated national health priority (NHP) in just 4 of the audited countries (*Table 5*), with Australia being the first to declare it as an NHP in 2002, followed by Chinese Taipei in 2005,

Singapore in 2008 and most recently China in 2011. While other countries have not declared osteoporosis an NHP, management guidelines were reported as available for all countries except Pakistan. However, not all guidelines are current, government endorsed, or have been rolled out at the national level.

**TABLE 5** Summary of where osteoporosis has been designated as a national health priority (NHP), where it is government backed & where osteoporosis guidelines and quality indicators are available

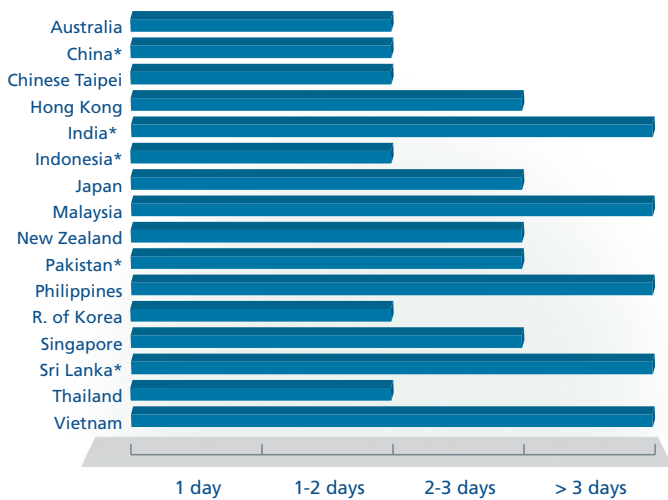
	OSTEOPOROSIS IS A NHP	GUIDELINES AVAILABLE	AUDIT & QUALITY INDICATORS AVAILABLE
Australia	yes (2002)	yes	no
China	yes (2011)	yes	yes
Chinese Taipei	yes (2005)	yes	yes
Hong Kong	no	yes	no
India	no	yes*	no
Indonesia	no	yes	no
Japan	no	yes	yes
Malaysia	no	yes	no
New Zealand	no	yes	in development
Pakistan	no	no	no
Philippines	no	yes	no
Republic of Korea	no	yes	no
Singapore	yes (2008)	yes	yes
Sri Lanka	no	yes	no
Thailand	no	yes	no
Vietnam	no	yes	no

\* glucocorticoid-induced osteoporosis (GIOP) only **SOURCE** data provided by IOF CNS member societies

## HIP FRACTURE

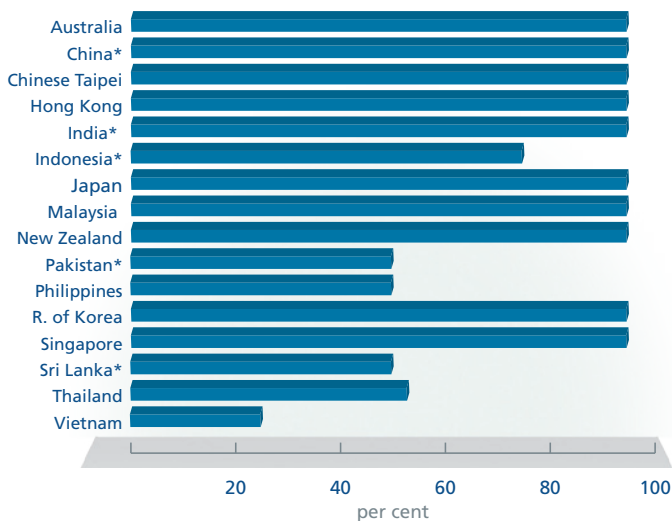
The time that hip fracture patients wait to receive surgery varies from country to country (Figure 4) with many countries indicating a waiting time of fewer than 3 days. India, Malaysia, Philippines, Sri Lanka and Vietnam all report that patients usually wait more than 3 days for surgery. In some countries, medical facilities and hospitals are concentrated in the urban areas; therefore, wait times are likely underestimated for the country as a whole. This is also the case for the proportion of hip fractures that are treated

**FIGURE 4** Waiting time for hip surgery



\* urban areas only SOURCE data provided by IOF CNS member societies

**FIGURE 5** Percentage of hip fractures treated surgically, by country



\* urban areas only SOURCE data provided by IOF CNS member societies

surgically (Figure 5). While the majority of countries report that 95% or more of hip fracture cases are treated surgically, this may be more representative of urban areas. Pakistan, Philippines, Sri Lanka and Thailand all report treating just 50% of hip fractures surgically and Vietnam reports surgically treating just 25%. This is a concern because hip fracture patients who are not surgically treated have lower rehabilitation rates and increased morbidity and mortality.

The cost of hip fracture throughout Asia varies by country and by public versus private facility (Table 6). The data provided by IOF national societies indicates the highest costs per hip fracture event are in Japan and Australia. Costs in Japan average USD 27,600 where it is likely that patients will spend around 38 days in hospital; and in Australia costs range from USD 21,824-29,617 with hospital stays of 7-12 days.

**TABLE 6** Hip fracture: hospital costs and bed days

	HOSPITAL COSTS OF TREATING OSTEOPOROTIC HIP FRACTURES (USD), PER EVENT	AVERAGE HOSPITAL BED DAYS
Australia	\$21,824-31,605	7-12
China	\$3,645-5,000	15-20
Chinese Taipei	\$3,242	13
Hong Kong	\$10,782	ACUTE 7 REHAB 20
India	PUBLIC \$772 PRIVATE \$2,360-3,860	PUBLIC 15 PRIVATE 5-6
Indonesia	PUBLIC \$7,000-9,000 PRIVATE \$5,000-8,000	PUBLIC 11-16 PRIVATE 5-14
Japan	\$27,599	38
Malaysia	\$6,000	7
New Zealand	HOSPITAL \$12,336 REHAB \$9,986	HOSPITAL 13.9 REHAB 22
Pakistan	\$1,200-2,400	4-6
Philippines	\$2,200	25-50
Republic of Korea	information not available	
Singapore	\$8,380	16
Sri Lanka	information not available	
Thailand	\$2,064	20
Vietnam	\$1,000-4,000	14

SOURCE data provided by IOF CNS member societies



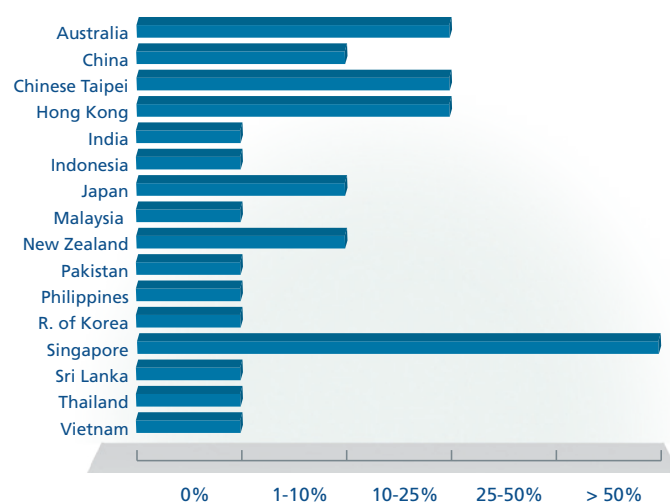
## FRACTURE REGISTRIES AND FRACTURE LIAISON SERVICES

Chinese Taipei, Japan, Malaysia, Philippines and Singapore each have fracture registries implemented at the national level collecting data on women and men over the ages of 40 or 50 years (Table 7). Other countries such as Australia and New Zealand are working toward implementing registries in the next few years. Many countries are making strides with the implementation of fracture registries at the hospital level, such as China, Indonesia and Sri Lanka.

Fracture liaison services (FLS) are becoming an important model of care for secondary fracture prevention worldwide, and a leading model for FLS in the Asia-Pacific region has been implemented in Singapore through Singapore General Hospital's secondary fracture programme, *Osteoporosis Patient Targeted and Integrated Management for Active Living (OPTIMAL)*. Singapore is a global leader, reporting that over 50% of the hospitals in the country have implemented an FLS. While most countries have few hospitals that have

implemented FLS, progress toward implementation is being seen in Australia, China, Chinese Taipei, Hong Kong, Japan and New Zealand (Figure 6).

**FIGURE 6** Per cent of hospitals that have implemented a fracture liaison service, by country



**TABLE 7** Fracture registries available by country

	FRACTURE REGISTRY AVAILABLE	FRACTURE TYPE COLLECTED	GENDER	AGE GROUPS (YEARS)
Australia	no*			
China	hospital level	all	women/men	50+
Chinese Taipei	national level	all	women/men	all
Hong Kong	no			
India	no			
Indonesia	hospital level	hip	women/men	40+
Japan	national and regional level	hip	women/men	40+
Malaysia	national level	all	women/men	50+
New Zealand	no*			
Pakistan	no			
Philippines	national and hospital level	all	women/men	40+
Republic of Korea	no			
Singapore	national level	hip fractures	women/men	40+
Sri Lanka	hospital level	hip fractures	women/men	40+
Thailand	no			
Vietnam	no			

\* under development SOURCE data provided by IOF CNS member societies

# VITAMIN D STATUS IN THE ASIA PACIFIC

## STATUS OF VITAMIN D IN THE ASIA-PACIFIC REGION

Low levels of vitamin D are observed region-wide in the Asia Pacific. This can be attributed to a number of causal factors including genetic, lifestyle, seasonal and geographical influences. However, urbanization seems to be having a major impact. Countries across the Asia Pacific have been experiencing a shift from rural to urban living over recent decades, which has resulted in decreased opportunities for exposure to sunlight. Along with city living come increasingly indoor lifestyles and this combined with the sunlight-blocking pollution, limit the amount of sunlight to which individuals are exposed and put them at risk for vitamin D insufficiency or deficiency. For example, in China, individuals are leaving more active outdoor occupations such as farming to work in an urban office setting<sup>1</sup>. Likewise, in Malaysia, there is lack of sun exposure because of the tendency to remain indoors during the day due to the heat and humidity<sup>2</sup>. In the Republic of Korea, adolescents forego outdoor play on their afternoons and weekends to study for the rigorous university entrance examinations<sup>3</sup>.

More than 68% of the countries in this Audit now have populations that are over 50% urban, and the resulting reduction in sunlight exposure is affecting vitamin D levels which contribute to osteoporosis risk.

The literature has indicated that the low levels of vitamin D may be due to several causes such as urbanization, low sun exposure, inadequate dietary vitamin D intake, lack of food fortification with vitamin D, pigmented skin, environmental pollution, and traditional dress code.

## VITAMIN D AND CALCIUM

Both vitamin D and calcium are essential nutrients for bone health. Eighty per cent of the body's vitamin D is derived from exposure of the skin to sunlight. Vitamin D is essential for skeletal health as it assists calcium absorption from food and ensures the correct renewal and mineralization of bone tissue. Recommended calcium (Ca) intakes vary around the world, however the World Health Organization (WHO) and the United States Department of Agriculture (USDA) recommend



View the IOF Vitamin D Status interactive maps online at [www.iofbonehealth.org/facts-and-statistics/vitamin-d-studies-map](http://www.iofbonehealth.org/facts-and-statistics/vitamin-d-studies-map)

1000–1300 mg Ca/day for adults. Studies across the region indicate that calcium intake, in addition to vitamin D levels, are well below recommendations. The population of India consumes much lower amounts of calcium, only 300–500 mg/day, which is far less than the optimal daily intake<sup>5</sup>. For example, in Chinese Taipei, a study found that the average daily calcium intake was 622 mg and 628 mg for older men and women respectively, which is lower than the daily recommended level of 1000 mg<sup>4</sup>. Combined, low vitamin D absorption due to the several reasons listed above, and low calcium consumption are contributing factors to poor skeletal health and osteoporotic fractures.

## VITAMIN D MAP

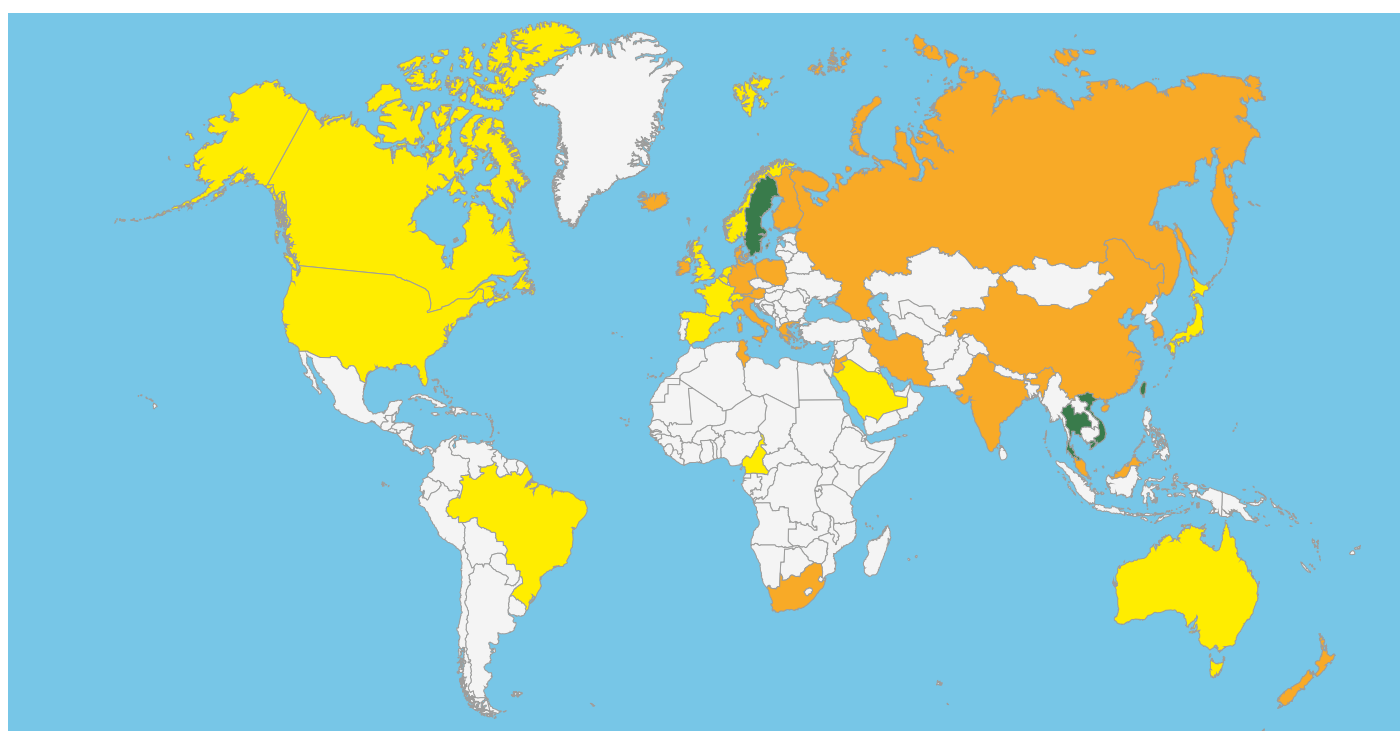
To provide a visual picture of global vitamin D levels, IOF has created a ‘map’ of the vitamin D status in the general, healthy, population around the world based on the study, *A Global Representation of Vitamin D status in healthy populations*<sup>6</sup>. The map, which can be found at [www.iofbonehealth.org](http://www.iofbonehealth.org), aims to provide a general overview of vitamin D status in countries for which data were available, examines the existing heterogeneity in vitamin D status, and identifies research gaps. The study is global, but one can zoom in on the Asia-Pacific region and the 16 countries represented in this Audit.

When using the map in conjunction with the data provided in each Audit chapter it is important to note that the map is an *independent publication* and contains information that complements, but may differ from, the Audit chapters. The Audit chapters report on vitamin D from current, local and sometimes grass-roots data – some of which may not be reflected in the map. Additionally, the Audit chapters have the flexibility of reporting vitamin D levels as originally published in their respective studies and may be difficult to compare with each other due to differences

**TABLE 1** Definition of vitamin D levels and the respective colour code

COLOUR CODE	VITAMIN D LEVEL (nmol/L)	DEFINITION
green	> 75	optimal
yellow	50-74	recommended
orange	25-49	below recommended
red	< 25	deficient

**FIGURE 1** Vitamin D status in adults (>18 years)<sup>6</sup>



in units (nmol/L versus ng/mL), study size, geographic location, population size and definitions of insufficiency versus deficiency.

IOF's vitamin D map (*Figure 1 & Figure 2*), however, based on its underlying studies, has used methodology and criteria that enable an overall comparison of the vitamin D levels of each country in one snap shot. Data are based on a systematic review of English literature from 1990–2001, from 200 studies from 46 countries. Studies were selected to represent their country if they included samples of randomly selected males and females from the general population and assessed circulating 25-hydroxyvitamin D (25(OH)D) levels. In the map, two different age categories were selected: childhood and adolescence (1–18 years) and adults (>18 years). Furthermore, gender was not accounted for when creating the map. For comparison purposes, the units have been calculated so they homogeneously represent Vitamin D levels in nmol/L. Definitions for varying vitamin D levels have been set and colour-coded (*Table 1*), and then a colour was assigned to each country based on the mean of the vitamin D levels reported in each respective country's

studies that met the mapping criteria.

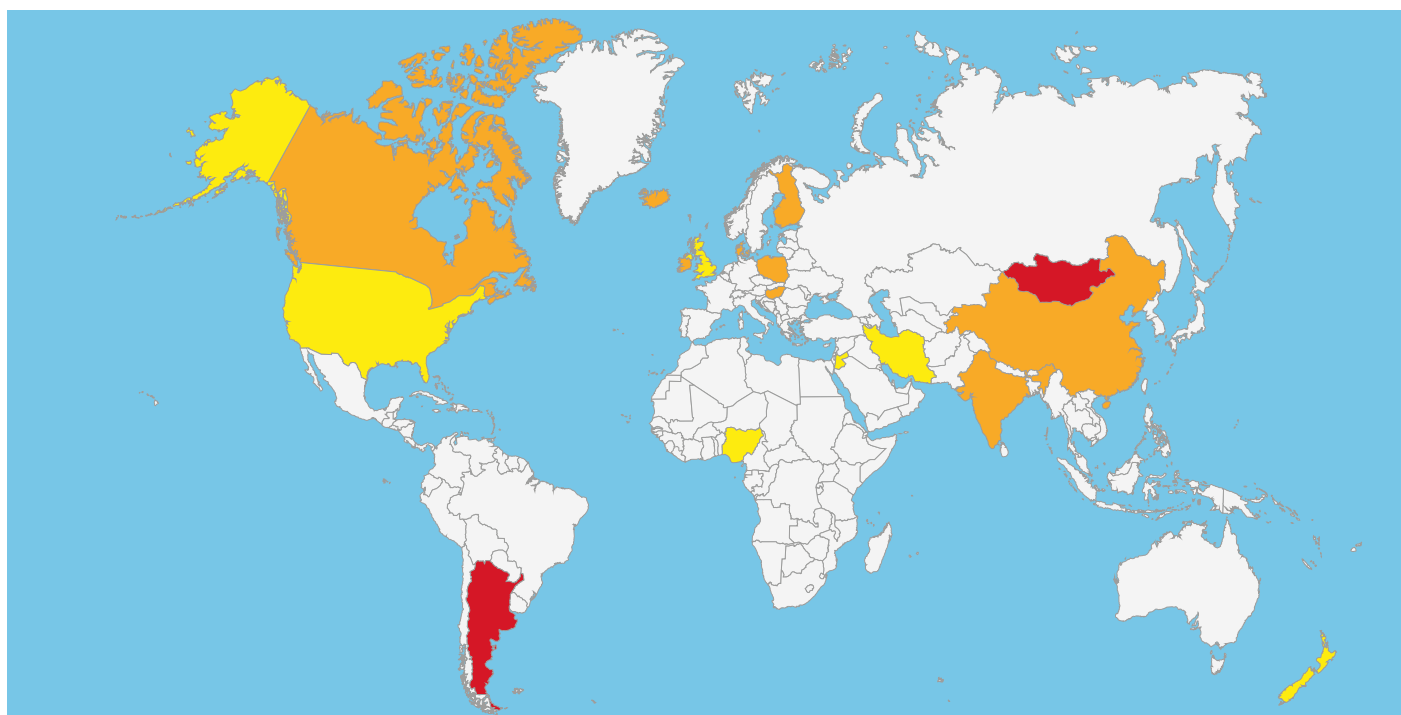
### VITAMIN D STATUS IN ADULTS (>18 YEARS)

Throughout the Asia-Pacific region, large areas of orange are seen in the vitamin D map, including from the two most populous countries in the world – India and China – indicating that a high percentage of the Asia-Pacific population has vitamin D levels falling below recommended levels (<25-49 nmol/L). Other countries at the orange level include: New Zealand, Malaysia and Republic of Korea.

There are also the occasional areas of yellow and green across the region, indicating that some countries have vitamin D levels at the recommended (50–74 nmol/L) or optimal (>75 nmol/L) levels, respectively. Countries with optimal levels (green) include Thailand, Vietnam and Chinese Taipei. Countries with recommended levels (yellow) include Australia and Japan.

A dearth of data on vitamin D levels is represented in 6 of the audited countries where there is lack of

**FIGURE 2** Vitamin D status in children (<18 years)<sup>6</sup>



colour: Hong Kong, Indonesia, Pakistan, Philippines, Singapore and Sri Lanka. It is in these countries where studies meeting the map criteria were not available and represent areas where further research is needed.

As mentioned above, it is important to point out some apparent disparities between the studies populating the vitamin D map and the studies represented in the country specific chapters of this Audit.

- Thailand, for example is coloured green on the map as a country with optimal vitamin D levels ( $>75$  nmol/L). In the country-specific chapter, however, the study reports vitamin D levels at 64.8–78.3 nmol/L and considers these to be *insufficient*<sup>7</sup>. The difference between the map and the Audit chapter is the definition of what Vitamin D levels are considered insufficient. According to the vitamin D map, the levels reported in the Thailand chapter would actually be considered recommended or optimal.
- Vietnam is coloured green with vitamin D levels in the *optimal range* ( $>75$  nmol/L). In contrast, the study in the Vietnam chapter reports high vitamin D deficiency with levels below 20 ng/mL<sup>8</sup> ( $<50$  nmol/L). Converting the units to nmol/L and using the vitamin D thresholds in the map, we see this study would fall in the orange, or below recommended, category. Secondly, the study in the Vietnam chapter is region specific reporting on Northern/rural areas, where the geographical location is likely to affect sunshine exposure.
- Chinese Taipei is also coloured green on the map for *optimal* levels of vitamin D. The Chinese Taipei chapter, which reports vitamin D levels from Chinese Taipei's 2004–2008 National Nutrition and Health Survey (NAHSIT), finds *low levels* of vitamin D in over half of the population at  $<20$  ng/mL<sup>9</sup> ( $<50$  nmol/L). Again, when converting nmol/L, the study results would fall into the orange category with below recommended levels on the vitamin D map.
- Australia is coloured yellow on the map for *recommended* levels of vitamin D at 50–74 nmol/L. However, the Australia chapter reports that 31% of Australians are vitamin D *deficient* with levels  $<50$  nmol/L<sup>10</sup>. Using these data when looking at the vitamin D map, this study would border on orange to yellow levels, which are below recommended and

recommended vitamin D levels, respectively – but not deficient.

- The Philippines, Singapore and Sri Lanka are not represented as a colour on the vitamin D map. However, the Audit chapters provide data from vitamin D studies. Placing these studies within the map parameters, the Philippines would be yellow/green (48–128 nmol/L<sup>11</sup>); Singapore would be orange ( $<50$  nmol/L<sup>12</sup>) and Sri Lanka would be red/orange ( $<12.5$  nmol/L to 35 nmol/L<sup>13</sup>).

## VITAMIN D STATUS IN CHILDREN (1–18 YEARS)

A worrying trend is the lower vitamin D levels present in younger populations. Facilitated by the growth in sedentary, urban lifestyles, these factors put the younger generation at risk for osteoporosis later in life.

As in the adult map, orange is the predominate colour evident in the most populated countries of China and India, indicating that vitamin D levels in young people are below recommendations at 25–49 nmol/L. New Zealand, however, is coloured yellow for its child/adolescent population, indicating vitamin D levels of 50–74 nmol/L which is in the recommended range (this is in contrast to New Zealand's adult population at the orange level with below recommended levels of vitamin D at 25–49 nmol/L).

Again, the dearth of data can be seen in the younger population, as well. Just 3 countries from the 16 in our Audit are represented on the map, indicating a need for further research. However, when looking at the individual country chapters of this Audit, data can be found for the young people in Vietnam, Republic of Korea, Thailand, Malaysia and Pakistan. Using the vitamin D findings from these studies and putting them into the parameters of the vitamin D map provides some insight on the greater picture of vitamin D levels in children in the Asia-Pacific region.

- Vietnam includes a study reporting vitamin D *deficiency* in younger women with levels  $<20$  ng/mL<sup>8</sup> ( $<50$  nmol/L). This level would actually colour Vietnam orange on the map for below recommended vitamin D levels.
- Republic of Korea studies have defined vitamin D *insufficiency* at  $<30$  ng/mL<sup>14</sup> ( $<75$  nmol/L) and have found such levels in 98.9% of Korean boys and

100% of girls. Colour-coded on the vitamin D map, however, the Republic of Korea would be yellow for its children - at the recommended vitamin D levels.

- Thailand studies revealed that being young and female are indications associated with lower vitamin D levels<sup>7</sup>. This study defined *insufficiency* at values <75 nmol/L, which if plotted on the vitamin D map for Thailand's children, would colour Thailand yellow with vitamin D levels in the recommended range.
- Malaysia reported 35% of school children were vitamin D *deficient* with levels at  $\leq 37.5$  nmol/L<sup>15</sup>; thus Malaysia would be coloured orange on the map for vitamin D levels in its children with levels that are below recommended.

## CONCLUSION

The overarching picture of vitamin D in the Asia Pacific indicates that the majority, adults and children, fall into the colour 'orange' – representing levels below recommended at 25–49 nmol/L, interspersed with few 'yellow' and 'green' countries with recommended/optimal levels of vitamin D in their populations (>50 nmol/L). It is clear from the map and from the individual country chapters that the methodological differences, including threshold parameters, measuring vitamin D levels are not homogeneous across the studies, which can make comparisons challenging.

One point of agreement, as frequently suggested in the literature, is that urbanization is a key culprit for the less than optimal vitamin D levels that are reported. With the increase in city-living comes pollution and indoor habitation – both of which decrease exposure to sunshine thereby increasing risk for vitamin D insufficiency/deficiency. Additionally, the increased tendency to avoid sun and/or apply sunscreen also inhibits vitamin D absorption. These practices are especially common in the younger population, as is apparent from the lower levels of vitamin D in this group. The concern is that this may predispose them to lower bone mass and bone strength in the future.

Finally, the colourless sections of the map along with the gaps in literature confirm that a dearth of data exists across the region. Thus, the picture of vitamin D status in Asia Pacific is yet to be complete pending the much needed research and studies quantifying and clarifying vitamin D status across the region.

## REFERENCES

1. Wang, Y, Tao, Y, Hyman, ME, Li, J & Chen, Y 2009, 'Osteoporosis in China', *Osteoporos Int*, vol. 20, pp. 1651–1662.
2. Khor, G, Chee, W, Shariff, Z, Poh, B, Arumugam, M, Rahman, J & Theobald, H 2011, 'High prevalence of vitamin D insufficiency and its association with BMI-for-age among primary school children in Kuala Lumpur, Malaysia', *BMC Public Health*, vol. 11, p. 95.
3. Shin, YH, Kim, KE, Lee, C, Shin, HJ, Kang, MS, Lee, HR & Lee, YJ 2012, 'High prevalence of vitamin D insufficiency or deficiency in young adolescents in Korea', *Eur J Pediatr*, vol. 171, pp. 1475–1480.
4. Lan, TY, Hou, SM, Chen, CY, Chang, WC, Lin, J, Lin, CC, Liu, WJ, Shih, TF & Tai, TY 2010, 'Risk factors for hip fracture in older adults: a case-control study in Taiwan', *Osteoporos Int*, vol. 21, pp. 773–784.
5. Shatrugna, V, Kulkarni, B, Kumar, PA, Rani KU & Balakrishna, N 2005, 'Bone status of Indian women from a low-income group and its relationship to the nutritional status', *Osteoporos Int*, vol. 16, p. 1827.
6. Wahl, DA, Cooper, C, Ebeling, PR, Eggersdorfer, M, Hilger, J, Hoffman, K, Josse, R, Kanis, JA, Mithal, A, Pierroz, DD, Stenmark, J, Stocklin, E & Dawson-Hughes, B 2012, 'A Global Representation of Vitamin D Status in Healthy Populations', *Arch Osteoporos*, vol. 7, pp. 1–2.
7. Chailurkit, LO, Aekplakorn, W & Ongphiphadhanakul, B 2011, 'Regional variation and determinants of vitamin D status in sunshine-abundant Thailand', *BMC Public Health*, vol. 11, p. 833.
8. Nguyen, HT, Von Schoultz, B, Nguyen, TV, Dzung, DN, Duc, PT, Thuy, VT & Hirschberg, AL 2012, 'Vitamin D deficiency in northern Vietnam: prevalence, risk factors and associations with bone mineral density', *Bone*, vol. 51, no. 6, pp. 1029–1034.
9. Lee, MS & et al. 2011, 'Preliminary Analysis of Taiwanese Vitamin D Status: From (NAHSIT) 1993-1996 to 2005-2008'.
10. Daly, RM, Gagnon, C, Lu, ZX, Magliano, DJ, Dunstan, DW, Sikaris, KA, Zimmet, PZ, Ebeling, PR, Shaw, JE 2012, 'Prevalence of vitamin D deficiency and its determinants in Australian adults aged 25 years and older: a national, population-based study', *Clin Endocrinol (Oxf)*, vol. 77, no. 1, pp. 26–35.
11. Raso, AA, Navarra, SV, Li-Yu, J & Torralba, TP 2009, 'Survey of vitamin D levels among post-menopausal Filipino women with osteoporosis', *Int J Rheum Dis*, vol. 12, pp. 225–229.
12. Chandran, M, Howe, TS, Goh, SK, Li, HH, Ng, A, Zhang, RF & Koh, J 2012, 'Vitamin D Levels, Physical and Biochemical Characteristics of South East Asian Patients with Osteoporotic Hip Fractures', *J ASEAN Fed Endocrine Soc*, vol. 27, no. 2, pp. 185–190.
13. Rodrigo, M, Hettiarachchi, M, Liyanage, C, Lekamwasam, S 2013 'Low serum vitamin D among community-dwelling healthy women in Sri Lanka', *Health*, vol. 5, no. 12A5 (In press).
14. Shin, YH, Kim, KE, Lee, C, Shin, HJ, Kang, MS, Lee, HR & Lee, YJ 2012, 'High prevalence of vitamin D insufficiency or deficiency in young adolescents in Korea', *Eur J Pediatr*, vol. 171, pp. 1475–1480.
15. Khor, G, Chee, W, Shariff, Z, Poh, B, Arumugam, M, Rahman, J & Theobald, H 2011, 'High prevalence of vitamin D insufficiency and its association with BMI-for-age among primary school children in Kuala Lumpur, Malaysia', *BMC Public Health*, vol. 11, p. 95.

# AUSTRALIA

## COUNTRY OVERVIEW

Australia is expected to experience a steady rise in population over the coming decades, with an increase of 13% by 2025, from 22.2 million to 25 million, and a further increase of 16% by 2050, reaching 29 million. Australians currently live to an average age of 82 years and life expectancy is projected to gradually increase to 84 years by 2050 (Figure 1). Those aged over 50 years constitute 33% of the total population, and with the ageing demographic this proportion will rise to 41% in 2050, from 7.3 million today to 11.8 million in 2050 (Figure 2). The burden of osteoporosis is certain to increase in the coming decades especially since those aged over 70 years will go from 2.2 million to almost 5 million in 2050. This represents a 123% increase, and at that point, the elderly will make up 17% of the population<sup>1</sup>.

FIGURE 1 Life expectancy in Australia



## State of osteoporosis/osteopenia

Approximately 1.2 million Australians aged over 20 years have osteoporosis, and a further 6.3 million have osteopenia. Thus, 34% of the population has low bone density. Focusing on Australians aged over 50 years, a new report indicates that 66% in this age group have poor skeletal health: 1.04 million with osteoporosis



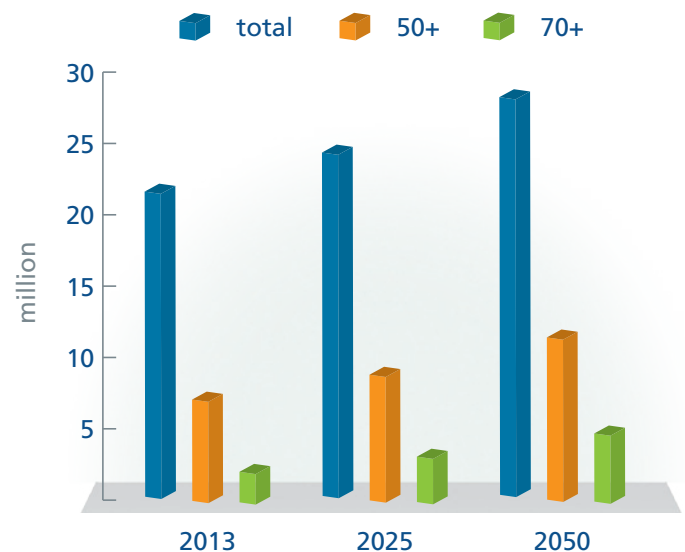
## CURRENT

Population **22.2 million**  
 Aged over 50 years **33%**  
 Life expectancy **82 years**  
 Hip fracture incidence per year **295/100,000** (women)  
 Cost per hip fracture **21,824–31,605 USD**  
 Number of DXA per million population **18**  
 Fracture liaison services **10-25% of hospitals**  
 National health priority status **since 2002**

## PROJECTED 2050

Population **29 million** ↑  
 Aged over 50 years **41%** ↑  
 Life expectancy **84 years** ↑

FIGURE 2 Population projection for Australia

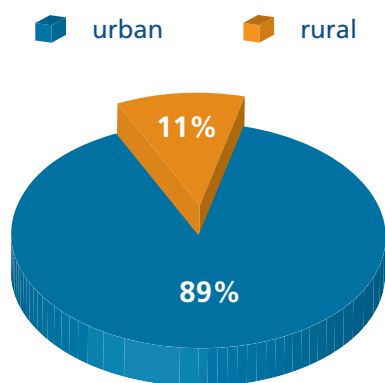


and 3.7 million with osteopenia<sup>2</sup>. Osteoporosis is mainly accounted for in Australian women (81%), and occurs predominately in people aged 50 years and over (85.8%)<sup>3</sup>. The residual lifetime fracture risk for Australians aged older than 50 years varies by region and sex, and is approximately 27% and 44% for men and women, respectively<sup>4</sup>. The majority of these fractures are non-vertebral, non-hip fractures.

### Lifestyle

It is estimated that 31% of Australian adults are vitamin D deficient (<50 nmol/L)<sup>5,6</sup>. A similar proportion of adults have inadequate dietary calcium intake. Consistent with findings in other areas of the Asia-Pacific region, the diagnosis of osteoporosis was more prevalent among those who live in major cities than the 12% living in rural and remote locations (Figure 3)<sup>7</sup>. In Australia, it is currently unknown whether this may be due to the decreased sun exposure and lower activity levels in urban areas, or if it is because people living in cities are more likely to seek medical care due to closer proximity of care providers.

**FIGURE 3** Urban versus rural population in Australia<sup>8</sup>



### Level of awareness

Osteoporosis Australia is very active in promoting public awareness of osteoporosis. Recently two major campaigns were launched with a focus on prevention. The ‘How Dense Are You’ media campaign, launched to coincide with World Osteoporosis Day in 2012, raised awareness of risk factors for osteoporosis, particularly in adults aged over 50 years. The ‘Healthy

Bones Australia’ website targets a younger audience with interactive tools to help users calculate their ‘healthy bones score’. A current/future priority is education of general practitioners to raise awareness of the importance of bone health and improve diagnosis and management of osteoporosis.

### FRACTURE RATES

During 2012, it is estimated that 140,822 adults aged over 50 years with osteoporosis or osteopenia (T-score  $\leq -1$ ) sustained a low trauma fracture (Table 1)<sup>2</sup>. This is an increase from that shown by 2007–2008 hospital data which estimated 52,730 fragility fractures occurred in those aged over 40 years, including 17,192 hip fractures<sup>9</sup>. More optimistically, however, a recent national study shows the age-related incidence of hip fracture is decreasing in both women and men, with decreases being more marked in women<sup>10</sup>. From 1997–2007 the decrease was 20% in females from 370 to 295 per 100,000 per year and 13% in males from 200 to 174 per 100,000 per year<sup>10</sup>. However, the absolute number of hip fractures continues to increase due to population ageing.

**TABLE 1** Number of fractures in Australians aged over 50 years in 2012<sup>2</sup>

FRACTURE SITE	NUMBER OF FRACTURES 2012–2013
Hip	22,981
Wrist	20,077
Spine	25,502
Other*	72,262

\*all other fracture sites except fingers and toes

There is also a higher, and increasing, rate of hip fracture in Aboriginal and Torres Strait Islander populations with indigenous men twice as likely to fracture their hip compared with non-indigenous males and Indigenous women at 26% increased risk of hip fracture<sup>11</sup>. Indigenous Australians were on average much younger than other Australians at the time of their hip fracture, aged 65 years (compared with 81 years) for males and 74 years (compared with 83 years) for females. Currently, more than 90% of hip fractures in Australia are managed surgically, and the average wait-time for surgery is 1–2 days.



In the state of New South Wales, 35% of minimal trauma fracture admissions from 2002–2008 presented to hospital with a re-fracture. Up-to-date epidemiological data on re-fracture are lacking, however, prospective studies have shown a benefit in reducing re-fractures by the introduction of fracture liaison services<sup>12</sup>.

Osteoporosis Australia has commissioned a study to address this and other issues concerning osteoporosis in Australia<sup>2</sup>. This study is due for completion in late 2013. Re-fracture prevention is a priority area for resourcing and development, and Osteoporosis Australia is currently seeking funding to initiate clinical services to address this.

## COST OF FRACTURE

The direct cost of osteoporotic fractures in Australia in 2012 was USD 1.65 billion (AUD 1.76 billion) per year, and the total cost of osteoporosis (pharmaceutical, DXA, medical visits plus (direct and indirect) cost of all fractures in adults >50 years with OP or osteopenia) in 2012 was USD 2.58 billion (AUD 2.75 billion)<sup>2</sup>. Current data on the cost of hip fracture in Australia have just been released in the ‘Burden of Disease Study’ commissioned by Osteoporosis Australia. The cost of a hip fracture case varies slightly by the age of the patient ranging from USD 21,824 (AUD 23,276) for those aged 50–69 years, to USD 31,605 (AUD 33,576) for those aged over 70 years with an average hospital stay of 7–12 days (Table 2)<sup>2</sup>.

**TABLE 2 Hip fracture in Australia**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$21,824–31,605	7–12	>90%

## FRACTURE REGISTRIES

Australia is currently developing a hip fracture registry that will run on the national level and collect data from individual States as well as from New Zealand. The planning phase is well underway with pilots running in two states in Australia. Meanwhile, Western Australia is already collecting fracture data at the state level through an electronic registry, whilst New South Wales’ registry is using a paper-based system.

When up and running, the national hip fracture registry will collect data on the Australian and New Zealand population aged over 50 years with hip fractures.

## FRACTURE LIAISON SERVICES

There are approximately 23 hospitals in Australia that have implemented a fracture liaison service, representing an implementation rate of 10–25%.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Primary care physicians (general practitioners/family doctors) manage the majority of the osteoporosis care in Australia. They are supported by gynaecologists, endocrinologists, rheumatologists, and geriatricians, all of whom receive some medical training in osteoporosis care at medical school. Orthopaedic surgeons are primarily involved in fracture repair.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis was officially documented as a national health priority in 2002 as mandated by the ministry of health <http://www.aihw.gov.au/national-health-priority-areas/>.

Currently, public health programmes focus on nutrition (vitamin D & calcium) and exercise. Expansion of these programmes to include other initiatives, such as falls prevention, is currently under negotiation.

### Guidelines

The guideline, ‘Clinical guideline for the prevention and treatment of osteoporosis in postmenopausal women and older men’ was published in 2010 by the Royal Australian College of General Practitioners, and has been endorsed by the National Health and Medical Research Council (NHMRC).

These guidelines address fracture risk assessment and treatment including prior fracture, age and bone mineral density (BMD) score, and tend to be more robust in recommendations than the government’s reimbursement level for diagnostics and treatment. For example the guidelines recognize recurrent falls and family history as major risk factors to trigger BMD testing. Yet, there is no government

reimbursement for the cost of BMD testing for people with these risk factors.

Another guideline document, ‘Building healthy bones throughout life: an evidence-informed strategy to prevent osteoporosis in Australia’ was published in the *Medical Journal of Australia* in 2013<sup>13</sup>. This is an evidence-informed set of recommendations for consumers, health care professionals and policymakers. The strategy was adopted by consensus at the Osteoporosis Australia Summit in Sydney, 20 October 2011.

**TABLE 3 Osteoporosis treatments and respective reimbursement in Australia**

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		Patient is responsible for a USD 34.05 co-pay
Alendronate	x		Patient is responsible for a USD 34.05 co-pay
Ibandronate		x	
Zoledronic acid	x		Patient is responsible for a USD 34.05 co-pay
Clodronate		x	
Pamidronate		x	
Raloxifene	x		Patient is responsible for a USD 34.05 co-pay
Bazedoxifene		x	
Denosumab	x		Patient is responsible for a USD 34.05 co-pay
Strontium Ranelate	x		Patient is responsible for a USD 34.05 co-pay
Teriparatide	x		Patient is responsible for a USD 34.05 co-pay
PTH (1-84)		x	
Vitamin D/Ca supplements		x	
Calcitonin		x	
Hormone Replacement Therapy		x	
Testosterone	x		For deficiency in males only
Alfacalcidol		x	
Calcitriol	x		Patient is responsible for a USD 34.05 co-pay

## Audit and quality indicator systems

Audit and quality indicator systems for the care of osteoporosis patients have not been implemented in Australia.

## TREATMENT

Australia operates a national health system covering the health-care costs in its population; with the patients responsible for a co-payment.

Reimbursement for osteoporosis treatment is not based on a percentage of the drug’s cost, but rather patients contribute a maximum ‘co-payment’ for each prescription. In 2013, the maximum patient co-payment is 34.05 USD (AUD 36.10) per prescription (*Table 3*). For concession holders (pensioners, students, disabled etc.), the co-payment is USD 5.54 (AUD 5.90). The Australian government pays the remaining cost of the drug.

There are conditions, however, associated with reimbursement and sometimes these interfere with treatments that physicians would normally recommend to their patients. For example, reimbursement for primary prevention is only reimbursed in those aged above 70 years who have a T score  $\leq -2.5$ . Other conditions associated with reimbursement include: prior fracture, secondary prevention, whether the drug is a first-or second-line treatment, and the requirement for an authorization.

Designated first-line treatments in Australia include alendronate, risedronate, zoledronic acid, denosumab, strontium ranelate, raloxifene and calcitriol. Teriparatide is a designated second-line treatment.

## DIAGNOSTICS

Access to diagnostics is readily available in Australia with 18 DXA machines available per one million of the population<sup>14</sup>. Generally, there is no waiting time for a scan and DXA, which costs between USD 80– 202 (AUD 85-214), is reimbursed for the most part except in atypical cases such as in younger postmenopausal women, where it is not reimbursed (*Table 4*).

Studies have shown that, in capital cities, men and women were both around 3-times more likely to undergo the investigation than those in remote areas<sup>7</sup>.

**TABLE 4** Diagnostics access and cost in Australia

	DXA	ULTRASOUND
Waiting time (d)	0	0
Cost (USD)	\$80-202	\$30
Is it reimbursed?	yes for certain indications	no
Is reimbursement a barrier to access to treatment?	yes, particularly in young post-menopausal women	no

## RECOMMENDATIONS

Despite musculoskeletal diseases being an Australian national health priority, osteoporosis remains an under-diagnosed and under-treated disorder, particularly in men. Population ageing means the population at risk is estimated to increase to at least 11.8 million by 2050, with increased associated health and disability costs.

A systems-based approach including, increased numbers of fracture liaison services, establishment of a national Hip Fracture Registry, and improved access to DXA scans at the time of menopause for women with risk factors for osteoporosis are all needed to address this growing public health problem.

Despite these demonstrated needs and opportunity, Australia is currently lagging behind some countries in the development of fracture prevention services and equity of access to bone densitometry for those at risk of fractures. Osteoporosis Australia is an advocate for change and abundant scientific evidence is present, however, neither State nor Commonwealth governments have been successfully engaged to date. Now is the time for commitment to this Australian national health priority.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Watts, JJ, Abimanyi-Ochom, J, Sanders, KM 2013, 'Osteoporosis costing all Australians: A new burden of disease analysis - 2012 to 2022', a report prepared for Osteoporosis Australia.
3. Henry, MJ, Pasco, JA, Nicholson, GC, Kotowicz, M 2011, 'Prevalence of osteoporosis in Australian men and women: Geelong Osteoporosis Study', *Med J Aust*, vol. 195, no. 6, pp. 321-323.
4. Cooley, H, Jones, G 2001, 'A Population-Based Study of Fracture Incidence in Southern Tasmania: Lifetime Fracture Risk and Evidence for Geographic Variations within the Same Country', *Osteoporos Int*, vol. 12, no. 2, pp. 124-130.
5. Daly, RM, Gagnon, C, Lu, ZX, Magliano, DJ, Dunstan, DW, Sikaris, KA, Zimmet, PZ, Ebeling, PR, Shaw, JE 2012, 'Prevalence of vitamin D deficiency and its determinants in Australian adults aged 25 years and older: a national, population-based study', *Clin Endocrinol (Oxf)*, vol. 77, no. 1, pp. 26-35.
6. Nowson, CA, McGrath, JJ, Ebeling, PR et al. 2012, 'Vitamin D and health in adults in Australia and New Zealand: a position statement', *Med J Australia*, vol. 196, no. 11, pp. 686-687.
7. Australian Institute of Health and Welfare, 2011, 'A snapshot of osteoporosis in Australia 2011', Arthritis series no. 15, Cat. no. PHE 137, Canberra: AIHW.
8. Rural Population (% Of Total Population) in Australia 2013, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/australia/rural-population-percent-of-total-population-wb-data.html>>.
9. AIHW 2011, 'A snapshot of osteoporosis in Australia 2011', Arthritis series no. 15, Cat. no. PHE 137, Canberra: AIHW, viewed 19 November 2013, <http://www.aihw.gov.au/publication-detail/?id=10737418750>.
10. Crisp, A, Dixon, T, Jones, G, Cumming, RG, Laslett, LL, Bhatia, K, Webster, A, Ebeling, PR 2012, 'Declining incidence of osteoporotic hip fracture in Australia', *Arch Osteoporos*, vol. 7, pp. 179-185.
11. Australian Institute of Health and Welfare, 2010, 'The problem of osteoporotic hip fracture in Australia', AIHW bulletin no. 76, Cat. no. AUS 121, Canberra: AIHW.
12. Lih, A, Nandapalan, H, Kim, M, Yap, C, Lee, P, Ganda, K, Seibel, MJ 2011, 'Targeted intervention reduces refracture rates in patients with incident non-vertebral osteoporotic fractures: a 4-year prospective controlled study', *Osteoporos Int*, vol. 22, no. 3, pp. 849-858.
13. Ebeling, PR, Daly, RM, Kerr, DA, Kimlin, MG 2013, 'Building healthy bones throughout life. An evidence informed strategy to prevent osteoporosis in Australia', *MJA Open*, vol. 2, suppl. 1:1.
14. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>: Kanis, JA, data on file.



China

# CHINA

## CURRENT

- Population **1.35 billion**
- Aged over 50 years **26%**
- Life expectancy **75 years**
- Hip fracture incidence per year **229/100,000** (women)
- Cost per hip fracture **3,600–5,000 USD**
- Number of DXA per million population **0.46**
- Fracture liaison services **1–10% of hospitals**
- National health priority status **since 2011**

## PROJECTED 2050

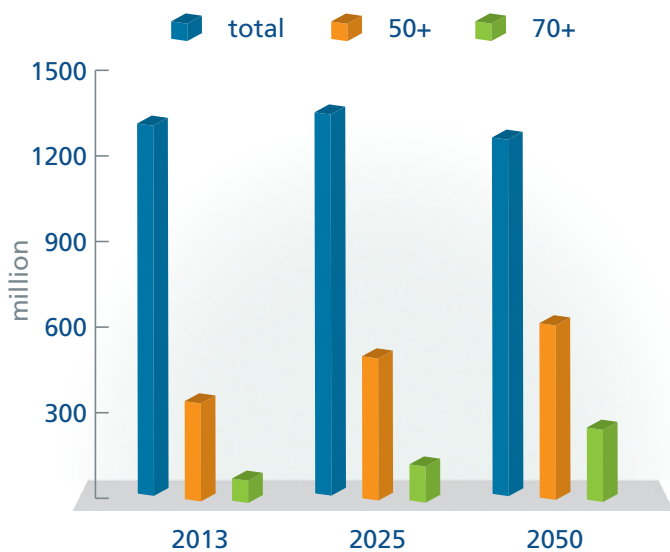
- Population **1.3 billion** ↓
- Aged over 50 years **49%** ↑
- Life expectancy **81 years** ↑

## COUNTRY OVERVIEW

The Chinese National Committee on Ageing declared in 2013 that the number of people aged older than 60 years had reached 200 million, in China<sup>1</sup>. According to the US Census Bureau (2013) the Chinese population totals 1.35 billion and life expectancy is 75 years, which has increased by 3.4 years since 2000. Osteoporosis risk increases in men and women aged over 50 years and in 2013, 26% (357 million) of the Chinese fell into this age range. Looking ahead, in just over 10 years to 2025, the population is predicted to grow to 1.39 billion, with those aged over 50 years exceeding 518 million. Thus 37% of the country's population will be in the age group most at risk for osteoporosis. By 2050, the Chinese population is projected to decrease slightly to 1.3 billion, but those aged over 50 years will reach almost half (49%) of the total population at 636 million. In addition, those aged 70 years or above are projected to rise from 81 million in 2013 to 132 million in 2025, reaching 263 million by 2050 (Figure 1).

These figures clearly indicate that osteoporosis is an increasingly important public health problem. Not surprisingly, the rate of hip fractures is already rising very rapidly in China<sup>2</sup>.

**FIGURE 1** Population projection for China



## State of osteoporosis/osteopenia

There have not been many studies on the prevalence of osteoporosis in China, and results vary based on region, sample size, and diagnostic methods. Considering this, Y. Wang and colleagues consolidated available Chinese studies and estimated that approximately 13% of Mainland Chinese adults have osteoporosis. As expected, osteoporosis is more prevalent in those aged over 50 years with 40.1% of women and 22.5% of men being affected<sup>3</sup>. A smaller study in 10 of China's cities estimated slightly lower osteoporosis prevalence of 31.2% in women and 10.4% in men aged over 50<sup>4</sup>. Looking back at data from 2006, there were 350 million people aged older than 50 years in Mainland China. Of these, it was estimated that 69.4 million people, or 19%, had bone mineral density (BMD) T scores lower than -2.5, and 213.9 million (60%) had BMD in the osteopenic range (-1 to -2.5)<sup>5</sup>. According to

several studies, osteoporosis in China is still lower than in Caucasian countries, and the prevalence does not appear to differ between rural and urban populations<sup>3,6</sup>. However, the incidence of osteoporosis is increasing<sup>3</sup>. Hip fracture rates are on the rise too, as demonstrated in one study where rates rose 10% per year between 2002–2006, in Chinese aged over 70 years<sup>7</sup>.

### Lifestyle

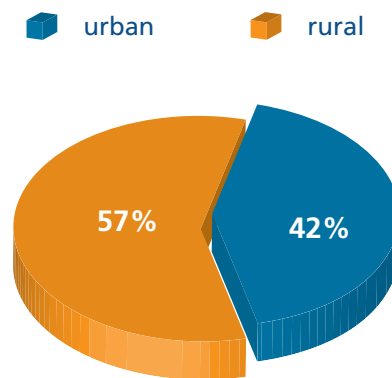
The ageing population and lifestyle changes are likely contributing to the increasing incidence of osteoporosis in China. Life expectancy has increased by 1 year since the previous IOF Audit was published in 2009, going from 74 years in 2009 to 75 years in 2013, and is projected to increase to 77 years and 81 years in 2025 and 2050, respectively (Figure 2). Improvements in medical care have resulted in longer survival of the elderly who are at increased risk of falling and breaking a bone<sup>3</sup>. Additionally, China is becoming more urbanized (urban living increased from 33% in 2000 to 42% in 2013<sup>4</sup>) (Figure 3). This population shift could result in an increased risk of osteoporosis given the decreased exposure to sunlight and reduced physical activity. For example, individuals are leaving more active outdoor occupations such as farming to work in an urban office setting, which results in less exposure to sunlight and increases the risk of vitamin D deficiency<sup>3</sup>. It has been found that vitamin D deficiency (<25 nmol/L) and insufficiency (>25 nmol/L and <50 nmol/L) is highly prevalent in the Chinese population in almost all age groups and areas. Studies indicate vitamin D deficiency in 40–90% of Chinese children (where rickets is also common) and in an even greater

FIGURE 2 Life expectancy in China



percentage of adults. Deficiency in Beijing and Shanghai was found in as many as 70–90% of the elderly<sup>4</sup>.

FIGURE 3 Urban versus rural population in China



Physical inactivity is another risk factor for osteoporosis and may also contribute to the increased incidence, as people are turning to cars and buses for transportation instead of walking. In fact, the number of adults owning cars increased from 4 per 100 adults in 1992 to 18 per 100 adults in 2004<sup>7</sup>. Additionally, as more Chinese are living in Western style apartments – with increased use of couches, chairs and western toilets – they are squatting less. Only 20-years ago many Chinese used to squat, rather than sit, as part of daily life. The benefit was strengthened leg muscles and improved balance, resulting in fewer falls<sup>7</sup>. Now, Chinese people are losing this protective benefit.

### Level of awareness

According to a study from the First Affiliated Hospital of Nanjing Medical University and the Peking Union Medical College, increased education is needed to increase the awareness of China's people about osteoporosis, starting with health-care providers<sup>9</sup>. In the study, which investigated awareness and prevention of osteoporosis, female nursing students responded correctly to just half of the questions in a test about osteoporosis. Basic facts such as bone loss after menopause, greater prevalence in women than men, race differences, drug therapies etc. were not common knowledge to the nursing students. After an osteoporosis educational programme was implemented, the knowledge of the nursing students improved

dramatically and they showed increased concern about osteoporosis for themselves, their sisters, mothers and grandmothers. With nurses being in a prime position to educate and treat people with osteoporosis, this study pointed out the critical need for continuing education on osteoporosis for Chinese health care providers, before they go on to work in clinical centres<sup>9</sup>.

Furthermore, an awareness assessment of osteoporosis was conducted among physicians in China and found that 33% did not know that published guidelines existed for BMD testing<sup>10</sup>.

## FRACTURE RATES

### Hip fracture

Hip fracture rates are increasing throughout urban Asia. A landmark study from Beijing 2002–2006 indicates the hip fracture incidence in those aged over 50 years to be 229/100,000 per year in women and 129/100,000 per year in men<sup>7</sup>. This study found the rates of age-specific hip fractures in those aged over 50 years increased by 58% in women and by 49% in men. The same study also compared hip fractures that occurred from 2002–2006 with those that had occurred previously from 1990–1992, and it was found that the adjusted age-specific rates of hip fracture over age 50 years increased 2.76-fold in women and 1.61-fold in men (*Figure 4*)<sup>7</sup>.

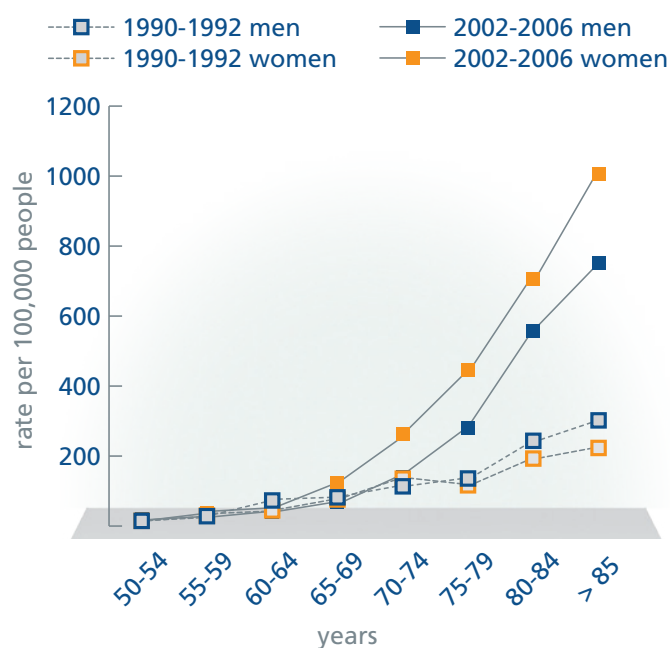
The increasing rate of hip fractures is serious since they are associated with increased mortality. The Singapore Chinese Health Study (SCHS) found that within the Chinese population, those having suffered a hip fracture were at greater risk of dying from other diseases within the following five years, than are Chinese who had not suffered a hip fracture<sup>11</sup>.

According to the national societies in China more information is available for urban areas when compared to rural ones. Just looking at the cities alone, approximately 90% of hip fractures are managed surgically, and the average waiting time for surgery is 1–2 days.

### Other fragility fractures

More data and studies are needed on fragility fracture in China. Of those conducted to date, a large nationwide study in Mainland China reported a prevalence of all fractures of 26.6%, and a local study conducted in Chongqing City reported a prevalence of 14%<sup>3</sup>.

**FIGURE 4** Change in age-specific incidence of hip fracture in Beijing, China from 1990–1992 to 2002–2006<sup>7</sup>



**SOURCE** Reproduced from Xia, W-B. et al. Rapidly Increasing Rates of Hip Fracture in Beijing, China.

### Vertebral fractures

In Mainland China, 1.8 million new osteoporotic vertebral fractures occurred in 2006. Since the number of people aged older than 60 years is expected to approach 438 million by 2050, it can be projected that the number of Chinese in this age group with osteoporotic vertebral fractures could reach 36.7 million and 48.5 million in 2020 and 2050, respectively<sup>5</sup> (*Table 1*). Looking at specific studies, according to data pulled from the Chinese Database of Trauma from 2001–2007, of the 82 720 Mainland Chinese of all ages identified with spinal trauma (caused by auto accidents, major falls, minor falls and non-traumatic specific events), 20% (16 544) of the fractures occurred in people aged over 60 years. In the

**TABLE 1** Vertebral fracture incidence and projections in China<sup>5</sup>

60+ WITH VERTEBRAL FRACTURES	
2006	1.8 million
2020	36.7 million
2025	48.5 million

age group 60 years and above, most of the fractures were lumbar, thoracic and non-traumatic and were determined to be age-related osteoporotic fractures<sup>5</sup>. The Osteoporosis in China<sup>7</sup> study found the prevalence of vertebral fracture in 2005, in those aged over 50 years as determined by patient questionnaire and lateral spine X-ray, to range from 13.3–16.2%<sup>3</sup>.

## COST OF FRACTURE

It is projected that by 2050, 50% of hip fractures will occur in Asia, with the majority occurring in China<sup>6</sup>. IOF's survey of the national osteoporosis societies in China reported that hospital costs for treating hip fractures range between 3,600 and 5,000 USD with an average of 15–20 hospital bed days (Table 2). This is supported by various studies estimating that each hip fracture in China may cost approximately 1,200 to 4,000 USD. These figures are based on local data, which varied between urban and rural areas, across regions, and increased over time<sup>3</sup>.

**TABLE 2 Hip fracture in China**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$3600–5000	15–20	90% (urban areas only)

## FRACTURE REGISTRIES

In general, China does not have fracture registries, however according to the Osteoporosis Committee of China Gerontological Society (OCCGS) and the Chinese Journal of Osteoporosis (CHO), a fracture registry does exist at the local level in the northern area of Beijing City. Here, the major hospitals serve 2 million residents and have been collecting fracture data for 10 years on both men and women aged over 50 years, including data on hip, spine, wrist and other fractures (Table 3).

## FRACTURE LIAISON SERVICES

It is reported by OCCGS and CHO that only approximately 1–10% of hospitals in China have implemented a coordinator-based, post-fracture system of care, otherwise known as a fracture liaison service.

**TABLE 3 Fracture registry data of hospitals in North Beijing (Hospital Information System Data, 2012)**

FRACTURES PER YEAR	
Hip	241
Spine	217
Wrist	173
All	1489

**SOURCE** Hospital health information system from China Medical University Aviation General Hospital, and the Hospital of Chinese People's Liberation Army. Data supplied by OCCGS & CHO.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis is still not taught as a separate interdisciplinary subject in China. Prior to 2009, there were not many registered doctors who were aware of the osteoporosis crisis and few were dedicated to its diagnosis and treatment. The IOF survey of the Chinese national osteoporosis societies found that osteoporosis care is not primarily managed by the general practitioners (i.e. family doctors, primary care physicians), but rather, in addition to the general practitioners, by a variety of specialities that have specific medical training for osteoporosis and also look after most cases. These include: rheumatology, orthopaedic surgery, gynaecology, endocrinology, geriatrics, rehabilitation medicine and internal medicine.

Things are beginning to change at the local hospital level, however, and some hospitals have arranged for osteoporosis and metabolic bone disease to be an isolated medical department with specialists dedicated solely to osteoporosis treatment. A complete list in Chinese can be found at <http://haoping.haodf.com/keshi/DE4r0u-lSI6BTj99T-5VQj38SlxeGa/keshi.htm>.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Mandated by the Ministry of Health, China recently documented osteoporosis as a national health priority (NHP) on May 9, 2011 (<http://www.moh.gov.cn/mohbgt/s10329/201105/51580.shtml>).

Action plans linked to the NHP can be found in the China Health Knowledge Sharing Plan (Osteoporosis 2011/ 中国健康知识传播激励计划 (骨质疏松.2011)). Public health programmes associated with the action plan cover:

- Education/information
- Nutrition (Vit D, Ca)
- Risk factors
- Exercise
- Prevention
- Diagnostics

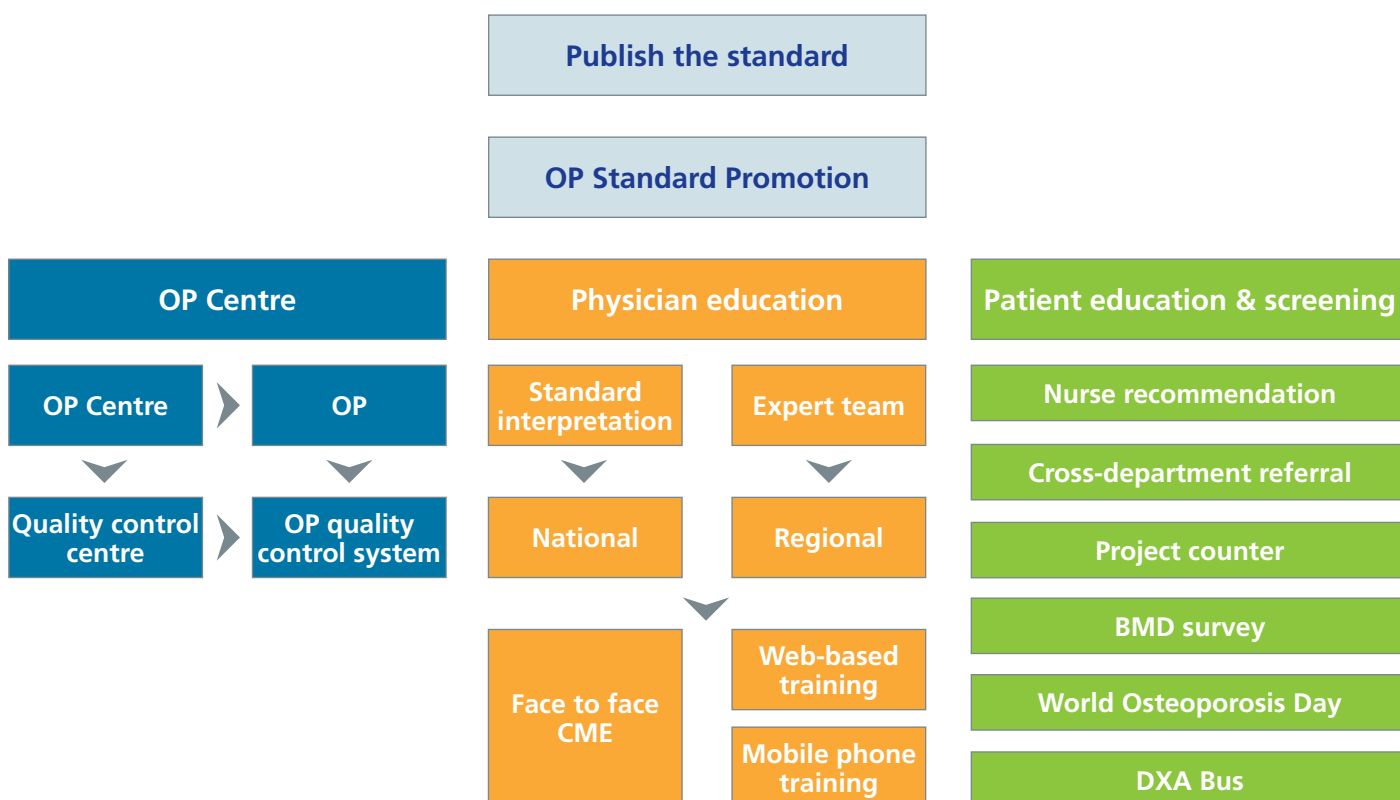
Additionally, China has many national societies which are actively involved with osteoporosis awareness, these include: the OCCGS in conjunction with CHO, and the Chinese Medical Association (CMA) in conjunction with the: 1) Chinese Society of Osteoporosis and Bone Mineral Research (CSOBMR), 2) osteoporosis division in Chinese society of orthopaedics, and 3) osteoporosis division in the Chinese society of endocrinology. There are also more than 20 local osteoporosis societies in province and city levels.

## Guidelines

China currently has several guidelines for osteoporosis diagnosis and management including:

- ‘*The Standard of Diagnosis, Treatment and Quality Control on Osteoporosis*’ (Figure 5) was published in 2013 by CSOBMR/CMA in collaboration with the Department of Medical Administration of the Ministry of Health. The goal was to standardize clinical outcomes and improve the osteoporosis diagnosis and treatment quality indicators nationwide in China.
- ‘*Guidelines on Diagnosis and Treatment of Primary Osteoporosis*.’ Published in 2011 by CSOBMR/CMA.
- ‘*Guideline on Diagnosis and Treatment of Osteoporosis and Bone Mineral Disease*’ published in 2006 by CSOBMR and CMA.

**FIGURE 5** The standard of diagnosis, treatment and quality control on osteoporosis in China



OP osteoporosis; CME continuing medical education; BMD bone mineral density; DXA BUS dual energy x-ray absorptiometry.



- The *Chinese Journal of Osteoporosis* published three editions of ‘*Guidelines for Osteoporosis*,’ in 1999, 2009 and recently in 2013 (<http://yunpan.cn/QX37YpTKPiDuZ>).
- The CMA published the ‘*Osteoporosis Treatment Guidelines*’ in 2006, with an update published in 2011 ([http://www.haodf.com/zhuangjiaguandian/liaodefa\\_583581080.htm](http://www.haodf.com/zhuangjiaguandian/liaodefa_583581080.htm)).

In general, the guidelines above address criteria for osteoporosis assessment and treatment including population screening; osteoporosis risk assessments, such as the IOF One-Minute Osteoporosis Risk Test and the Osteoporosis Self-assessment Tool for Asians (OSTA); fracture risk assessments, including FRAX; and specific risk factors (e.g. age, BMD, prior fracture, and falls risk). According to the national societies in China, the osteoporosis guidelines for assessment and treatment are compatible with existing reimbursement guidelines.

### Audit and quality indicator systems

In China, the audit and quality indicator system for tracking the quality of care for osteoporosis is provided at the national level. The document due to be published in late 2013 is called the ‘Standard of Diagnosis, Treatment and Quality Control on Osteoporosis.’

### TREATMENT

Treatment for osteoporosis is reimbursed in part by the national health system and in part by private health insurance. In general, osteoporosis treatments are reimbursed 70–90% for inpatient care and approximately 30–50% for outpatient care in most cities, depending on the diagnosis and different insurance policies. Traditional Chinese medicine is often used for osteoporosis treatment and is reimbursed at 80% (*Table 4*).

### DIAGNOSTICS

BMD measurement techniques in China include dual-energy X-ray absorptiometry (DXA), quantitative ultrasound (QUS), and single photon absorptiometry (SPA)<sup>6</sup>. In China, however, not everyone at risk can get a BMD measurement. A study carried out by Yongsheng Zhao and colleagues found that few, especially elderly women in rural areas, are willing to go to the hospital for a DXA, due to cost and other personal reasons.

**TABLE 4** Osteoporosis treatments and respective reimbursement in China

	YES	NO	IF YES, % REIMBURSED
Risedronate	variable		80%
Alendronate	x*		90%
Ibandronate		x	
Zoledronic acid	x*		80%, only for inpatient
Clodronate		x	
Pamidronate	variable		
Raloxifene	x*		90%
Bazedoxifene		x	
Denosumab		x**	
Strontium Ranelate		x	
Teriparatide		x	
PTH (1-84)	variable		
Vitamin D/Ca supplements	x*		90–100%
Calcitonin	variable*		
Hormone Replacement Therapy	x*		90–100%
Testosterone	variable		
Alfacalcidol	x*		90–100%
Calcitriol	x*		90%

\* first-line treatment, \*\*not available

This results in osteoporosis not being confirmed in these women until fractures occur and the optimum time for therapy has been missed<sup>12</sup>.

According to the national osteoporosis societies in China, there are approximately 0.46 DXA machines per million of the general population in the urban areas of China and often none in the rural areas. In the cities where DXA and ultrasound are available there is little or no wait time, and the cost is approximately 27 USD for DXA and 8–20 USD for ultrasound (*Table 5*). Patients can receive reimbursement for both DXA and ultrasound, although the level of reimbursement for DXA can be inadequate, sometimes presenting a barrier to treatment.

**TABLE 5** Diagnostics access and cost in China

	DXA	ULTRASOUND
Waiting time (d)	immediately	immediately
Cost (USD)	27	8-10
Is it reimbursed?	in part	in part
Is reimbursement a barrier to access to treatment?	yes	yes

## RECOMMENDATIONS

The Chinese Department of Medical Administration of the Ministry of Health has provided an overview of programmes that are taking place in China now aimed at the overall improvement of osteoporosis care. A summary of their activities is given below.

In 2009, the China Ministry of Health implemented the national project, “Win Over Osteoporosis (WOO)” and launched the project nationwide to the China Medical Doctors Association (CMDA). Beginning in 2009, physician education and patient screening were carried out in the 431 newly established osteoporosis centres. Since then, the scientific influence was cascaded down from the WOO advisory board to the centre leaders, specialists and physicians. By the end of 2012, the number of dedicated osteoporosis specialists had rapidly expanded to 1,659 – who then reached 3.8 million patients through multichannel avenues including nurse recommendations, cross-department referrals, educational seminars, public relationship programmes, etc. Project WOO has an official website at, <http://www.op-woo.com>, and an iPhone application for public and clinician education.

## REFERENCES

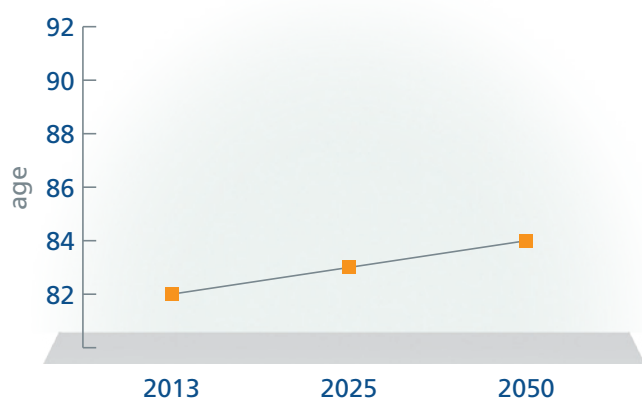
1. 我国老年人口明年突破两亿. 2013, <[http://news.xinhuanet.com/local/2012-10/19/c\\_113422369.htm?prolongation=1](http://news.xinhuanet.com/local/2012-10/19/c_113422369.htm?prolongation=1)>.
2. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
3. Wang, Y, Tao, Y, Hyman, M.E., Li, J & Chen, Y 2009, ‘Osteoporosis in China’, *Osteoporos Int*, vol. 20, pp. 1651–1662.
4. Zhang, W, Stoecklin, E & Eggersdorfer, M 2013, ‘A glimpse of vitamin D status in Mainland China’, *Nutrition*, [Epub ahead of print].
5. Liu, P, Yao, Y, Liu, MY, Fan, Wl, Chao, R, Wang, ZG, Liu, YC, Zhou, JH & Zhao, JH 2012, ‘Spinal Trauma in Mainland China From 2001 to 2007: An Epidemiological Study Based on a Nationwide Database’, *SPLINE*, vol. 37, no. 15, pp. 1310–1315.
6. Bow, CH, Tsang, SWY, Loong, CHN, Soong, CSS, Yeung, SC & Kung, AWC 2011, ‘Bone mineral density enhances use of clinical risk factors in predicting ten-year risk of osteoporotic fractures in Chinese men: the Hong Kong Osteoporosis Study’, *Osteoporos Int*, vol. 22, pp. 2799–2807.
7. Xia, WB, He, SL, Xu, L, Liu, AM, Jiang, Y, Li, M, Wang, O, Xing, XP, Sun, Y & Cummings, SR 2012, ‘Rapidly Increasing Rates of Hip Fracture in Beijing, China’, *J Bone Miner Res*, vol. 27, no. 1, pp. 125–129.
8. *Rural Population (% Of Total Population) In China 2013*, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/china/rural-population-percent-of-total-population-wb-data.html>>.
9. Zhang, YP, Li, XM, Wang, DL, Guo, XY & Guo, X 2012, ‘Evaluation of educational program on osteoporosis awareness and prevention among nurse students in China’, *Nursing and Health Sciences*, vol. 14, pp. 74–80.
10. Ford, MA, Bass, M, Zhao, Y, Bai, JB & Zhao, Y 2011, ‘Osteoporosis Knowledge, Self-Efficacy, and Beliefs among College Students in the USA and China’, *J Osteoporos*, pp. 1-8.
11. Koh, GCH, Tai, BC, Ang, LW, Heng, D, Yuan, JM & Koh, WP 2013, ‘All-cause and cause-specific mortality after hip fracture among Chinese women and men’, *Osteoporos Int*, vol. 24, pp. 1981–1989.
12. Zhao, Y, Liu, Y & Zheng, Y 2013, ‘Osteoporosis and related factors in older females with skeletal pain or numbness: A retrospective study in East China’, *J Int Med Res*, vol. 41, no. 3, pp. 859–866.

# HONG KONG

## COUNTRY OVERVIEW

In 2013, the population of Hong Kong was 7.18 million people with an average life expectancy of 82 years of age. Given the projected 2% increase, life expectancy will reach 84 years by 2050 (Figure 1). While the overall population is projected to decrease by approximately 14% by 2050 to 6.1 million, those aged over 50 years will increase by 28% and those over 70 years will increase by 165% (Figure 2). Currently close to 40% of the population is aged over 50 years. By 2025, half of the total population will be aged over 50 years and this figure will rise to 60% by 2050<sup>1</sup>. These figures indicate a clear need for Hong Kong to invest in the health-care infrastructure for their elderly citizens, including those with osteoporosis and related fractures.

**FIGURE 1** Life expectancy in Hong Kong



## State of osteoporosis/osteopenia

While the last 50 years has seen a sharp increase in hip fractures in Hong Kong, studies over the past decade, including the Hong Kong Osteoporosis Study, are showing a reversal in this trend. Hong Kong is now experiencing a decrease in the incidence of age-adjusted hip fractures in women and men as well as a lower prevalence of osteoporosis and osteopenia<sup>2</sup>. In the past decade, Cheung and colleagues found significantly higher bone mineral density (BMD) levels in women



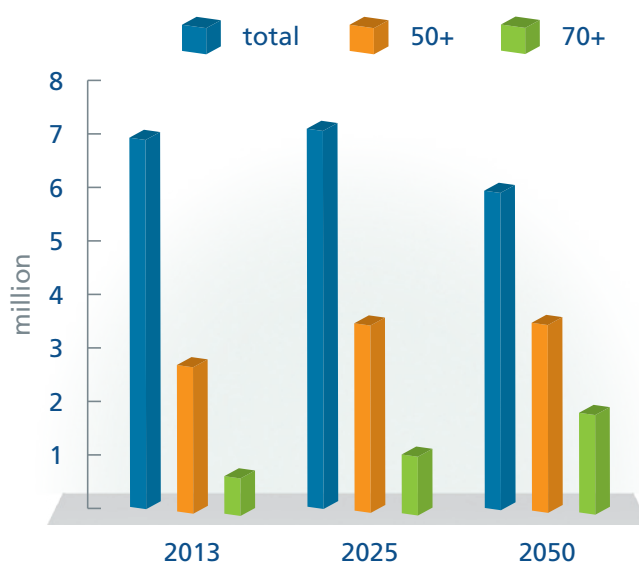
## CURRENT

Population **7.18 million**  
 Aged over 50 years **40%**  
 Life expectancy **82 years**  
 Hip fracture incidence per year **123/100,000**  
 Cost per hip fracture **10,782 USD**  
 Number of DXA per million population **20.7**  
 Fracture liaison services **10–25%**

## PROJECTED 2050

Population **6.1 million** ↓  
 Aged over 50 years **60%** ↑  
 Life expectancy **84 years** ↑

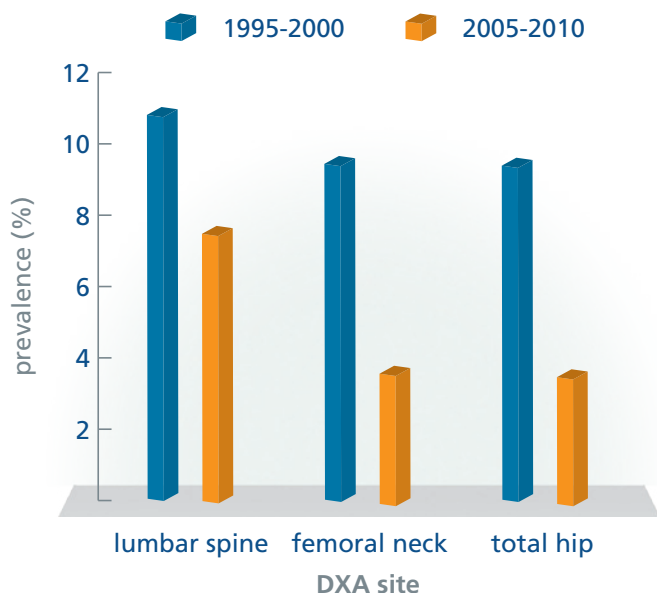
**FIGURE 2** Population projection for Hong Kong



**NOTE** Statistics are from the U.S. Census Bureau and may be underestimated due to the regular influx of immigrants from Mainland China at a rate of approximately 150 per day.

aged over 50 years with BMD values increasing by approximately 9%. The same study indicated that the prevalence of osteoporosis was lower in 2005–2010 than it was in the previous study conducted in 1995–2000; respectively, the prevalence decreased from 11.2 to 7.8 % at the spine, from 9.7 to 3.7 % at the femoral neck, and from 9.6 to 3.6 % at the total hip<sup>2</sup> (Figure 3).

**FIGURE 3** Percentage of subjects with osteoporosis in southern Chinese women recruited in 1995–2000 and 2005–2010<sup>2</sup>



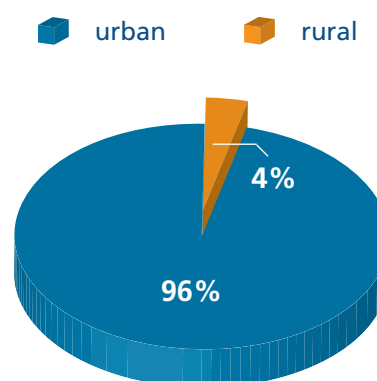
**SOURCE** Figure reproduced from Cheung E. et al. (2013). A secular increase in BMD in Chinese women.

Nevertheless, osteoporosis is a major and increasingly important public health issue in Hong Kong. Although the incidence of age-adjusted hip fractures seems to be decreasing over time and the prevalence of osteoporosis within Hong Kong is lower today than a decade ago, when compared to Caucasians, Hong Kong men and women still have a higher prevalence of osteoporosis and a lower BMD. One community-based study showed 35.8% of Hong Kong women have osteoporosis versus 20% of Caucasian women<sup>3,4</sup>. Furthermore, the absolute number of age-related hip fractures continues to rise due to the ageing population<sup>4</sup>.

## Lifestyle

According to Cheung and colleagues<sup>2</sup>, the last decade in Hong Kong has seen bone health improvements such as increases in BMD and decreases in age-adjusted fractures because the people have been leading healthier lifestyles, have increased access to anti-osteoporosis drugs and have greater awareness of osteoporosis. This is good news; however the negative lifestyle habits that lead to increased risk of osteoporosis are still highly prevalent in Hong Kong. A sedentary lifestyle is common, with the average amount of outdoor exercise being around one hour per week. This leads to limited time in the sun and an increased risk of vitamin D deficiency. Additionally, studies reveal that calcium intake still remains low (approximately 400 mg/day) as it has over the past years<sup>2</sup>. The urbanization of Hong Kong and the ageing population signifies that the burden of osteoporosis will remain a looming problem over the years to come (Figure 4). Adoption of a more “Western” lifestyle and its effects on osteoporosis are evident in Hong Kong with studies showing BMD to be lower and the hip fracture rate to be much higher than in Mainland China<sup>4,5,6</sup>.

**FIGURE 4** Urban versus rural population in Hong Kong<sup>7</sup>



## Level of awareness

According to the Osteoporosis Hong Kong 2013 Guidelines, over the past decade there has been an increase in public awareness of osteoporosis. Hong Kong men and women are making better lifestyle choices in general, and at the district level there have been some official steps taken to improve community

awareness of fall prevention and exercise through Tai Chi classes. Prevention messages however may not be effectively reaching men. One study points out that Hong Kong men display a continued lack of interest in health-related activities in general – which increases their risk as they remain under informed about osteoporosis prevention or their own BMD status<sup>8</sup>. Further, the reported increase in public awareness of osteoporosis is not capturing the attention of policy makers since osteoporosis is not a national health priority and is not considered among the top 10 priority diseases by the Hong Kong Health Authority.

## FRACTURE RATES

### Hip fracture

Several studies indicate that hip fracture rates in both men and women in Hong Kong are lower than in Caucasians<sup>3,8,9</sup>. One study of men aged over 50 in the Hong Kong Osteoporosis Study found the incidence of hip fracture to be 123/100,000 person years<sup>8</sup>. However, when compared to mainland China hip fracture rates in Hong Kong are much higher<sup>4,5</sup>.

The past 10–15 years has generally seen a decline in age-adjusted hip fractures in Hong Kong<sup>2,4,8</sup>. In the past, over a 50-year period, there was a 300% and 200% increase in the age-specific incidence of hip fracture in women and men aged over 50, respectively. More recently however, between 1995 and 2004, the Clinical Data Analysis and Reporting System of the Hospital Authority showed hip fracture incidence declining almost 50% in men and women in their fifties, but remaining stable for those aged 80 years and over – the age range at which most hip fractures still occur<sup>5</sup>.

The ageing population, however, will counterbalance the stabilization seen in hip fracture incidence and the absolute numbers of hip fractures are expected to see an *exponential increase*<sup>5</sup>. In 2009 there were an estimated 4,400 hip fracture surgeries. Using this figure, combined with the 2013 Osteoporosis Society of Hong Kong (OSHK) Guidelines' projection that the total number of hip fractures in the year 2015 will reach 7,642 (5,293 women and 2,349 men)<sup>5</sup> we are looking at an approximate 70% increase in hip fractures over this 6-year period.

In Hong Kong, most hip fractures are treated surgically. As stated above, in 2009 there were an estimated 4,400

hip fracture surgeries in Hong Kong and of these 68% of the patients were operated within 2 days of admission. Unfortunately, the delay and/or cancellation of hip surgeries is high in Hong Kong hospitals due to perceptions that the elderly have a lower priority for surgery than the young and the fear that elderly patients may not be “fit for surgery”<sup>10</sup>. However, the Queen Mary Hospital System is working to improve the statistics. The recently implemented *geriatric hip fracture clinical pathway* increased the number of hip fracture patients operated on within 2 days to 86%. This *pathway* has improved overall hip fracture patient care at Queen Mary Hospital – and the hope is to extend it to other hospitals around Hong Kong<sup>10</sup>.

### Other fragility fractures

Consistent with the data on hip fractures, many studies indicate that men and women in Hong Kong also have a lower fragility fracture rate, with the exception of vertebral fractures, than Caucasians<sup>8</sup>. Additionally, the past decade has seen a plateau in the age-adjusted fracture rate when compared to the previous 50 years where fractures increased two-fold<sup>2,8</sup>. However, more studies are needed on the actual fracture rate as well as the prevalence of fragility fractures in Hong Kong, since one study in 2005 indicated 30.4% of men over 50 reported a fragility fracture, and another study in 2006 found only 6.6% had a history of fracture<sup>11</sup>.

### Vertebral fractures

While findings indicate that hip and other fragility fractures in Hong Kong are low, studies show that the prevalence of vertebral fractures are actually equal to if not higher than Caucasians counterparts, and are much higher than those in Mainland China<sup>5</sup>. A possible explanation may be due to the higher prevalence of osteoporosis found in men and women in Hong Kong, but a lower fall rate<sup>3</sup>. The Hong Kong Osteoporosis Study found the overall prevalence of vertebral fractures, as determined by a questionnaire gathering BMD and clinical risk factors, in postmenopausal women to be 22% (age 60–69 = 19%; age 70–79 = 44%; age >80 = 68%). As expected, vertebral fractures increased with age, clinical risk factors, and decreasing BMD<sup>12</sup>. Another study, looking at the radiographic vertebral fractures using Genant's semiquantitative (SQ) scoring system, found that in those aged over 65 years the prevalence of vertebral fractures was 8.6% (5% for men and 12.1% for women)<sup>9</sup>. The Hong

Kong Osteoporosis Guidelines for 2013 used the methodology of vertebral height ratio reduction by three or more standard deviations (SDs) to estimate the prevalence of vertebral fracture and found that in men and women aged 70–79 years the prevalence was 30% in women and 17% in men.

## COST OF FRACTURE

According to the Clinical Data Analysis & Reporting System (CDARS) of the Hospital Authority in Hong Kong, there have been approximately 4,500 cases of hip fracture every year amounting to 52 million USD in annual hospital expenditure. With the ageing of the Hong Kong population, despite the plateauing of the age-specific incidence of hip fracture, it is expected that the absolute number of cases of hip fracture will continue to rise in the next 10–20 years<sup>10</sup>.

Looking at direct hospital and rehabilitation costs, estimates from the OSHK indicate that treating hip fracture patients amounts to over 10 000 USD per fracture, with an average of 7 hospital bed days and 20 rehabilitation bed days (*Table 1*). On average, the cost of care of a hip fracture patient in acute hospital and rehabilitation is approximately 400 USD each day<sup>10</sup>.

**TABLE 1 Hip fracture in Hong Kong**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$10,782	ACUTE 7 REHAB 20	95%

## FRACTURE REGISTRIES

There are no fracture registries in Hong Kong.

## FRACTURE LIAISON SERVICES

It is estimated that approximately 10–25% of hospitals in Hong Kong have set up a fracture liaison service (FLS), which are coordinator-based, post-fracture systems of care aimed at decreasing secondary fractures.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

According to the OSHK, osteoporosis is primarily managed by endocrinologists and orthopaedic surgeons. Other specialities that may also manage osteoporosis include:

- Family doctors
- Rheumatologists
- Gynaecologists
- Geriatricians
- Rehabilitation medicine physicians
- Internal medicine physicians

It is reported that osteoporosis is neither a recognized medical speciality in itself, nor a recognized component of specialized medical training.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

In Hong Kong, osteoporosis is not officially documented as a national health priority. Osteoporosis has been a major public health problem in Hong Kong but has not received proportional attention from policy makers as compared to other chronic diseases such as diabetes, hypertension, cardiac and cerebrovascular disease or dementia. Currently there are no authoritative local reports on the prediction of the magnitude of osteoporosis. Despite the considerable case load (4,500 cases of hip fracture every year), osteoporosis and related hip fractures have not been listed among the top 10 priority diseases in the annual plan of the Hong Kong Health Authority.

### Guidelines

Guidelines for the treatment of osteoporosis in Hong Kong have been available since 1998 with updates published in 2004 and 2013. The latest Guideline, ‘2013 OSHK Guideline for Clinical Management of Postmenopausal Osteoporosis in Hong Kong’, was formulated by a task group from the OSHK and was published in the *Hong Kong Medical Journal* in April 2013. These guidelines aim to provide guidance for practice by both primary care physicians and specialists in various fields who are interested in the care of osteoporosis patients<sup>5</sup>.

**TABLE 2** Osteoporosis treatments and respective reimbursement in Hong Kong

	YES	NO	IF YES, WHAT % IS REIMBURSED?
Risedronate		x	
Alendronate	x		100 with prior fracture
Ibandronate		x	
Zoledronic acid	x		100 with prior fracture and intolerance to oral alendronate
Clodronate		x*	
Pamidronate		x*	
Raloxifene		x	
Bazedoxifene		x**	
Denosumab	x		100 with prior fracture and intolerance to oral alendronate
Strontium Ranelate	x		100 with prior fracture and intolerance to oral alendronate
Teriparatide		x	
PTH (1-84)		x**	
Vitamin D/Ca supplements	x		
Calcitonin	x		Only employed for pain treatment in acute vertebral fracture
Hormone Replacement Therapy	x		
Testosterone	x		
Alfacalcidol		x*	
Calcitriol		x*	

\* not employed for treatment of osteoporosis \*\* information not available

The guidelines address fracture risk assessment and treatment including prior fracture, age, BMD, FRAX, smoking & drinking, family fracture history, use of corticosteroids and secondary causes of osteoporosis.

Due to the nature of the health-care system, the guidelines on osteoporosis are not always compatible with reimbursement policy because reimbursement for assessments (i.e. dual-energy X-ray absorptiometry (DXA)) in the public sector is limited to patients who have had a prior fracture, and in the private sector DXAs are self-financed by the patient.

### Audit and quality indicator systems

Data not provided.

### TREATMENT (REIMBURSEMENT OF MEDICATION)

The treatment of osteoporosis and osteoporotic fracture has been haphazard in both the public and private sectors depending on the interest of the respective clinicians. The prevalence of vitamin D insufficiency (25OHD level <75 nmol/L) has been reported to be as

high as 62.8% in community-dwelling Chinese adults aged 50 years and over. Yet, calcium and vitamin D supplements are not routinely prescribed to osteoporosis patients, nor are specific anti-osteoporosis drugs.

The OSHK reports that the national health system only reimburses treatment for osteoporosis in patients with prior history of fracture. In patients who fracture, oral alendronate is the first-line treatment, and if it is not tolerated second-line treatments include: zoledronic acid, strontium ranelate and denosumab. All other forms of treatments, as well as treatment in patients without history of fracture are not reimbursed and must be paid for by the patients themselves (*Table 2*).

### DIAGNOSTICS

In Hong Kong, DXA is the recommended diagnostic tool for osteoporosis, and the use of ultrasound is not recommended. There are approximately 20.7 DXA<sup>13</sup> machines per one million in general population, and the average waiting time for a scan has a wide variation in the public sector with a median of 9 months. There is no waiting time in the private sector. The cost of DXA

can range from approximately 40-120 USD and is free in the public sector. However, in both sectors, there are barriers to access: the public sector requires history of prior fracture for reimbursement and the private sector does not offer reimbursement (Table 3).

**TABLE 3 Access to DXA and ultrasound in Hong Kong**

	DXA	ULTRASOUND
Waiting time (d)	Wide variation in public sector (median 9 month) No waiting time in private	Not recommended
Cost (USD)	40 to 120	
Is it reimbursed?	Free in public sector	
Is reimbursement a barrier to access to treatment?	No	

## RECOMMENDATIONS

Osteoporosis has long been a major public health problem in Hong Kong but has not received proportional attention from policy makers compared with other chronic diseases like diabetes, hypertension, heart or cerebrovascular diseases and dementia. There is a need for more epidemiological data regarding all aspects of osteoporosis in Hong Kong, notably osteoporotic fracture. At the hospital level, priority should be diverted to the establishment of an interdisciplinary, structured secondary fracture prevention programme across the territory to address the treatment gap that evidently exists. At the community level, the health authorities should play a leading role to address the importance of osteoporosis prevention and fall prevention through a large-scale territory-wide campaign targeting the young and old population, respectively. Last but not least, systematic data collection and analysis of cases of atypical femur fractures which appear to deter patients and clinicians from accepting bisphosphonate treatment need to be conducted.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Cheung, E, Bow, C, Loong, C, Lee, KK, Ho, AYY, Soong, C, Chan, YY, Tan, K & Kung, A 2013, 'A secular increase in BMD in Chinese women', *J Bone Miner Metab*, Epub ahead of print.
3. Bow, CH, Cheung, E, Cheung, CL, Xiao, SM, Loong, C, Soong, C, Tan, KC, Luckey, MM, Cauley, JA, Fujiwara, S & Kung, AWC 2012, 'Ethnic difference of clinical vertebral fracture risk', *Osteoporos Int*, vol. 23, pp. 879-885.
4. Tsang, SWY, Kung, AWC, Kanis, JA, Johansson, H & Oden, A 2009, 'Ten-year fracture probability in Hong Kong Southern Chinese according to age and BMD femoral neck T-scores', *Osteoporos Int*, vol. 20, pp. 1939-1945.
5. Ip, TP, Cheung, SK, Cheung, TC, Choi, TC, Chow, SL, Ho, YY, Kan, SY, Kung, WC, Lee, KK, Leung, KL, Leung, YY, Lo, ST, Sy, CT & Wong, YW 2013, 'OSHK Task Group for Formulation of 2013 OSHK Guideline for Clinical Management of Postmenopausal Osteoporosis in Hong Kong', *Hong Kong Med J*, vol. 19, no. 2, pp. 1-40 <[http://www.hkmj.org/supplements/article\\_pdfs/hkm1304sp2p6.pdf](http://www.hkmj.org/supplements/article_pdfs/hkm1304sp2p6.pdf)>.
6. Chan, R, Woo, J, Lau, W, Leung, J, Xu, L, Zhao, X, Yu, W, Lau, E & Pocock, N 2009, 'Lifestyle Effects of lifestyle and diet on bone health in young adult Chinese women living in Hong Kong and Beijing', *Food Nutr Bull*, vol. 30, no. 4, pp. 370-378.
7. *Rural Population (% Of Total Population) In Hong Kong*, 2013. Trading Economics. Viewed 01 September 2013, <<http://www.tradingeconomics.com/hong-kong/rural-population-percent-of-total-population-wb-data.html>>.
8. Bow, CH, Tsang, SWY, Loong, CHN, Soong, CSS, Yeung, SC & Kung, AWC 2011, 'Bone mineral density enhances use of clinical risk factors in predicting ten-year risk of osteoporotic fractures in Chinese men: the Hong Kong Osteoporosis Study', *Osteoporos Int*, vol. 22, pp. 2799-2807.
9. Kwok, AWL, Gong, JS, Wang, YXJ, Leung, JCS, Kwok, T, Griffith, JF & Leung, PC 2012, 'Prevalence and risk factors of radiographic vertebral fractures in elderly Chinese men and women: results of Mr. OS (Hong Kong) and Ms. OS (Hong Kong) studies.'
10. Lau, TW, Leung, F, Siu, D, Wong, G & Luk, KDK 2010, 'Geriatric hip fracture clinical pathway: the Hong Kong experience', *Osteoporos Int*, vol. 21, pp. S627-S636.
11. Wang, Y, Tao, Y, Hyman, ME, Li, J & Chen, Y 2009, 'Osteoporosis in China', *Osteoporos Int*, vol. 20, pp. 1651-1662.
12. Tsang, SWY, Bow, CH, Chu, EYW, Yeung, SC, Soong, CC & Kung, AWC 2011, 'Clinical risk factor assessment had better discriminative ability than bone mineral density in Identifying subjects with vertebral fracture', *Osteoporos Int*, vol. 22, pp. 667-674.
13. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat*, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>; Kanis JA, data on file.

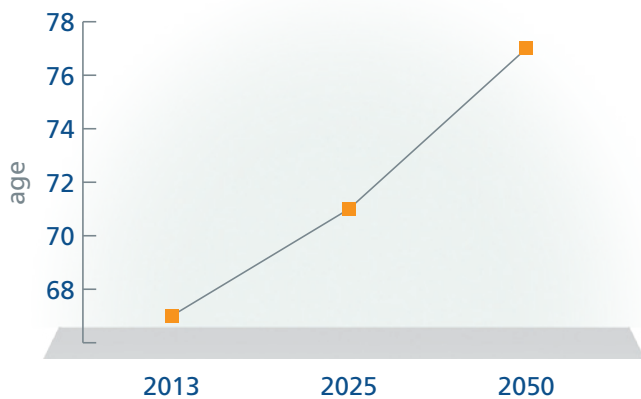


# INDIA

## COUNTRY OVERVIEW

India, with a population of 1.2 billion people, is the second largest emerging economy and second most populated country in the world. Life expectancy is 67 years and is expected to increase to 71 years by 2025 and to 77 years by 2050 (Figure 1)<sup>1</sup>. Currently, approximately 10% of India's population (more than 100 million) is aged over 50 years. Based on current patterns of growth, India's population is expected to grow by 16% to reach 1.4 billion by 2025. From 2025 to 2050 the population will increase by a further 34%, reaching 1.88 billion (Figure 2)<sup>1</sup>. Those above the age of 50 years will constitute 22% of the population in 2025 and 33% of the population in 2050. With estimates showing that approximately 80% of the urban Indian population is vitamin D deficient<sup>2</sup> and hip fractures occur about a decade earlier than in western nations<sup>3</sup>, osteoporosis is a major concern for this ageing population.

**FIGURE 1** Life expectancy in India



## State of osteoporosis/osteopenia

In the 2009 IOF Asian Audit, expert groups estimated that the number of osteoporosis patients in India was approximately 26 million in 2003, with projections indicating that this would rise to 36 million patients by



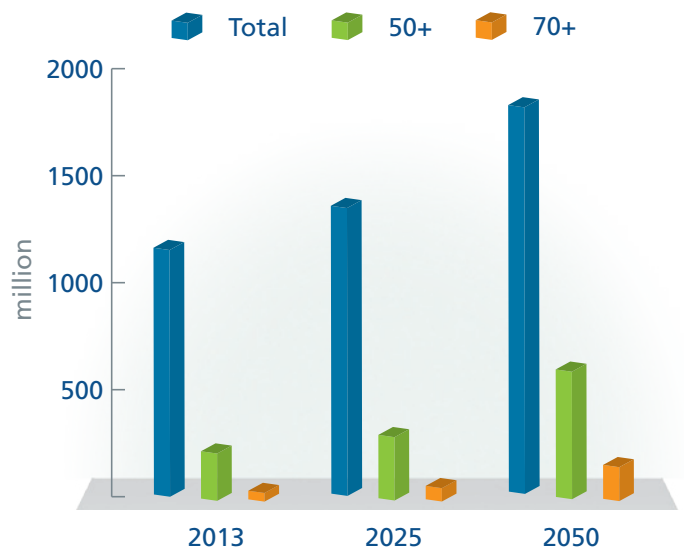
## CURRENT

Population **1.2 billion**  
 Aged over 50 years **10%**  
 Life expectancy **67 years**  
 Hip fracture incidence per year **163/100,000** (women)  
 Cost per hip fracture **772–3,860 USD**  
 Number of DXA per million population **0.26**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **1.88 billion** ↑  
 Aged over 50 years **33%** ↑  
 Life expectancy **77 years** ↑

**FIGURE 2** Population projection for India until 2050



2013<sup>4</sup>. Now, in 2013, sources estimate that 50 million people in India are either osteoporotic (T-score lower than  $-2.5$ ) or have low bone mass (T-score between  $-1.0$  and  $-2.5$ )<sup>5</sup>.

In a study among Indian women aged 30–60 years from low-income groups, bone mineral density (BMD) at all skeletal sites was much lower than values reported from developed countries, with a high prevalence of osteopenia (52%) and osteoporosis (29%), thought to be due to inadequate nutrition<sup>6</sup>. In a more recent study from Delhi, 792 males and 808 postmenopausal females with a mean age of  $57.67 \pm 9.46$  years were evaluated. Osteoporosis was present in 35.1% of subjects (M-24.6%, F-42.5%) and osteopenia in 49.5% (M-54.3%, F-44.9%)<sup>7</sup>. Both of these studies used the manufacturer's White Caucasian reference database.

In an attempt to generate an India-specific database, the Indian Council for Medical Research (ICMR) carried out a large multicentre study which confirmed data from smaller, single-centre studies, and showed that Indians have lower BMD than their North American counterparts<sup>8</sup>. A study involving more than 3,500 subjects carried out at a tertiary care center in South India to study the effect of the newly generated ICMR database (ICMRD) on the diagnosis of osteoporosis reported that a greater proportion were diagnosed as having osteoporosis with Hologic as compared to the ICMR database. Osteoporosis at the spine and hip was present in 42.7% and 11.4% subjects using the Hologic database and in 27.7% and 8.3% subjects using the ICMR database<sup>9</sup>.

Similarly in a study from North India where age-specified BMD reference ranges were established in females between 18–85 years, the prevalence of osteoporosis among women aged older than 50 years was significantly higher based on Caucasian T-scores as opposed to using peak BMD/standard deviation values from the population under review at lumbar spine. However, there was no major difference observed at femoral neck<sup>10</sup>.

Reasons ascribed for lower BMD in Indians include possible genetic differences, nutritional deficiency and smaller skeletal size<sup>11</sup>.

### Lifestyle

Widespread vitamin D deficiency has been shown unequivocally across all ages throughout India. More

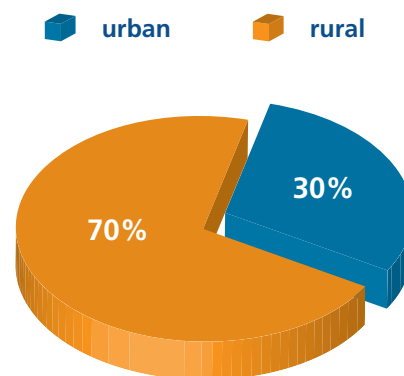
than 80% of urban Indians have serum 25(OH)D levels below 20 ng/mL. This includes pregnant women and their newborns, children and adolescents, young adults and the elderly. Vitamin D deficiency during childhood and adolescence decreases peak bone mass in adults and may increase the risk of developing osteoporosis<sup>11</sup>. Studies indicate approximately 80–90% of hip fracture patients are vitamin D deficient<sup>12,13</sup>. The high rate of vitamin D deficiency may be due to several causes such as low sun exposure, inadequate dietary vitamin D intake, lack of food fortification with vitamin D, pigmented skin, environmental pollution, and traditional dress code<sup>4</sup>. To combat the low levels of vitamin D a couple of states have recently initiated vitamin D fortification of edible oil and milk fortification which can be an effective means of delivering vitamin D<sup>14</sup>.

Nutritionally, the Indian population consumes much lower amounts of calcium (300–500 mg/day) than the ideal daily intake<sup>15</sup>. Additionally, tea is a popular beverage consumed by the Indian population; however, due to the high caffeine content, some studies have suggested that it may be associated with a greater risk of hip fracture<sup>16</sup>.

As in other Asian countries, urbanization also appears to be associated with an increase in prevalence of osteoporosis due to lifestyle changes, lower physical activity, increase in indoor living, and lower sun exposure (*Figure 3*)<sup>17,18</sup>.

Glucocorticoids are taken on a long-term basis by an estimated 1% of the Indian adult population, especially the elderly. This is a contributing factor to osteoporosis in India<sup>19</sup>.

**FIGURE 3** Urban versus rural population in India<sup>18</sup>



Expatriate Indians also show evidence of poorer bone health than their western counterparts. Experts have found that women from India who have migrated to western countries are at increased risk of accelerated age-related bone loss when compared to their counterparts living in the same geographic region due to their darker skin, dressing habits and lower bone mass<sup>20</sup>.

### Level of awareness

Awareness of osteoporosis is low in India with a number of small-scale surveys indicating that in the urban population approximately 10–15% are familiar with the disease. However, awareness varies widely according to the level of education and those with a family history of the disease. One study reveals that Indians find information about osteoporosis mostly through the television and radio (55%) when compared with family/friends, newspaper and doctors (approximately 20% each). Unfortunately, information from the media is not always accurate, and with only 20% of information coming from physicians there is a clear need for increased involvement of doctors in educating patients about osteoporosis<sup>21</sup>.

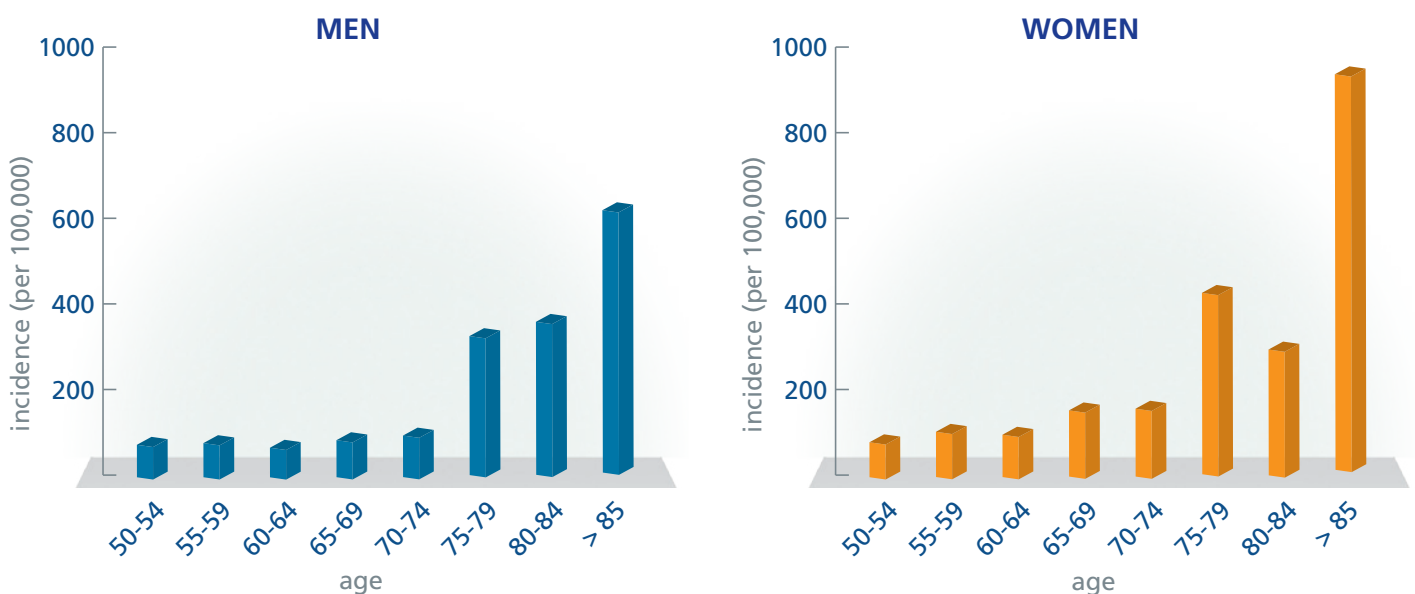
## FRACTURE RATES

### Hip fracture

Hospital-based studies suggest that hip fractures are common in India too<sup>22</sup>. A study on expatriate Indians in Singapore showed that hip fracture rates in Indians are somewhat lower than in the Chinese and higher than in Malays<sup>23</sup>. This study has been used to develop the FRAX model for India. A recent study from Rohtak district in North India shows an annual incidence rate of 163 and 121 per 100,000 per year in women and men respectively above the age of 55 years (Figure 4)<sup>24</sup>. However, with the rapid increase in the ageing population, an exponential rise is expected in the absolute numbers of fractures in the next decade<sup>1</sup>.

The preponderance of hip fractures in females that is observed in Western populations is less striking in India<sup>3,24</sup>. In Caucasians, hip fractures are twice as common in women, whereas in India the ratio of hip fractures in women to men is more in the order of 3:2<sup>24</sup>. Additionally, it has been suggested that hip fractures occur at an earlier age in Indians in comparison with

**FIGURE 4** The age- and sex-specific hip fracture incidence in Rohtak district, North India during 2009



SOURCE Dhanwal D.K. et al. (2013) Incidence of hip fracture in Rohtak district, North India.

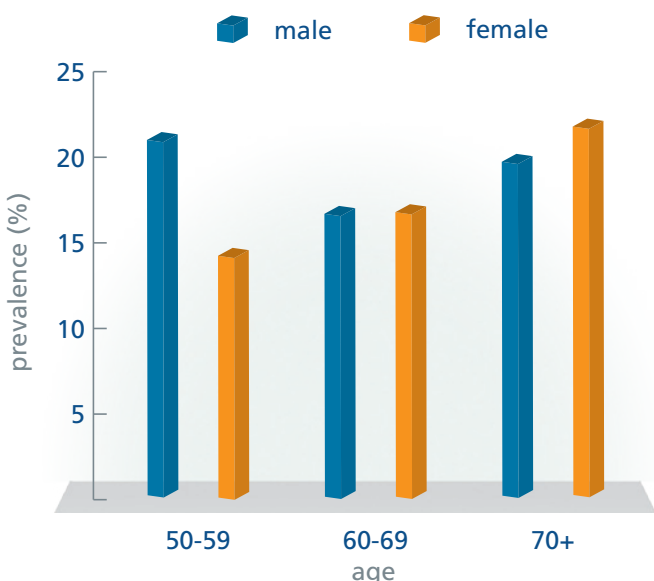
western counterparts with the peak age for hip fractures in Indians occurring in their sixties<sup>3</sup>. This may be a function of a shorter life span. Studies of osteoporotic, postmenopausal women in India found that on average, 34% were aged below 60 years<sup>24</sup>. The 1-year mortality after hip fractures is high at over 30% in the public hospital setting<sup>24</sup>.

India does not have standardized criteria for the management and treatment of hip fractures, and procedures vary by hospital setting. The Indian Society of Bone and Mineral Research (ISBMR) estimates that 90% or more of hip fractures are managed surgically in urban areas. While the average waiting time for hip surgery is less than 1 day in private hospitals, Indians often wait over 3 days for hip surgery in public hospitals where the majority of cases are seen. The proportion of patients undergoing surgery in rural areas is likely to be much lower.

### Other fragility fractures

In a large questionnaire-based study involving 14,271 subjects, population incidence of low trauma fractures at hip, spine and wrist was 34.3/100,000 per year<sup>25</sup>.

**FIGURE 5** Prevalence of vertebral fractures in males and females according to age strata<sup>26</sup>



**SOURCE** Marwaha R.K. et al. (2012). The prevalence of and risk factors for radiographic vertebral fractures in older Indian women and men: Delhi Vertebral Osteoporosis Study (DeVOS).

### Vertebral fractures

Vertebral fractures are common in Indians, with 15–20% of older urban adults aged over 50 years showing evidence of at least one vertebral fracture. The prevalence of radiographic vertebral fractures in older adults in Delhi has been recently reported to be 17.9% (18.8% male and 17.1% female); indicating that vertebral fracture prevalence in India is similar to Western populations (*Figure 5*)<sup>26</sup>.

### COSTS OF FRACTURE

Costs vary according to town, bed type and whether or not the hospital is governmental, public or private. In private hospitals, the total cost of hip surgery is between 2,360–3,860 USD (150,000 to 250,000 Rs), and in public hospitals the cost is approximately 772 USD (50,000 Rs). Private hospitals generally report shorter bed days of 5–6 days than public hospitals, where the stay can often be 15 days (*Table 1*).

**TABLE 1** Hip fracture in India

	HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
Private	\$2,360–3,860	5-6	90% (urban areas)
Public	\$772	15	

### FRACTURE REGISTRIES

There are no official fracture registries in India, although there could possibly be some at the hospital level.

### FRACTURE LIAISON SERVICES

India does not have any coordinator-based models of care, otherwise known as fracture liaison services (FLS) for secondary fracture prevention. However, at least two hospitals in New Delhi are in the early stages of developing a FLS.

### SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

The general management of osteoporosis is by orthopaedists and endocrinologists, but other specialities

also manage patients, including: family doctors, rheumatologists, gynaecologists, endocrinologists, geriatricians, rehabilitation specialists and internal medicine physicians.

There is little osteoporosis-related education at the medical undergraduate level. However, osteoporosis is a recognized component of speciality training for endocrinologists. Various aspects of osteoporosis are also a component of training for orthopaedic surgeons, gynaecologists, rheumatologists and rehabilitation medicine physicians.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a national health priority (NHP) in India. Of the NHPs, the one that will most closely impact osteoporosis is the nutritional programme aimed at schoolchildren to provide vitamins and minerals including vitamin D and calcium. Although not formally recognized in health programmes, vitamin D deficiency is increasingly becoming an important public health issue, and there is a proposal currently under review for musculoskeletal diseases to be a NHP.

### Guidelines

The Indian guidelines on glucocorticoid-induced osteoporosis, 'Indian Rheumatology Association guidelines for management of glucocorticoid-induced osteoporosis (GIOP)' were published in 2011 as a collaboration between the Indian Rheumatology Association, the Endocrine Society of India, and the Indian Society of Bone & Mineral Research<sup>27</sup>.

Postmenopausal Osteoporosis guidelines are in the process of development jointly by the Endocrine Society of India and ISBMR and are expected to be released in late 2013.

There are numerous initiatives and programmes hosted by ISBMR promoting osteoporosis awareness and education, such as:

- Education programmes and conferences for doctors
- Research grants for young investigators awarded annually
- Bone densitometry courses
- Web based education on osteoporosis
- Printed educational material produced

Additionally, there are numerous campaigns targeted toward healthcare providers:

- Orthopaedic & gynaecologic initiative
- IOF/ISCD courses
- Osteoporosis for students
- National Bone Health Quiz for medical students organized every few years
- Essay competition for nutritionists

### Audit and quality indicator systems

Audit and quality indicator systems are not in place in India.

## TREATMENT (REIMBURSEMENT OF MEDICATION)

In general, patients pay for treatment directly out-of-pocket. Health-care coverage is limited to less than

**TABLE 2** Osteoporosis treatments and respective reimbursement in India

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		<10
Alendronate	x		<10
Ibandronate	x		<10
Zoledronic acid	x		<10
Clodronate		x	
Pamidronate		x	
Raloxifene	x		<10
Bazedoxifene		x	
Denosumab		x*	
Strontium Ranelate	x		<10
Teriparatide	x		<10
PTH (1-84)		x	
Vitamin D/Ca supplements	x		<10
Calcitonin	x		<10
Hormone Replacement Therapy	x		<10
Testosterone	x		<10
Alfacalcidol	x		<10
Calcitriol	x		<10

\*not available

10% of users. Those with health insurance (e.g. central government employees, state insurance or private coverage) are generally only reimbursed for hospital-based services. Outpatient services, including diagnostics and medications, are not commonly reimbursed. This is true for osteoporosis care as well with designated first-line treatments such as bisphosphonates, vitamin D and calcium, which are paid for by the patients (*Table 2*). In cases where reimbursement is available, it is based on the doctor's prescription without any strict regulations. However, 'cheaper' generic medications are available and are usually preferred in public/government systems. And, because only hospitalized patients are reimbursed by insurance companies, several doctors prefer to infuse zoledronic acid in the hospital setting. *Table 2* summarizes the treatments available to those who have health-care coverage.

## DIAGNOSTICS

Most Indian women cannot afford dual-energy X-ray absorptiometry (DXA) due to the costs involved<sup>28</sup>. Like medication treatments, reimbursement is also limited for the diagnoses of osteoporosis. In general, DXA and ultrasound are not reimbursed, and patients pay for scans out of pocket (*Table 3*). There are approximately 0.26 DXA machines per one million of the general population<sup>29</sup> and very few of these are based at the government hospitals, a fact which further limits access. In the private centres where DXA is available, there is no waiting time for DXA, but again a very small proportion of the population is reimbursed through the private sector.

Due to the limited reimbursement for DXA and ultrasound, cost is a barrier to access. In general DXA costs 27–67 USD. Ultrasound has no waiting time and costs between 25–40 USD.

## RECOMMENDATIONS

While there has been considerable progress in research and epidemiology of osteoporosis in India since the last IOF Asian Audit in 2009, numerous gaps still exist. Some of the high-priority areas for action over the next three years are listed below.

### Prevention

- Fortification of food with vitamin D needs to be introduced as a universal government programme.
- Greater emphasis is needed on attainment of peak bone mass/childhood adolescent bone health by nutrition and life style measures. Intensive, sustained, awareness and intervention programmes need to be initiated at the school level.

### Treatment

- Establishment of reliable, accurate hip fracture registries is urgently needed and is a prerequisite to the improvement of hip fracture care and implementation of secondary prevention strategies.
- Introduction of fracture liaison services will considerably help secondary fracture prevention efforts.

### Research

- There is a need for multicentre, large-scale hip fracture incidence studies for which attempts are being made by ISBMR. The validation of a FRAX tool specifically for India would enable better use of diagnostic facilities and improve selection of patients requiring treatment.

**TABLE 3** Diagnostics access and cost in India

	DXA	ULTRASOUND
Waiting time (d)	0	0
Cost (USD)	27-67	25-40
Is it reimbursed?	limited to no reimbursement	limited to no reimbursement
Is reimbursement a barrier to access to treatment?	yes	yes

## REFERENCES

1. Government of India: Ministry of Home Affairs 2011, Office of the Registrar General & Census Commissioner, India, <<http://censusindia.gov.in>>.
2. Beloyartseva, M, Mithal, A, Kaur, P, Kalra, S, Baruah, MP, Mukhopadhyay, S, Bantwal, G & Bandgar, TR 2012, 'Widespread vitamin D deficiency among Indian health care professionals', *Arch Osteoporos*, vol. 7, no. 1-2, pp. 187-192.
3. Malhotra, N & Mithal A 2008, 'Osteoporosis in Indians', *Indian J Med Res*, vol. 127, no. 3, pp. 263-268.
4. Ambrish, M, Dhingra, V & Lau, E 2009, 'The Asian Audit: Epidemiology, costs and burden of osteoporosis in Asia', *International Osteoporosis Foundation*, pp. 24-29.
5. 'Osteoporosis in Asia: a call to action' 2012, *Curr Osteoporos Rep*, vol. 10, no. 4, pp. 245-247.
6. Shatrugna, V, Kulkarni B, Kumar, PA, Rani, KU & Balakrishna, N 2005, 'Bone status of Indian women from a low-income group and its relationship to the nutritional status', *Osteoporos Int*, vol. 16, p. 1827.
7. Marwaha, RK, Tandon, N, Garg, MK, Kanwar, R, Narang, A, Sastry, A, Saberwal, A, Bhadra, K & Mithal, A 2011, 'Bone health in healthy Indian population aged 50 years and above', *Osteoporos Int*, vol. 22, no. 11, pp. 2829-2836.
8. 'Population based reference standards of peak bone mineral density of Indian males and females: An ICMR multi-center task force study' 2010, *New Delhi: ICMR Publication; Published by Director General*, pp. 1-24.
9. Paul, T, Asha, HS, Mahesh, DM, Naik, D, Rajaratnam, S, Thomas, N & Seshadri, MS 2012, 'The diagnosis of osteoporosis among subjects of southern Indian origin above 50 years of age – The impact of the Indian council of medical research versus Caucasian bone mineral density reference standards Department of Endocrinology, Diabetes & Metabolism, Christian Medical College, Vellore, India', *Indian J Endocrinol Metab*, vol. 16, no. 2, pp. S514-S524.
10. Marwaha, R, Tandon, N, Kaur, P & Mani, KJ 2012, 'Establishment of age-specified bone mineral density reference range for Indian females using dual-energy X-ray absorptiometry', *J of Clin Dens*, vol. 15, no. 2, p. 241.
11. Shivane, V, Sarathi, V, Lila, A, Bandgar, T, Joshi, S, Menon, P & Shah, N 2012, 'Peak Bone Mineral Density and Its Determinants in an Asian Indian Population', *J Clin Densitom: Assessment of Skeletal Health*, vol. 15, no. 2, pp. 152-158.
12. Dhanwal, DK, Sahoo, S, Gautam, VK & Saha, R 2013, 'Hip fracture patients in India have vitamin D deficiency and secondary hyperparathyroidism', *Osteoporos Int*, vol. 24, pp. 553-557.
13. Khadgawat, R, Brar, KS, Gahlo, M, Yadav, CS, Malhotra, R, Guptat, N & Tandon, N 2010, 'High Prevalence of Vitamin D Deficiency in Asian Indian patients with fragility hip fracture: A pilot study', *JAPI*, vol. 58, pp. 539-542.
14. Khadgawat, R, Marwaha, RK, Garg, MK, Ramot, R, Oberoi, AK, Sreenivas, V, Gahlot, M, Mehan, N, Mathur, P & Gupta N 2013, 'Impact of vitamin D fortified milk supplementation on vitamin D status of healthy school children', *Osteoporos Int*, [Epub ahead of print].
15. Shatrugna, V, Kulkarni, B, Kumar, PA, Rani KU & Balakrishna, N 2005, 'Bone status of Indian women from a low-income group and its relationship to the nutritional status', *Osteoporos Int*, vol. 16, p. 1827.
16. Jha, R, Mithal, A, Malhotra, N & Brown, E 2010, 'Pilot case control investigation of risk factors for hip fractures in the urban Indian population', *BMC Musculoskelet Disord*, vol. 11, p. 49.
17. Harinarayan, CV, Ramalakshmi, T & Prasad, UV 2007, 'High Prevalence of low dietary calcium, high phytate consumption and vitamin D deficiency in healthy south indians', *Am J Clin Nutr*, vol. 85, pp. 1062-1067.
18. *Rural Population (% Of Total Population) In India*. 2013, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/india/rural-population-percent-of-total-population-wb-data.html>>.
19. Saigal, R, Mathur, V, Prashant, RK & Mittal, V 2006, 'Glucocorticoid induced osteoporosis', *Indian J Rheumatol*, vol. 1, no. 1, pp. 20-26.
20. Alekel, DL, Mortillaro, E, Hussain, EA, West, B, Ahmed, N, Peterson, CT, Werner, RK, Arjmandi, BH & Kukreja, SC 1999, 'Lifestyle and biologic contributors to proximal femur bone mineral density and hip axis length in two distinct ethnic groups of premenopausal women', *Osteoporos Int*, vol. 9, pp. 327-328.
21. Patil Sapna, S, Hasammis Ameya, A, Jena, SK, Rashid, AK & Narayan, KA 2010, 'Low Awareness of Osteoporosis Among Women Attending an Urban Health Centre in Mumbai, Western India', *Malaysian J Public Health Med*, vol. 10, no. 1, pp. 6-13.
22. Sankaran, B 2000, 'Clinical studies: Incidence of fracture neck of femur and intertrochanteric fractures in three Delhi hospitals', *New Delhi: South East Asia Regional Office, World Health Organization*, pp. 9-18.
23. Koh, LK, Saw, SM, Lee, JJ, Leong, KH & Lee, J 2001, 'Hip fracture Incidence rates in Singapore 1991-1998', *Osteoporos Int*, vol. 12, no. 4, pp. 311-318.
24. Dhanwal, DK, Siwach, R, Dixit, V, Mithal, A, Jameson, K & Cooper, C 2013, 'Incidence of hip fracture in Rohtak district, North India', *Arch Osteoporos*, vol. 8, pp. 135-139.
25. Tandon, N, Mithal, A, Anjana, RM, Pradeepa, R, Deepa, M, Mani, K & Mohan, V 2011, 'Population prevalence of fragility fractures in India based on a nationwide questionnaire based epidemiological study', *Abstract submitted in IOF regional-2nd Asia-Pacific Osteoporosis and Bone meeting to be conducted by ANZBMS and JSBMR*; September 4-8, 2011, Gold Coast Convention and Exhibition Center.
26. Marwaha, RK, Tandon, N, Gupta, Y, Bhadra, K, Narang, A, Mani, K, Mithal, A & Kukreja, S 2012, 'The prevalence of and risk factors for radiographic vertebral fractures in older Indian women and men: Delhi Vertebral Osteoporosis Study (DeVOS)', *Arch Osteoporos*, vol. 7, no. 1-2, pp. 201-207.
27. Krishnamurthy, V, Sharma, A, Aggarwal, A, Kumar, U, Amin, S, Rao, UR, Narsimulu, G, Handa, R, Mithal, A & Joshi, S 2011, 'Indian rheumatology association guidelines for management of glucocorticoid-induced osteoporosis', *Indian J Rheumatol*, vol. 6, no. 2, pp. 68-75.
28. Aggarwal, N, Raveendran, A, Khandelwal, N, Sen, RK, Thakur, RS, Dhaliwal, LK, Singla, V & Manoharan, SRR 2011, 'Prevalence and related risk factors of osteoporosis in peri- and postmenopausal Indian women', *J Midlife Health*, vol. 2, no. 2, pp. 81-85.
29. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>; Kanis, JA, data on file.



Indonesia

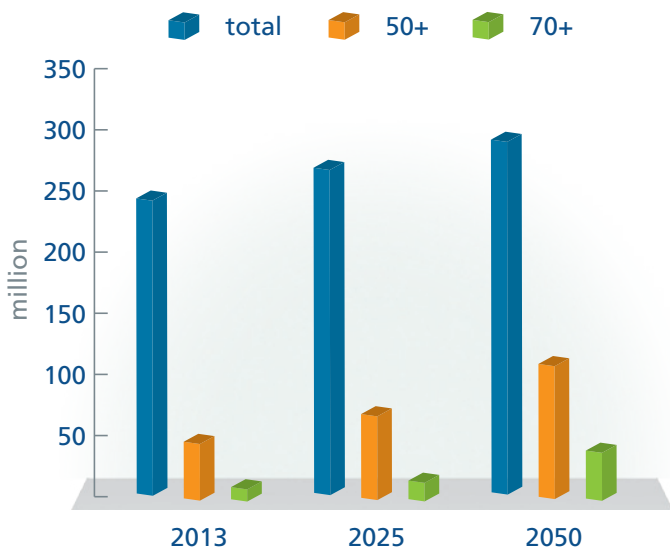
## CURRENT

Population **251 million**  
 Aged over 50 years **19%**  
 Life expectancy **72 years**  
 Hip fracture incidence per year **119/100,000**  
 Cost per hip fracture **5,000–9,000 USD**  
 Number of DXA per million population **< 0.1**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **300 million** ↑  
 Aged over 50 years **38%** ↑  
 Life expectancy **80 years** ↑

FIGURE 1 Population projection for Indonesia

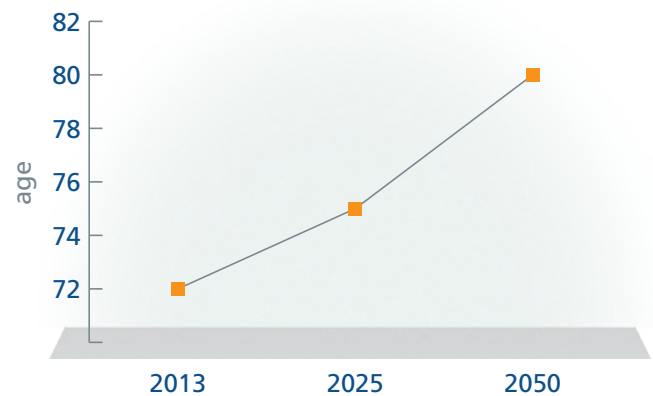


# INDONESIA

## COUNTRY OVERVIEW

The Indonesian population is expected to grow by 20% over the next four decades, from 251 million in 2013 to 300 million in 2050. Life expectancy is likely to reach age 80 years by 2050, an 11% increase from the current 72 years (Figure 1). The most dramatic increase is predicted to be in those aged over 50 and 70 years, with estimates showing that by 2050 the population in these age groups will grow by 135% to 113 million and by 294% to 40.8 million, respectively. By 2050, those at most risk for osteoporosis, i.e. men and women aged over 50 years, will make up over one-third of the total Indonesian population (Figure 2)<sup>1</sup>.

FIGURE 1 Life expectancy in Indonesia

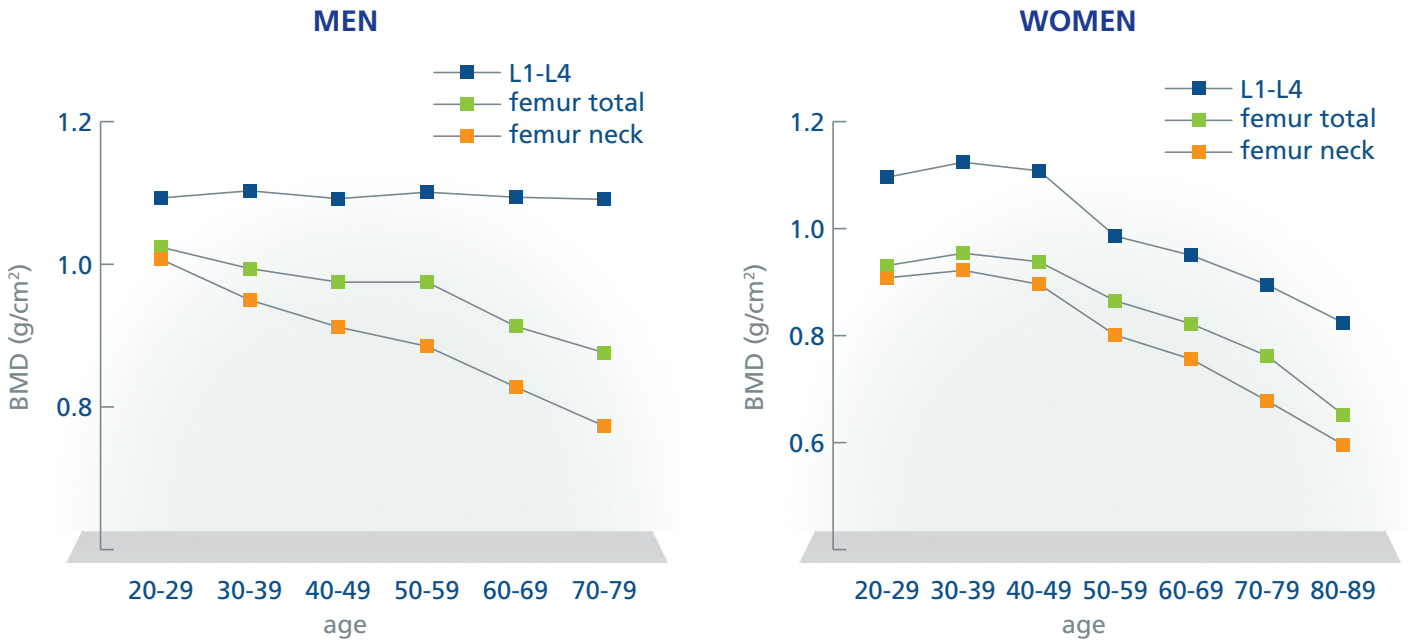


## State of osteoporosis/osteopenia

One of the few studies on bone mineral density (BMD) levels and osteoporosis prevalence (T score < -2.5) in the Indonesian population was conducted in 2006. Results found that the prevalence of osteoporosis in women aged between 50–80 years was 23% and between 70–80 years was 53%<sup>2</sup>. Prevalence of osteoporosis also increased in men, where BMD decreases of 10–20% between the ages of 20–39 years and 70–79 years were shown; however the risk for men was 4-times less than the risk for women<sup>2</sup>.



**FIGURE 3** Spine and femur BMD in Indonesian men and women



**SOURCE** Tirtarahardja Gunawan, Setyohadi Bambang, Zhou Weynand Q. Bone Mineral Density Reference Values for Indonesian Men and Women. ASBMR presentation slide. 2006.

The graphs shown in *Figure 3* and *Figure 4* were reported in a study by Tirtarahardja et al., ‘Bone Mineral Density Reference Values for Indonesian Men and Women,’ and demonstrate the decreasing BMD values and increasing osteoporosis prevalence in Indonesians as they age<sup>2</sup>.

### Lifestyle

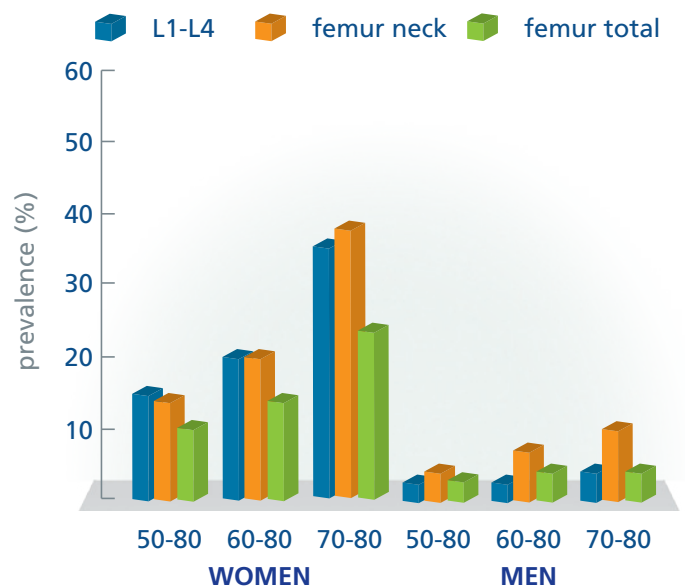
Of the 251 million people in Indonesia, slightly more than half (51%) of the people live in urban areas (*Figure 5*)<sup>3</sup>.

### Level of awareness

The Indonesian Healthy Bone Foundation, known as PERWATUSI, is a not-for-profit organization promoting awareness about osteoporosis throughout Indonesia. Established in 2002, the organization has grown to 26 branches throughout the country. Programmes promoted by PERWATUSI include:

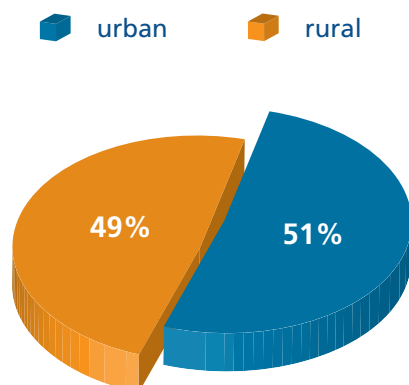
- Training of instructors in exercises for bone health
- Educating about prevention and rehabilitation
- Distributing materials and books on osteoporosis
- Conducting seminars and symposia for lay people
- Expanding reach throughout Indonesia through opening more branches

**FIGURE 4** Osteoporosis prevalence in Indonesian men and women



**SOURCE** Tirtarahardja Gunawan, Setyohadi Bambang, Zhou Weynand Q. Bone Mineral Density Reference Values for Indonesian Men and Women. ASBMR presentation slide. 2006.

**FIGURE 5** Urban versus rural population in Indonesia<sup>3</sup>



## FRACTURE RATES

### Hip fracture

The IOF hip fracture incidence map indicates Indonesian hip fracture rates of 119/100,000 per year in men and women<sup>4</sup>. Another study estimated that there were 38,618 hip fractures that occurred in 2010 with approximately half of those occurring in individuals with T-scores <-2.5 SD<sup>5</sup>. The large hospitals in the urban areas of Indonesia estimate that the average waiting time for surgery, after hip fracture, is about 1–2 days and approximately 75–90% are managed surgically. It is likely these figures are less favourable in the rural areas.

### Other fragility fractures

Data not provided.

### Vertebral fractures

Data not provided.

## COST OF FRACTURE

**TABLE 1** Hip fracture in Indonesia

	HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
Private	\$7,000–9,000	5–14	70%–90%
Public	\$3,000–5,000	11–16	

According to hospital data, costs of treating hip fractures vary between private and public hospitals. It costs approximately 1,000–2,000 USD less to receive treatment privately and patients spend less time in the hospital (*Table 1*).

## FRACTURE REGISTRIES

Fracture registries in Indonesia are organized at the hospital level in both the public and private sector, and each hospital is required to submit a fracture report to the Ministry of Health every three months. These reports include all types of fractures in patients of all ages. Approximately 43,000 hip fractures were reported in 2010 for men and women aged over 40 years (*Table 2*).

**TABLE 2** Hospital hip fracture registry in Indonesia, 2010 data

AGE (YEARS)	WOMEN	MEN
40-50	1736	1794
51-60	2925	2377
61-75	14,350	4352
75+	11,655	3813

## FRACTURE LIAISON SERVICES

There are currently no fracture liaison services in Indonesia.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

The primary care physicians (family doctors/general physicians/geriatricians/internists) are primarily responsible for managing osteoporosis patients in Indonesia and look after most of the patients with the disease. Speciality physicians also see osteoporosis patients and some receive special training as part of their medical curriculum including: orthopaedists, rheumatologists, endocrinologists and gynaecologists. Other physicians also take part in the management of osteoporosis including sports medicine specialists, nutritionists and clinical pharmacologists.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not officially a national health priority (NHP) in Indonesia. Some activity was seen in that osteoporosis was recognized by the Ministry of Health in 2006 as an NHP. However, since little action has been taken, osteoporosis was recently removed from the health priorities.

To promote the importance of osteoporosis at the government level, the ‘Indonesian Woman Leaders Roundtable’ was formed in 2005. This group of women pushes the government to include osteoporosis as a priority health problem; members include a senior journalist, a former minister, a former member of parliament, and other respected senior citizens.

### Guidelines

The guidelines ‘Panduan Penatalaksanaan Osteoporosis’ were published in 2010 by the Indonesian Osteoporosis Association (Perhimpunan Osteoporosis Indonesia: PEROSI).

### Audit and quality indicator systems

At present, there are no audit and quality indicator systems in place for osteoporosis treatment.

## TREATMENT

Access to health care in Indonesia can be challenging due to the geographical dispersion of the islands, the low ratio of health-care providers to population and the concentration of health-care services in the urban areas. Coverage for care is mostly private and reimbursement is limited to treatment, and thus does not include prevention. Currently, Indonesia is working toward providing universal health-care coverage, but is not quite there yet. Until then, just over half of the population have some form of health insurance leaving the other half with difficulties accessing and paying for medical services<sup>6</sup>.

When treating osteoporosis, bisphosphonates are designated as the first-line treatment but are not reimbursed. In the public sector, calcium supplements only are reimbursed at 100% and zoledronic acid is

reimbursed but only for the treatment of metastatic bone disease (*Table 3*).

## DIAGNOSTICS

Access to dual-energy X-ray absorptiometry (DXA) in Indonesia is limited especially since most machines are located in the cities and just under half of the population live in rural areas. It has been estimated that there are about 65 DXA instruments in Indonesia, which equates to less than 0.1 DXA instruments per million individuals<sup>7</sup>.

For those who can access DXA, the waiting time is generally 1 day and it costs approximately 54 USD. The lack of reimbursement is a barrier to access and so scans are generally limited to those who can afford private

**TABLE 3** Treatments available in Indonesia and reimbursement levels

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		
Alendronate	x		
Ibandronate	x		
Zoledronic acid	x		only for Metastatic Bone Disease
Clodronate	x		
Pamidronate	x		
Raloxifene	x		
Bazedoxifene		x	
Denosumab		x**	
Strontium Ranelate	x		
Teriparatide		x	
PTH (1-84)		x	
Vitamin D/Ca supplements	x		100%
Calcitonin	x		
Hormone Replacement Therapy	x		
Testosterone	x		
Alfacalcidol		x	
Calcitriol		x	

\*\*not available

insurance. Ultrasound is slightly more accessible with no waiting time or associated cost and is mainly offered in the commercial sector by pharmaceutical companies to promote their products (Table 4).

**TABLE 4** Diagnostics access and cost in Indonesia

	DXA	ULTRASOUND
Waiting time (d)	immediate	immediate
Cost (USD)	\$54	free
Is it reimbursed?	no	n/a
Is reimbursement a barrier to access to treatment?	yes	n/a

## RECOMMENDATIONS

As previously stated, by 2050 the Indonesian population aged over 50 years will have grown by 135% to 113 million and those aged over 70 years will have grown by 294% to 40.8 million (Figure 2). These age groups will account for over one-third of the total population with a lifespan averaging 80 years. These figures are a strong indication that Indonesia will feel the burden of osteoporosis in its ageing population. Some recommendations that may bring relief to the health system and comfort to the elderly with osteoporosis include:

- Utilizing the existing fracture registry for up-to-date analysis of the actual prevalence and incidence of fragility fractures to realize the true burden of osteoporosis.
- Promoting the implementation of fracture liaison services.
- Expanding the availability of DXA and osteoporosis health care providers to the more rural areas of the country.
- Encouraging the government to increase activities promoting osteoporosis care and treatment.

## REFERENCES

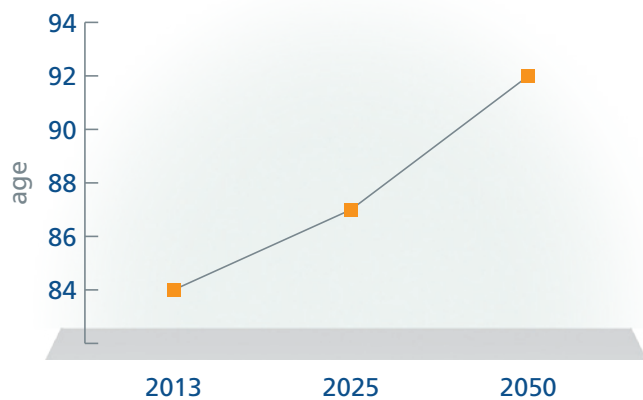
1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Tirtarahardja, G, Setyohadi, B, Weynand, LS & Zhou, Q 2006, 'ASBMR Lecture', *Bone Mineral Density Reference Values for Indonesian Men and Women*, American Society for Bone and Mineral Research Annual Meeting
3. *Rural population (% Of Total Population) in Indonesia 2013*, Trading Economics, viewed 05 September 2013, <<http://www.tradingeconomics.com/indonesia/rural-population-wb-data.html>>.
4. *Hip fracture incidence map*, International Osteoporosis Foundation, viewed 20 November 2013, <<http://www.iofbonehealth.org/facts-and-statistics/hip-fracture-incidence-map>>.
5. Odén, A, McCloskey, E, Johansson, H & Kanis, J 2013, 'Assessing the Impact of Osteoporosis on the Burden of Hip Fractures', *Calcif Tissue Int*, vol. 92, pp. 42–49.
6. Franken, J 2011, *The Jakarta Post: Oxford Business Group*, <<http://www.thejakartapost.com/news/2011/05/02/analysis-indonesia-the-health-nation.html>>.
7. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp/>>: Kanis, JA, data on file.

# JAPAN

## COUNTRY OVERVIEW

In 2013, the population of Japan was 127.2 million with an average life expectancy of 84 years, rising to 92 years by 2050 (Figure 1). The population is expected to decrease by approximately 16% between now and 2050, falling to 123.3 million in 2025 and 107.2 million in 2050 (Figure 2). Currently 45% of the population is aged over 50 years. However, with an ageing population, the proportion of those aged over 50 years will increase to 51% of the population in 2025, and 57% in 2050. The numbers are more striking when looking at the population aged over 70 years. As Figure 1 illustrates, in just over a decade, by 2025, 25% of the population will be aged over 70 years with an average life expectancy of 87 years. This will increase to 32% of the population aged over 70 years in 2050 at a time when the average life expectancy is estimated to be 92 years. Therefore, in 2050 not only will over half of the population be aged over 50 years, but close to one-third will be over the age of 70 years which presents Japan with a tremendous need to focus on the health of its elderly, including osteoporosis<sup>1</sup>.

**FIGURE 1** Life expectancy in Japan



## State of osteoporosis/osteopenia

It is estimated that 10% of Japan's population aged over 40 years are osteoporotic; with 3 million men



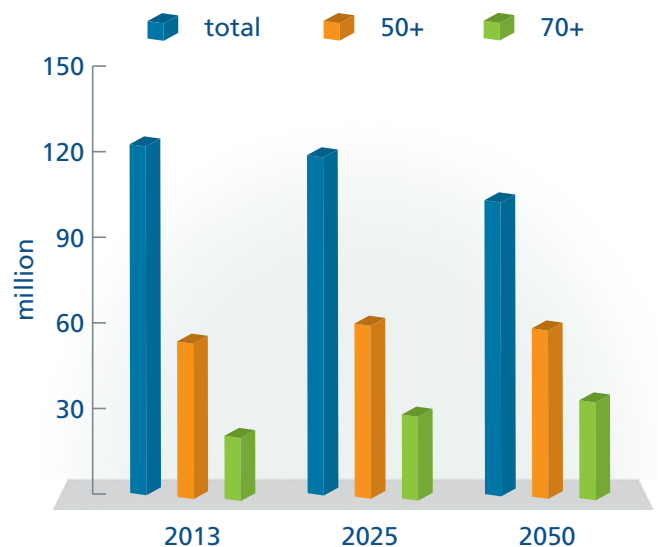
## CURRENT

Population **127.2 million**  
 Aged over 50 years **45%**  
 Life expectancy **84 years**  
 Hip fracture incidence per year **180/100,000** (women)  
 Cost per hip fracture **27,599 USD**  
 Number of DXA per million population **20.8**  
 Fracture liaison services **1–10% of hospitals**

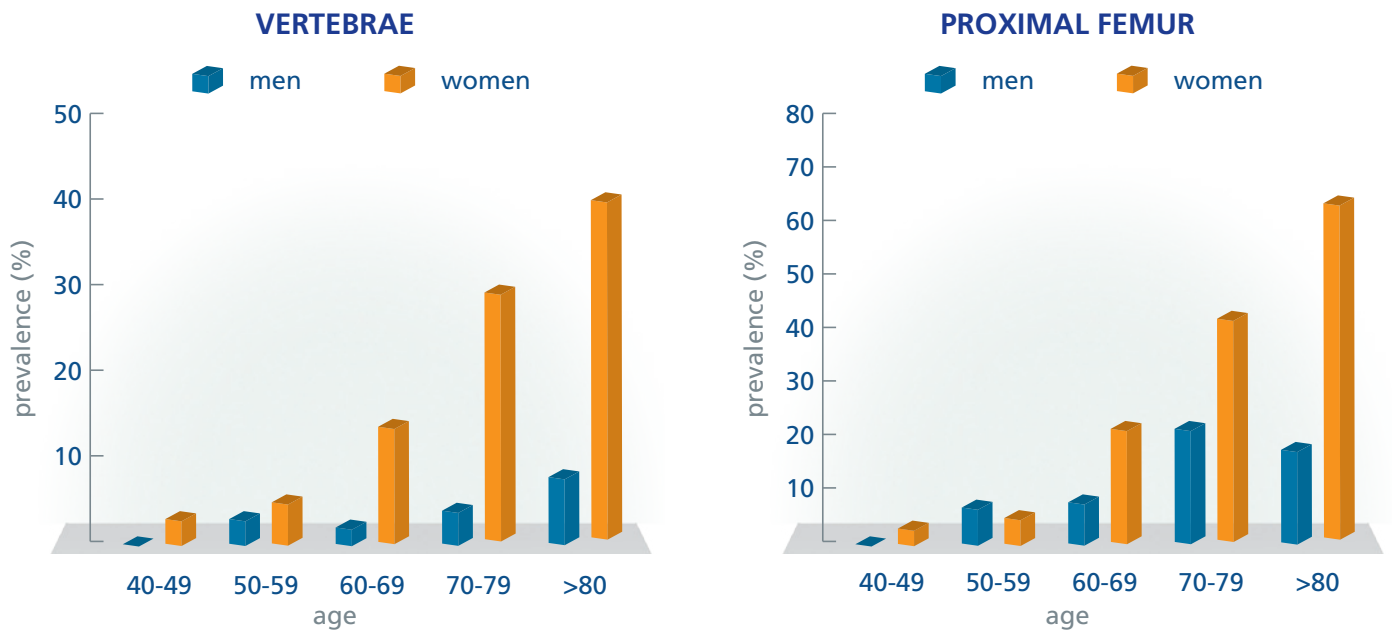
## PROJECTED 2050

Population **107.2 million** ↓  
 Aged over 50 years **51%** ↑  
 Life expectancy **92 years** ↑

**FIGURE 2** Population projection for Japan

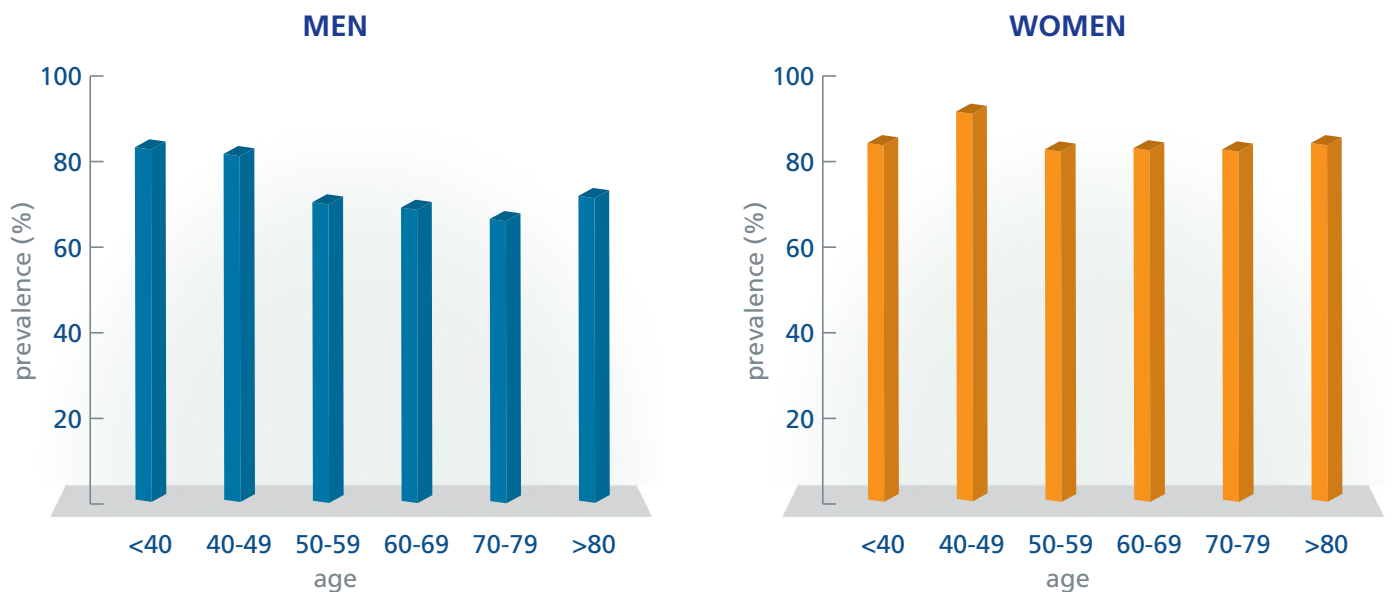


**FIGURE 3** Estimated prevalence of osteoporosis in Japan in vertebrae L 2–4 and proximal femur, 2005<sup>2</sup>



SOURCE Reproduced from Orimo H. et al. Japanese 2011 guidelines for prevention and treatment of osteoporosis-executive summary

**FIGURE 4** The number of individuals with vitamin D insufficiency and deficiency as classified by gender<sup>3</sup>



SOURCE Reproduced from Yoshimura N et al. Profiles of vitamin D insufficiency and deficiency in Japanese men and women: association with biological, environmental, and nutritional factors and coexisting disorders: the ROAD study.

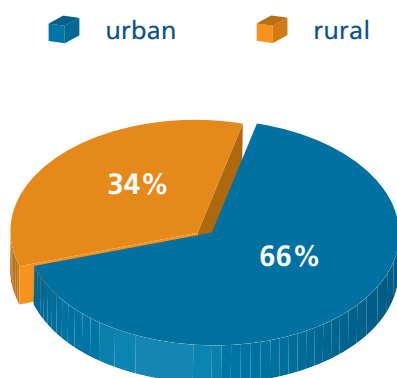
and 9.8 million women having the disease (Figure 3)<sup>2</sup>. Furthermore, based on spinal bone mineral density (BMD) data in men and women aged between 40 and 79 years, it is estimated that the annual incidence of osteoporosis is 0.6 % in men and 2.3 % in women<sup>2</sup>.

## Lifestyle

According to recent data from a large-scale population-based cohort study with more than 3,000 men and women in Japan, the prevalence of vitamin D insufficiency was 81.3% and deficiency was 1.2% (vitamin D deficiency and insufficiency were defined by serum 25D levels <10 ng/mL and between 10 and 30 ng/mL, respectively)<sup>3</sup> (Figure 4). Vitamin D deficiency was higher in women and was significantly associated with current smoking, lack of regular outdoor walking, higher parathyroid hormone (iPTH), and poor daily vitamin D intake. In another community-based study, the proportion of subjects who were vitamin D insufficient was 35.3% and deficient was 3.7%<sup>4</sup>.

There is evidence that the age-related incidence of hip fracture in Japan may be declining. Supporting this, some studies indicate a recent increase in BMD of older Japanese men and women<sup>5</sup>. Lifestyle changes that may have contributed to this increase could include an increase in body weight (which positively affects BMD) and increases in the use of osteoporosis drugs and exercise and falls programmes<sup>6</sup>. Additionally, the local habit of sleeping on a low futon may increase muscle strength and balance as it requires greater muscular effort to get in and out of bed daily<sup>6</sup>.

**FIGURE 5** Urban versus rural population in Japan<sup>7</sup>



An ageing population combined with people living “westernized” lifestyles, burdens Japan with osteoporosis. While age-specific hip fracture incidence may be declining, there are more osteoporosis and fracture patients because of the increase in those aged over 50 years and more people living in urban areas who experience less sunshine exposure (Figure 5). Furthermore, the consequences of osteoporosis are worsened by the elderly living longer and becoming more prone to falls, as well as a decrease in exercise secondary to a more sedentary, indoor lifestyle<sup>6</sup>.

## Level of awareness

In general, the Japanese have a high level of awareness about osteoporosis. Consistent with this notion, a fracture registry has been developed from which the incidence of hip fractures is derived every 5 years. Additionally, the Ministry of Health mandates that osteoporosis population screenings are conducted and has implemented nationwide educational programmes for falls prevention and exercise as they pertain to osteoporosis. Furthermore, physicians in Japan have a high level of awareness of osteoporosis. According to a survey of doctors specializing in orthopaedics, internal medicine, and obstetrics and gynaecology, the recognition rates of diagnostic criteria for osteoporosis in Japan were 61% in total and more than 90% by orthopaedists<sup>6</sup>.

## FRACTURE RATES

### Hip fracture

Recently reported hip fracture incidence in men and women aged over 39 years is 50/100,000 per year and 180/100,000 per year respectively<sup>6</sup>.

Since 1987, Japan has carried out a nationwide survey from which the incidence of hip fractures may be derived at the population level every 5 years. During the first 15-year period, it was found that the number of new hip fractures increased 2.2 fold (from 53,200 in 1987 to 117,900 in 2002). In general, although with an ageing population there is an overall increase in new patients experiencing hip fracture, in some age groups and regions the incidence of hip fracture may be declining. The exception is in Western Japan where in the Tottori region hip fracture incidence is higher and appears to be increasing<sup>5</sup>. Table 1 outlines the survey results in 5-year increments from 1987 to 2012, and projects hip fractures in 2020 and 2040.

According to a Committee of Japanese Societies, 95% of hip fractures in Japan are managed surgically, and the average waiting time for surgery is up to 3 days.

**TABLE 1 Hip fracture incidence and projections in Japan<sup>5</sup>**

YEAR	HIP FRACTURES	PER CENT CHANGE FROM PREVIOUS PERIOD
1987	53,200	
1992	76,600	44
1997	92,400	21
2002	117,900	28
2007	148,000	26
2012	190,000	28
2020	240,000	26
2040	320,000	33

### Other fragility fractures

Data not provided.

### Vertebral fractures

Vertebral fracture status is commonly assessed in clinical practice in Japan since Japanese guidelines recommend using X-rays to diagnose osteoporosis<sup>8</sup>. A 2007 study targeting a rural population in Japan revealed that the 10-year cumulative incidence of vertebral fractures for men and women in their sixties was 5.1% and 14%, respectively and 10.8% and 22.2% among men and women in their seventies, respectively<sup>2</sup>.

Other studies have found vertebral fractures to be more prevalent among Japanese women than Caucasian women, and have found that the increasing incidence of vertebral fractures in Japanese women is associated with increased mortality. Women with one vertebral deformity had a 1.3-fold greater risk of dying, and those with more than 3 vertebral deformities had an almost 4-fold greater risk of death. Studies following the Japanese women 10 years after fracture, found that the survival rate was 69% compared with 86% in those who did not fracture<sup>9</sup>.

### COST OF FRACTURE

Ninety-five per cent (95%) of hip fractures are treated surgically in Japan, and on average patients spend over a month (38.2 nights) in the hospital to undergo treatment. The average hospital costs for this treatment amounts to 27,599 USD per hip fracture (Table 2).

**TABLE 2 Cost of hip fracture in Japan**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	AVERAGE HOSPITAL BED DAYS
\$27,599	38.2	95%

According to Japan's fracture database, 190,000 hip fractures were registered in 2012, with 95% of those being surgically treated. From these figures we can derive that Japan is spending over 4.9 billion USD per year on hip fracture care – and this is just the hospital costs.

### FRACTURE REGISTRIES

Japan has both national and regional centralized databases to register hip fractures. The data are collected every 5 years and includes information on men and women over 40 years. In 2012 there were 190,000 hip fractures registered and a reported 95% were treated surgically.

### FRACTURE LIAISON SERVICES

Approximately 1–10% of hospitals in Japan have implemented a scheme to refer fracture patients, who are aged over 50 years, to a fracture liaison service.

### SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Mainly, it is the orthopaedic surgeons who are specifically trained and responsible for looking after osteoporosis patients in Japan. Other specialities that are also specifically trained for osteoporosis care include: gynaecologists, endocrinologists and internal medicine physicians. In some cases, patients may also be managed by their rheumatologist or general practitioner.

Additionally, osteoporosis is in itself a recognized medical speciality in some Japanese hospitals.



## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a national health priority in Japan. However, the Ministry of Health, Labour and Welfare does order that osteoporosis screenings, carried out by the National Health Promotion be conducted by the local city, town and village governments; 277,489 people were screened in 2011. Additionally, Japan has a national public health programme focusing on exercise and is revising its standards and guidelines to include the benefits of exercise on osteoporosis prevention and treatment<sup>6</sup>.

### Guidelines

The Japanese Guidelines for Prevention and Treatment of Osteoporosis were published in 2011 by the Japan Osteoporosis Society, the Japanese Society for Bone and Mineral Metabolism Research and the Japan Osteoporosis Foundation.

The guidelines specifically address population-based screening as well as fracture risk assessment and treatment focusing on prior fracture, age, BMD score, FRAX score and family history of fracture. In general, the guidelines are compatible with the reimbursement policies in Japan where typically 70% of costs are covered.

### Audit and quality indicator systems

Through its national hip fracture database, Japan has implemented audit and quality indicators for osteoporosis tracking and care. Currently, this is just applicable to hip fractures and it is updated every 5 years.

## TREATMENT (REIMBURSEMENT OF MEDICATION)

Approximately 90% of Japan's population has healthcare coverage whether it is through the National Health Insurance or the Employees Health Insurance. Typically, patients pay 30% of the costs and the health insurance covers the remaining 70%. Private insurance is available to cover the co-payments and



non-covered costs. Osteoporosis care and treatment is covered by health insurance, and the coverage provided to those aged over 75 years is even higher, covering 90% of costs.

Generally, while an authorization is not required for treatment to be reimbursed, there are conditions that may need to be met in order for some treatments to be covered. For example, teriparatides are only reimbursed if there is history of a prior fracture, and some other treatments are only reimbursed for patients with a BMD score  $T < -2.5SD$ .

**TABLE 3 Osteoporosis treatments and respective reimbursement in Japan**

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		70% (90% for ≥75 years)
Alendronate	x		70% (90% for ≥75 years)
Ibandronate	x		
Zoledronic acid		x	
Clodronate		x	
Pamidronate		x	
Raloxifene	x		70% (90% for ≥75 years)
Bazedoxifene	x		70% (90% for ≥75 years)
Denosumab	x		70% (90% for ≥75 years)
Strontium Ranelate		x	
Teriparatide	x		70% (90% for ≥75 years)
PTH (1-84)		x	
Vitamin D/Ca supplements	x (Ca)	x (D)	70% (90% for ≥75 years)
Calcitonin	x		70% (90% for ≥75 years)
Hormone Replacement Therapy	x		70% (90% for ≥75 years)
Testosterone		x	
Alfacalcidol	x		70% (90% for ≥75 years)
Calcitriol	x		70% (90% for ≥75 years)
Eldecalcitol	x		70% (90% for ≥75 years)
Vitamin K2	x		70% (90% for ≥75 years)
Minoronate	x		70% (90% for ≥75 years)
Ipriflavone	x		70% (90% for ≥75 years)
Nandrolone decanoate	x		70% (90% for ≥75 years)

Regarding first- and second-line treatment, a survey of physicians found that 43% of doctors prescribed bisphosphonates and 29% chose vitamin D<sup>3</sup> for patients over 65 years without existing fractures. For those patients with fractures, 55% of doctors chose bisphosphonates and 22% chose activated vitamin D<sup>6</sup>.

However, sometimes the conditions and reimbursement policies, at 70% in most cases, do interfere with what physicians would normally recommend to patients. *Table 3* shows the osteoporosis treatments and coverage available in Japan.

## DIAGNOSTICS

Both dual-energy X-ray absorptiometry (DXA) and ultrasound are used in Japan to diagnose osteoporosis and access to both is immediate. Both are reimbursed by health insurance at 70%, and costs are around 16–35 USD for DXA and 8.00 USD for ultrasound (*Table 4*).

**TABLE 4 Diagnostics access and cost in Japan**

	DXA	ULTRASOUND
Waiting time (d)	no wait	no wait
Cost (USD)	16-35	8
Is it reimbursed?	yes (70%)	yes (70%)
Is reimbursement a barrier to access to treatment?	no	no

According to data from 2008, Japanese health-care institutions had a DXA equipment density of 20.8 per one million of the general population<sup>10</sup>.

Population-based pre-screening is also available in Japan through FRAX, which has a model specifically calibrated for the Japanese population, and the Osteoporosis Screening Tool for Asians (OSTA) which has been validated in the Japanese population<sup>11</sup>.

## RECOMMENDATIONS

- Increase studies about the cost-effectiveness of osteoporosis treatment or fracture prevention. Currently, hip fracture epidemiology data (both

national-based and regional-based) is available; however, data analysing cost-effectiveness is limited.

- There has been a drastic increase in the number of fracture patients in the past 10 years in Japan. Appropriate treatment and prevention of hip fractures, including the treatment of osteoporosis and more effective interventions for preventing falls, need to be further discussed and addressed as these are important factors that will help reduce the burden of osteoporosis.
- Advocate to have osteoporosis become a national health priority by continuing to bring osteoporosis and its consequences to the attention of the government and Ministry of Health.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Orimo, H, Nakamura, T, Hosoi, T, Iki, M, Uenishi, K, Endo, N, Ohta, H, Shiraki, M, Sugimoto, T, Suzuki, T, Soen, S, Nishizawa, Y, Hagino, H, Fukunaga, M & Fujiwara, S 2012, 'Japanese 2011 guidelines for prevention and treatment of osteoporosis—executive summary', *Arch Osteoporos*, vol. 7, pp. 3-20.
3. Yoshimura, N, Muraki, S, Oka, H, Morita, M, Yamada, H, Tanaka, S, Kawaguchi, H, Nakamura, K & Akune, T 2013, 'Profiles of vitamin D insufficiency and deficiency in Japanese men and women: association with biological, environmental, and nutritional factors and coexisting disorders: the ROAD study', *Osteoporos Int*, [Epub ahead of print].
4. Nakamura, K, Tsugawa, N, Saito, T, Ishikawa, M, Tsuchiya, Y, Hyodo, K, Maruyama, K, Oshiki, R, Kobayashi, R, Nashimoto, M, Yoshihara, A, Ozaki, R, Okano, T & Yamamoto, M 2008, 'Vitamin D status, bone mass, and bone metabolism in home-dwelling postmenopausal Japanese women: Yokogoshi Study', *Bone*, vol. 42, pp. 271-277.
5. Hagino, H, Furukawa, K, Fujiwara, S, Okano, T, Katagiri, H, Yamamoto, K & Teshima, R 2009, 'Recent trends in the incidence and lifetime risk of hip fracture in Tottori, Japan', *Osteoporos Int*, vol. 20, pp. 543-548.
6. Orimo, H, Yaegashi, Y, Onoda, T, Fukushima, Y, Hosoi, T & Sakata, K 2009, 'Hip fracture incidence in Japan: estimates of new patients in 2007 and 20-year trends', *Arch Osteoporos*, vol. 4, pp. 71-77.
7. *Rural Population (% Of Total Population) In Japan 2013*, *Trading Economics*, viewed 01 September 2013, <<http://www.tradingeconomics.com/japan/rural-population-percent-of-total-population-wb-data.html>>.
8. Fujiwara, S, Hamaya, E, Goto, W, Masunari, N, Furukawa, K, Fukunaga, M, Nakamura, T, Miyauchi, A & Chen, P 2011, 'Vertebral fracture status and the World Health Organization risk factors for predicting osteoporotic fracture risk in Japan', *Bone*, vol. 49, pp. 520-525.
9. Ikeda, Y, Sudo, A, Yamada, T & Uchida, A 2010, 'Mortality after vertebral fractures in a Japanese population', *J Orthop Surg*, vol. 18, no. 2, pp. 148-52.
10. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>
11. Oh, SM, Nam, BH, Rhee, Y, Moon, SH, Kim, DY, Kang, DR & Kim, HC 2013, 'Development and validation of osteoporosis risk-assessment model for Korean postmenopausal women', *J Bone Miner Metab*, [Epub ahead of print]: Kanis, JA, data on file.



Malaysia

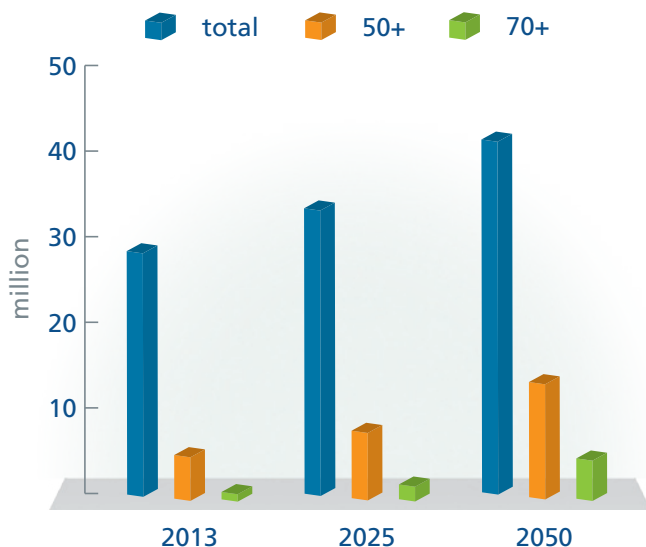
## CURRENT

Population **29.6 million**  
 Aged over 50 years **18%**  
 Life expectancy **74 years**  
 Hip fracture incidence per year **90/100,000**  
 Cost per hip fracture **6,000 USD**  
 Number of DXA per million population **2**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **42.9 million** ↑  
 Aged over 50 years **32%** ↑  
 Life expectancy **81 years** ↑

FIGURE 2 Population projection for Malaysia

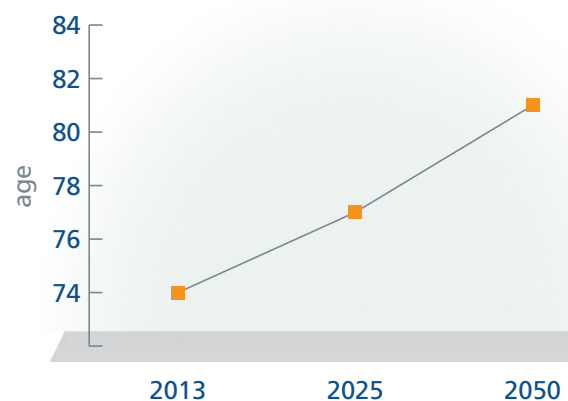


# MALAYSIA

## COUNTRY OVERVIEW

The proportion of the Malaysian population aged over 70 years is projected to increase by 417% over the next four decades, rising from 939,010 in 2013 to 4.8 million in 2050. Life expectancy will also be about seven-years longer than today, rising from 74 years to 81 years (Figure 1)<sup>1</sup>. Over the same period, the number of people aged over 50 years is projected to increase by 163% from 5.3 million to 13.9 million. While the overall population will also increase from 29.6 million in 2013 to 42.9 million in 2050, this 45% rise is small in comparison to the increase in the older age groups (Figure 2). By 2050, those aged over 50 years will account for approximately one-third of the total population. The increasing proportion of older people in this ageing population indicates that urgent action is required to tackle the projected burden of osteoporosis.

FIGURE 1 Life expectancy in Malaysia



## State of osteoporosis/osteopenia

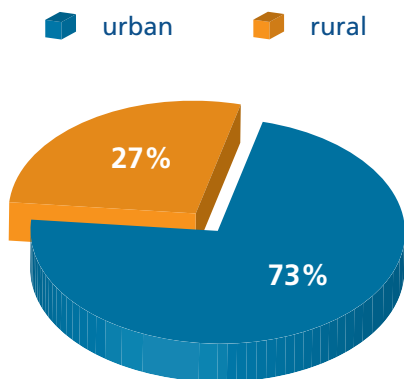
Osteoporosis remains under-diagnosed and under-treated in Malaysia and the prevalence is not well known or documented other than from the 1997 study on hip fractures which is discussed in more detail later.

## Lifestyle

Calcium intake remains low in Malaysia, with several surveys showing daily calcium intakes of below 500 mg daily, both in premenopausal and postmenopausal women<sup>2-4</sup>. Similarly, overall population levels of vitamin D remain in the insufficient range, with mean levels of 48 nmol/L<sup>5</sup>.

Vitamin D levels in Malaysia are suboptimal across most age groups. Studies have found that over 35% of Malaysian children are vitamin D deficient ( $\leq 37.5$  nmol/L)<sup>7</sup>. Among adults in Kuala Lumpur, a study showed that approximately 41% and 87% of males and females respectively were vitamin D insufficient ( $< 50$  nmol/L)<sup>6</sup>. Possible reasons for the insufficiency could be low dietary intake of vitamin D as well as the lack of fortification in foods. Additionally, there is lack of sun exposure because of the tendency to remain indoors during the day due to the hot and humid climate as well as the increase in urban living (Figure 3)<sup>7,8</sup>.

**FIGURE 3** Urban versus rural population in Malaysia<sup>7</sup>



## Level of awareness

One study found the level of awareness about osteoporosis among the general population in Malaysia to be fairly good. Responding to a questionnaire, 87.1% of people said they had heard of osteoporosis; 97.1% identified low calcium intake as a risk factor; and 75.8% knew postmenopausal status increased the risk of osteoporosis in women. In general, the study found increased knowledge in women who had more schooling and in those with a higher income. The main

sources from which they obtained information about osteoporosis appeared to be newspapers and magazines<sup>9</sup>.

## FRACTURE RATES

### Hip fracture

There remains a serious lack of osteoporotic fracture data in Malaysia underscoring the need for large-scale epidemiological fracture studies to be funded and conducted. The most reliable data are from analyses of hip fracture incidence for the years 1996 and 1997. The Malaysian Osteoporosis Society (MOS) is currently in the process of gathering new data on recent hip fracture incidence for the year 2012 and comparing it with the 1996 and 1997 data.

Hip fracture incidence in 1996–1997 in those aged over 50 years was 90 per 100,000 individuals per year, and has likely increased due to the ageing population (Table 1)<sup>10</sup>. The Chinese portion of the population had the highest incidence of hip fractures compared to the Malays and Indians, accounting for 44.8% of hip fractures in women. The inpatient hospital cost for hip fractures in 1997 was estimated to be 6.8 million USD (RM 22 million), and this is not counting rehabilitation or nursing home care costs. With an ageing population, hip fracture numbers and costs are expected to escalate<sup>11</sup>.

**TABLE 1** Hip fracture incidence by age group (per 100,000) in Malaysia<sup>10</sup>

AGE	MALE	FEMALE	OVERALL
50-54	10	10	10
55-59	20	30	20
60-64	40	50	40
65-69	60	100	80
70-74	100	230	170
75+	320	640	510

**SOURCE** Lee, J-K, Khir, ASM, 'The incidence of hip fracture in Malaysians above 50 years of age: variation in different ethnic groups'.

According to the MOS more than 90% of hip fractures in Malaysia are managed surgically. The time a patient

waits for surgery depends on whether the private or public system is used. In public hospitals, the average waiting time is between one to two weeks. In private hospitals access to surgery is much faster and takes place within a few days.

**Other fragility fractures**

Data not provided.

**Vertebral fractures**

Data not provided.

**COST OF FRACTURE**

Information provided by the MOS and the Osteoporosis Awareness Society of Kuala Lumpur estimates that the average hospital costs for a hip fracture event are approximately 6,000 USD, and in the public sector the

patient would be responsible for approximately half of this cost. In general, patients remain in hospital for about 7 days (Table 2).

**TABLE 2 Hip fracture in Malaysia**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$6,000	7	95%

**FRACTURE REGISTRIES**

Malaysia has a fracture registry organized at the national level collecting data on hip fractures for men and women of all ages. However, to date, data from the registry has not been officially released or published.



The hip fracture incidence for individuals aged above 50 years, for the years 1996 and 1997 was initiated by the MOS with the support and collaboration from private and government hospitals. The MOS is in the process of collecting similar data for the year 2012 and is optimistic about using the data to generate references for a Malaysia specific FRAX model.

## FRACTURE LIAISON SERVICES

Hospitals in Malaysia have not implemented fracture liaison services.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis in Malaysia is managed by both general practitioners and specialists from various specialties. Physicians such as endocrinologists and rheumatologists play an important role for the medical treatment of osteoporosis. However, orthopaedic surgeons play an active role both in fracture fixation and repair as well as medical treatment for osteoporosis. Orthopaedic surgeons are generally comfortable in initiating and monitoring medical treatment for osteoporosis. General practitioners refer patients with more complicated conditions or secondary osteoporosis to specialists.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not among the national health priorities in Malaysia although there was a meeting of the Ministry of Health officials in 2012 about the importance of osteoporosis.

Non-governmental organizations, however, do run regular programmes to increase awareness of osteoporosis. The MOS works with the medical community while the Osteoporosis Awareness Society Kuala Lumpur (OASKL) works with the general public.

Between the two organizations, the programmes offered include:

- Awareness and educational programmes for medical practitioners, Scientific Meeting and clinical practice guideline (CPG)

- “Healthy Bone for Life” campaign and awareness of bone health among the public

## Guidelines

In 2012, under the MOS an updated version of the Malaysian Clinical Guidance for the Management of Osteoporosis was completed and accepted by the Ministry of Health Malaysia as an approved Clinical Practice Guideline for Malaysia<sup>12,13</sup>. A summary of the guidance for postmenopausal osteoporosis was subsequently published as a journal article<sup>11</sup>. Since its launch in June 2012, the clinical guidance was disseminated to GPs and specialists through Continuing Medical Education (CME) programmes organized by the MOS throughout the country and in various towns.

Offering guidance for postmenopausal women, men and those with glucocorticoid-induced osteoporosis,

**TABLE 3 Osteoporosis treatments and respective reimbursement in Malaysia**

	YES	NO	IF YES, % REIMBURSED
Risedronate	private only		varies
Alendronate	x		100%
Ibandronate	x		100%
Zoledronic acid	private only		varies
Clodronate	private only		varies
Pamidronate	private only		varies
Raloxifene	private only		varies
Bazedoxifene		x	varies
Denosumab	private only		varies
Strontium Ranelate	x		100%
Teriparatide	private only		varies
PTH (1-84)		x	
Vitamin D/Ca supplements	x		100%
Calcitonin	private only		varies
Hormone Replacement Therapy	x		100%
Testosterone	x		100%
Alfacalcidol	x		100%
Calcitriol	x		100%

the guidelines address population-based screening, and fracture risk assessment and treatment.

### Audit and quality indicator systems

Audit and quality indicators are not currently available for osteoporosis treatment in Malaysia.

## TREATMENT (REIMBURSEMENT OF MEDICATION)

While a national health system is not in place, patients can choose to go to either a public or private hospital for treatment. If they go to a public hospital, a handful of osteoporosis treatments (Table 3) are offered and are reimbursed in full. Usually, prior authorization is required and only the senior doctors such as clinical specialists or consultants are allowed to prescribe osteoporosis drugs. If patients choose to go to a private hospital they can access a wider variety of treatments, which may be partially or fully covered depending on the private health insurance held by the patient. If the patient does not have private insurance, self-pay is an option in the private system.

## DIAGNOSTICS

There has been greater usage and accessibility of dual-energy X-ray absorptiometry (DXA) scanners over recent years, and currently throughout Malaysia there are about 100 DXA scanners<sup>11</sup> which represents an approximate DXA equipment density of 2.0 per million of the general population<sup>14</sup>. Access to a scan is usually immediate, and in the worst case waiting times are no longer than one week. If DXA is accessed in the public system there is no cost to the patient. If accessed in the private system,

**TABLE 4** Diagnostics access and cost in Malaysia

	DXA	ULTRASOUND
Waiting time (d)	up to 1 week	not used
Cost (USD)	<b>PUBLIC</b> \$0	not used
	<b>PRIVATE</b> \$40-\$100	
Is it reimbursed?	<b>PUBLIC</b> free	no
	<b>PRIVATE</b> not reimbursed	
Is reimbursement a barrier to access to treatment?	<b>PUBLIC</b> no <b>PRIVATE</b> possible	

costs run at approximately 40 USD per scan and there is no reimbursement in most of the health insurance plans (Table 4). Ultrasound is not used for the medical diagnosis of osteoporosis in the hospitals and therefore reimbursement is not offered. If ultrasound is used, it is mainly used for screening and increasing awareness among general public of all ages and sexes, by commercial entities during the health awareness campaigns.

## RECOMMENDATIONS

### Achievements

- Malaysian Osteoporosis Society – promote awareness and educational programmes for medical practitioners, together with scientific meetings and clinical practice guidelines (CPG).
- Osteoporosis Awareness Society of Kuala Lumpur – promote “Healthy Bone for Life” campaign and awareness of bone health among the public.
- Availability of diagnostic tools (about 100 DXA scanners in the whole country), screening tools to raise awareness among public (such as quantitative ultrasound).
- Availability of most of the treatment options (HRT, SERMs, Bisphosphonates, Strontium ranelate, Calcitonin, Teriparatide and Denosumab). Most of these agents are available in government hospitals and subsidized by the health-care system in Malaysia.
- Availability of Bone Turnover Markers (BTM) in private labs for the purpose of monitoring treatment efficacy and to decide on possibility of drug holiday.
- Availability of specialists, implants and fracture fixation systems to fix different types of osteoporosis fractures.
- Regular densitometry training courses organized for clinicians and technologists from the International Osteoporosis Foundation (IOF) and International Society for Clinical Densitometry (ISCD).

### Unmet Needs in Osteoporosis

- Lack of recognition of the importance of osteoporosis as a disease under the National Health Care System. Osteoporosis and bone health has not



been given priority compared to other diseases such as diabetes mellitus, hypertension, coronary heart disease, AIDs and others.

- Absence of a structured programme at the national level to promote healthy bones for all age groups (from an expectant mother, to young adult and even elderly) and a preventive programme for osteoporosis.
- Absence of epidemiological data on the incidence and prevalence of osteopenia and osteoporosis.
- Lack of epidemiological data on the incidence and prevalence of osteoporosis related vertebral and hip fractures. The most reliable data were the 1997 incidence of hip fracture among individuals above 50 years of age.
- Absence of reference database on bone mineral density of different ethnic groups in Malaysia.
- Absence of reference database on bone turnover markers of different ethnic groups in Malaysia.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Pon, LW, Noor-Aini, MY, Ong, FB, Adeed N, Seri, SS, Shamsuddin, K, Mohamed, AL, Hapizah, N, Mokhtar, A & Wan, HW 2006, 'Diet, nutritional knowledge and health status of urban middle-aged Malaysian women', *Asia Pac J Clin Nutr*, vol. 15, no. 3, pp. 388-399.
3. Chong, HC, Chee, SS, Goh, EM, Chow, SK & Yeap, SS 2007, 'Dietary calcium and bone mineral density in premenopausal women with systemic lupus erythematosus', *Clin Rheumatol*, vol. 26, no. 2, pp. 182-185.
4. Chee, WS, Suriah, AR, Zaitun, Y, Chan, SP, Yap, SL, Chan, YM 2002, 'Dietary calcium intake in postmenopausal Malaysian women: comparison between the food frequency questionnaire and three-day food records', *Asia Pac J Clin Nutr*, vol. 11, no. 2, pp. 142-146.
5. Green, TJ, Skeaff, CM, Rockell, JE, Venn, BJ, Lambert, A, Todd, J, Khor, GL, Loh, SP, Muslimatun, S, Agustina, R & Whiting, SJ 2008, 'Vitamin D status and its association with parathyroid hormone concentrations in women of child-bearing age living in Jakarta and Kuala Lumpur', *Eur J Clin Nutr*, vol. 62, no. 3, pp. 373-378.
6. Moy, FM & Bulgiba, A 2011, 'High prevalence of vitamin D insufficiency and its association with obesity and metabolic syndrome among Malay adults in Kuala Lumpur, Malaysia', *BMC Public Health*, vol. 11, p. 735.
7. Khor, G, Chee, W, Shariff, Z, Poh, B, Arumugam, M, Rahman, J & Theobald, H 2011, 'High prevalence of vitamin D insufficiency and its association with BMI-for-age among primary school children in Kuala Lumpur, Malaysia', *BMC Public Health*, vol. 11, p. 95.
8. *Rural Population (% Of Total Population) In Malaysia 2013*, *Trading Economics*, viewed 01 September 2013, <<http://www.tradingeconomics.com/japan/rural-population-percent-of-total-population-wb-data.html>>.
9. Yeap, SS, Goh, EM & Das Gupta, E 2010, 'Knowledge about osteoporosis in a Malaysian population', *Asia Pacific Journal of Public Health*, vol. 22, no. 2, pp. 233-241.
10. Lee, J-K, Khir, ASM 2007, 'The incidence of hip fracture in Malaysians above 50 years of age: variation in different ethnic groups', *Int J Rheum Dis*, vol. 10, no. 4, pp. 300-305.
11. Yeap, SS, Hew, FL, Lee, JK, Goh, EM, Chee, W, Mumtaz, M, Damodaran, P, Lim, HH & Chan, SP 2013, 'The Malaysian Clinical Guidance on the Management of Postmenopausal Osteoporosis, 2012: A Summary', *Int J Rheum Dis*, vol. 16, pp. 30-40.
12. Ministry of Health Malaysia 2013, Kementerian Kesihatan Malaysia, <<http://www.moh.gov.my>>.
13. Malaysian Osteoporosis Society 2013, Persatuan Osteoporosis Malaysia, <<http://www.osteoporosis.my>>.
14. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>: Kanis, JA, data on file.



New Zealand

## CURRENT

Population **4.3 million**  
 Aged over 50 years **32%**  
 Life expectancy **81 years**  
 Hip fracture incidence per year **218/100,000**  
 Cost per hip fracture **22,322 USD**  
 Number of DXA per million population **12**  
 Fracture liaison services **implementation in 2014**

## PROJECTED 2050

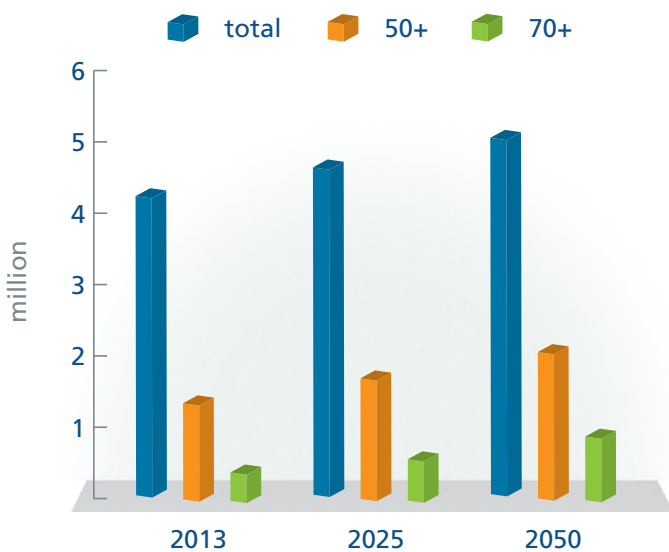
Population **5.1 million** ↑  
 Aged over 50 years **41%** ↑  
 Life expectancy **84 years** ↑

# NEW ZEALAND

## COUNTRY OVERVIEW

The New Zealand demography is experiencing a marked ageing of the population, but at an earlier stage and lower rate than in many other countries (with significant internal migration patterns). The current life expectancy is 81 years, and this is expected to increase to 84 years by 2050 (Figure 1). The total population is expected to increase 9% by 2025 and experience a further 9% increase by 2050 going from 4.3 million today to 5.1 million in 2050. However, the population aged over 50 years and 70 years is expected to increase at a higher rate. Those over 50 years make up 32% of the population today at 1.4 million, and there is a projected increase of 25% to 1.7 million in 2025 and another 21% increase to 2.1 million by 2050, by which time 41% of New Zealand's population will be aged over 50 years (Figure 2). The proportion of older persons in New Zealand is increasing at a higher rate than the rest of the population. Those aged over 70 years are projected to rise from 414,050 to 927,683 between now and 2050, which represents a 124% increase (Figure 2)<sup>1</sup>.

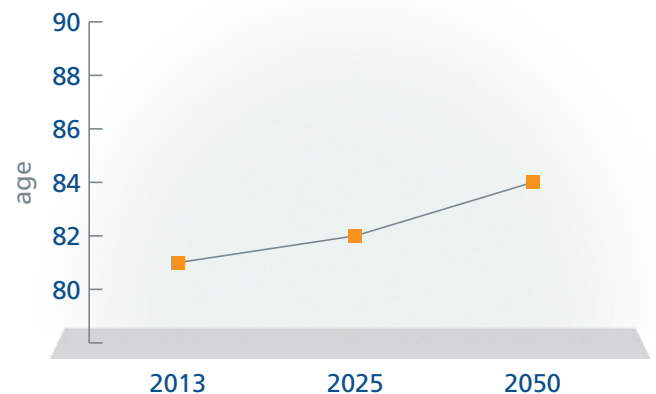
FIGURE 2 Population projection for New Zealand



## State of osteoporosis/osteopenia

According to Osteoporosis New Zealand, the nation's Maori and Pacific island populations have a low incidence of osteoporosis but with highly prioritized

FIGURE 1 Life expectancy in New Zealand



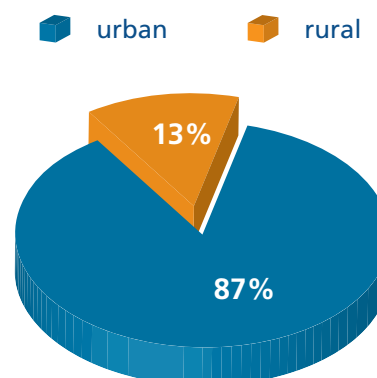
health needs in other areas. A report in the year 2007 estimated that approximately 70,000 people over 50 years were diagnosed with osteoporosis (Table 1), almost 90% of them being female. It is estimated that the actual prevalence of osteoporosis may be higher than reported due to several factors such as the high cost of dual-energy X-ray absorptiometry (DXA), low reimbursement, under-reporting of vertebral fractures and under-documentation of osteoporosis cases<sup>2</sup>.

Table 2 is reproduced from Osteoporosis New Zealand's, 'The Burden of Osteoporosis in New Zealand 2007–2020.' It details the estimated number of osteoporosis diagnoses taken from the New Zealand Health Survey in 2002–2003. The table shows the number of men and woman diagnosed with osteoporosis, by the occurrence of a fracture or by other means, and is arranged by age<sup>2</sup>.

### Lifestyle

The population of New Zealand living in urban areas is high, at 85% (Figure 3)<sup>3</sup>. The urban lifestyle contributes to osteoporosis risks with less sun exposure due to more time spent indoors and lower activity levels<sup>3</sup>. Access to sunlight and dairy produce is widespread but not always for those who have the highest risk for osteoporosis. Surveys still show that New Zealand shares the international propensity to vitamin D insufficiency and a low calcium intake in many sub-groups.

**FIGURE 3** Urban versus rural population in New Zealand<sup>5</sup>



The National Nutrition Survey conducted in New Zealand in 1997 found that milk and milk products were the main source of calcium intake in this country. This survey also found that 20% of the New Zealand population and one in four women did not have an adequate intake of calcium compared to the UK recommendations<sup>4</sup>. Overall, women showed higher prevalence of inadequate intake compared to men; especially for those aged 15–18 years, Maori and people living in low socioeconomic areas<sup>4</sup>. This means that these women will reach a lower peak bone mass and enter the high-risk menopausal period with weaker bones<sup>2</sup>.

**TABLE 1** Estimated number of men and women diagnosed with osteoporosis in New Zealand in 2007 (from New Zealand Health Survey 2002–2003)

		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	TOTAL
<b>DIAGNOSED BY FRACTURE</b>	Men	903	1046	9	1082	407	11	0	474	3932
	Women	467	1363	982	12	0	1255	1100	273	5452
	<b>Total</b>	<b>1370</b>	<b>2409</b>	<b>991</b>	<b>1094</b>	<b>407</b>	<b>1266</b>	<b>1100</b>	<b>747</b>	<b>9384</b>
<b>DIAGNOSED OTHER</b>	Men	1175	1100	3285	1458	2749	1907	1284	2498	15456
	Women	3662	5043	5269	5110	7472	6532	8159	4544	45791
	<b>Total</b>	<b>4837</b>	<b>6143</b>	<b>8554</b>	<b>6568</b>	<b>10221</b>	<b>8439</b>	<b>9443</b>	<b>7042</b>	<b>61247</b>
<b>DIAGNOSED</b>	Men	2078	2146	3294	2540	3156	1918	1284	2972	19388
	Women	4129	6406	6251	5122	7472	7787	9259	4817	51243
	<b>Total</b>	<b>6207</b>	<b>8552</b>	<b>9545</b>	<b>7662</b>	<b>10628</b>	<b>9705</b>	<b>10543</b>	<b>7789</b>	<b>70631</b>

SOURCE Osteoporosis New Zealand, Inc., 'The Burden of Osteoporosis in New Zealand: 2007–2020'

## Level of awareness

Awareness about osteoporosis in New Zealand has improved significantly, and so has the knowledge that there is a gap in care leaving fragility fracture patients vulnerable. The statistics from recent studies, as detailed later, have prompted New Zealand to improve osteoporosis care by taking measures to implement fracture registries and fracture liaison services (FLS) to help close this care gap.

As reported in Osteoporosis New Zealand’s, ‘Bone Care 2020: a systematic approach to hip fracture care and prevention for New Zealand,’ findings from eight New Zealand orthopedic units about osteoporosis interventions for patients admitted with fragility fractures highlighted the need to increase awareness about the care gap in osteoporosis management<sup>5</sup>:

- Less than half of inpatients with fragility fractures were taking a bisphosphonate.
- Of 77% of inpatients who were not taking osteoporosis medication on admission, less than 3% had a DXA scan organized in response to their new fracture.
- Just 12% of patients were initiated on treatment, of which the majority was started by a visiting Orthogeriatrician Service which was available at two

of the hospitals; nearly all of these patients were hip fracture sufferers.

- Just 11% of patients were started on medication during their admission.
- Osteoporosis was mentioned in the discharge summaries for only 30% of the patients that were already taking osteoporosis treatment.

## FRACTURE RATES

### Hip fracture, fragility fractures and vertebral fractures

The 2007-2020 burden of osteoporosis report in New Zealand indicated hip fracture rates to be 218/100,000 per year (288/100,000 per year in women and 140/100,000 per year in men)<sup>2</sup>. The same report estimated 84,354 fragility fractures in 2007<sup>2</sup>. Vertebral fractures were the most common at 33% of all fractures, followed by rib (25%) and forearm (14%) and finally, hip at just 5% (Table 2). Of all fractures, women suffered the most at 60%<sup>2</sup>. The same report projected the fracture increase between 2013 and 2020 and estimated fragility fractures will increase over 30% to approximately 115,914 fractures in 2030. These fracture rates due to osteoporosis are comparable with those identified elsewhere, including Australia, the USA and Europe<sup>2</sup>.

**TABLE 2 Total projected osteoporotic fractures in 2007, 2013 and 2020**

		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	TOTAL
2007	Hip	46	87	107	171	274	555	890	1673	3803
	Vertebra	2552	1890	2258	2209	3319	4569	4309	6889	27994
	Other	4572	6678	3512	4775	4384	6212	8266	14157	52556
	<b>Total</b>	<b>7170</b>	<b>8654</b>	<b>5877</b>	<b>7155</b>	<b>7977</b>	<b>11336</b>	<b>13465</b>	<b>22720</b>	<b>84354</b>
2013	Hip	54	94	128	212	338	574	965	2170	4585
	Vertebra	2970	2052	2708	2735	4101	4720	4702	8976	32965
	Other	5345	7222	4214	5922	5419	6412	9056	18410	61999
	<b>Total</b>	<b>8369</b>	<b>9368</b>	<b>7051</b>	<b>8869</b>	<b>9858</b>	<b>11706</b>	<b>14722</b>	<b>29556</b>	<b>99500</b>
2020	Hip	57	105	147	235	429	715	1070	2591	5350
	Vertebra	2676	2253	2985	3034	5177	5885	5317	10917	38244
	Other	5030	7965	4818	6598	7031	8169	10329	22381	72321
	<b>Total</b>	<b>7763</b>	<b>10324</b>	<b>7950</b>	<b>9866</b>	<b>12637</b>	<b>14769</b>	<b>16715</b>	<b>35889</b>	<b>115914</b>

SOURCE Osteoporosis New Zealand, Inc., ‘The Burden of Osteoporosis in New Zealand: 2007–2020’

## COST OF FRACTURE

Osteoporosis New Zealand used the figures given in *Table 2* to estimate total costs of fracture for the year 2007. From the estimated 84,954 fragility fractures that occurred in 2007, the cost of treating the fractures is estimated to have exceeded 248 million USD (300 million NZD), with another 27.3 million USD (33 million NZD) spent on management of osteoporosis and over 662 million USD (800 million NZD) to treat and manage secondary illnesses related to osteoporosis. If nothing is done, these numbers are expected to increase significantly by 2013 and 2020<sup>2</sup>.

It is reported that over 90% of hip fractures in New Zealand are managed surgically, each costing approximately 12,336 USD (14,937 NZD) for the hospital visit and 9,986 USD (12,062 NZD) for the rehabilitation<sup>2</sup>. The wait time to receive surgery varies by the hospital and the clinical status of the patient.

Every effort is made to access surgery immediately, but in reality it takes about 2–3 days before most patients are actually in the operating room (*Table 3*). Records are kept as quality markers and are frequently aligned with clinical pathways. Improvements will be seen in this process when the new hip fracture registry, the ‘Australia and New Zealand Hip Fracture Registry’, is in place.

**TABLE 3 Hip fracture in New Zealand**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
<b>Hospital</b> \$12,336	13.9	>90%
<b>Rehab</b> \$9,986	22	



## FRACTURE REGISTRIES

New Zealand has made significant progress towards developing a national hip fracture registry in association with Australian counterparts, but it is not yet in place in New Zealand and sustainable resourcing remains to be confirmed.

The website that will host the hip fracture registry, called the Australia and New Zealand Hip Fracture Registry, is live at [www.anzhfr.org](http://www.anzhfr.org). The lead agency for New Zealand is the Health Quality & Safety Commission who is viewing this project as a quality of care framework. A steering group is active with support from collaborative organizations.

## FRACTURE LIAISON SERVICES

FLS will be implemented in all District Health Boards by July 2014 through a national planning directive. It is hoped the resourcing for the Hip Fracture Registry will be resolved in parallel with this.

The implementation and outcome of FLS as well as hip fracture registries in other countries, notably the UK, has been influential. As a small country, New Zealand has had the opportunity to benefit from this well-documented experience and knowledge and as a result should be able to implement FLS in a shorter period of time. In this respect New Zealand has been fortunate to have a leading exponent of these initiatives immigrate to New Zealand and become a resource of strength to the country and to Osteoporosis New Zealand as an organization. New Zealand also has well respected researchers in bone physiology, metabolism and clinical treatments who make a big impact internationally and keep the osteoporosis community well informed.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis care is primarily managed by the general practitioners (i.e. family doctors, primary care physicians). Geriatricians, along with endocrinologists and rheumatologists, form the majority of the secondary specialists involved, and some of these clinicians also provide DXA scanning services.

Speciality training for osteoporosis care is a major component in the medical curriculum mainly for internal medicine, geriatric medicine, rheumatology,

endocrinology and orthopaedic surgery. Other specialists, however, are also free to follow a path of osteoporosis management if their personal interest lies in the management of this disease.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a designated national health priority in New Zealand. According to the National Health Board, the health priorities in New Zealand focus on improving the infrastructure of the care system as a whole. While not specifically directed at osteoporosis, the priorities will likely have an indirect benefit on the field through improvements to health-care infrastructure as a whole. The four key priority areas include<sup>6</sup>:

- Strengthening the health workforce
- Improving hospital productivity
- Speeding up the implementation of the Primary Health Care Strategy
- Improving value for money

### Guidelines

New Zealand does not have formal guidelines on osteoporosis care that have been rolled out on a national level. Specialized practitioners are familiar with and rely on guidelines from demographically similar countries. On a regional level, some groups have developed their own local clinical guidance on osteoporosis care, and such documents are available from the Auckland Bone Group and other special interest groups in Christchurch.

### Audit and quality indicator systems

Formal audit and quality indicator systems for osteoporosis are underway and will become formalized with the implementation of the Australia and New Zealand Hip Fracture Registry. In the meantime, the Health Round Table benchmarking can be used for audit and quality purposes on the national level and on the regional level there are various reporting and audit systems that include falls reports, clinical pathways, quality projects and initiatives, local osteoporosis and falls clinics and community services.

## TREATMENT

For osteoporosis care, treatment is often reimbursed through the national health service; however, the overall picture is complex. The reimbursement levels are determined by the Pharmaceutical Management Agency (PHARMAC) who, on behalf of the District Health Boards, decides which medicines and related products are subsidized for use in the community and public hospitals (<http://www.pharmac.health.nz/>)<sup>7</sup>. Some

major treatments are only funded under certain criteria. Not all available medications are registered for and/or supported as best practice for osteoporosis treatment. Medications generally carry a small cost 4.16 USD (\$5 NZD) which varies according to a range of subsidy arrangements (*Table 4*).

Access to osteoporosis medications in New Zealand has generally been restricted and delayed, and there are not any formalized ‘first-line’ treatments. This is less marked than in previous years but, for example, denosumab is still not funded and its designation is not formalized. Additionally, zoledronate is funded under tight criteria, and the administration (by infusion) of zoledronic acid is not funded which creates an access issue due to the high cost of administration that must be borne by the patient. On a positive note, New Zealand is a small country and there is a body of interested clinicians who are generally well linked, informed and active in the policies surrounding osteoporosis management.

## DIAGNOSTICS

In New Zealand there are 12 DXA scanners per one million of the population<sup>8</sup>. They cost approximately 100–134 USD per scan and have relatively reasonable wait times ranging from a number of days in the private sector to a few weeks in the public sector (*Table 5*). However, DXA is not reimbursed which creates a barrier to access as the patients must pay directly. Due to this, in the public sector especially, DXA scans have variable to

**TABLE 4** Osteoporosis treatments and respective reimbursement in New Zealand

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Alendronate	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Ibandronate		x	
Zoledronic acid	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Clodronate		x	
Pamidronate	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Raloxifene	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Bazedoxifene		x	
Denosumab		x	
Strontium Ranelate		x	
Teriparatide	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
PTH (1-84)		x	
Vitamin D/Ca supplements	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Calcitonin	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Hormone Replacement Therapy	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Testosterone	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Alfacalcidol	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)
Calcitriol	x		Patient is responsible for a co-pay of USD 4.16 (NZD 5)

**TABLE 5** Diagnostics access and cost in New Zealand

	DXA	ULTRASOUND
Waiting time (d)	Usually a short number of days privately, maybe weeks publically – if available	not used
Cost (USD)	\$100–134 (NZD 75–100)	
Is it reimbursed?	no	
Is reimbursement a barrier to access to treatment?	yes	

very poor usage despite being frequently required as a prerequisite to access funded medication. As an example, one study found that less than 3% of patients with a new fragility fracture had a DXA scan organized<sup>5</sup>.

## RECOMMENDATIONS

Osteoporosis remains an under-appreciated, undervalued, under-treated and under-resourced disorder of high prevalence. As a chronic disorder affecting predominantly older people, it has traditionally had a low national priority and low organizational support. The consequences of population ageing and associated health and disability costs are slowly drawing attention to fracture prevention through osteoporosis and falls prevention. These two contributors have recently been linked more closely in initiatives and this has been reflected in the direction of Osteoporosis New Zealand as an organization. The move from QUALYs to DALYs, as disability rather than premature mortality drives health systems, has been slow to impact at national level.

Thus fracture liaison services, a hip fracture registry, a national priority for fracture prevention, and improved access to DXA scans are all critical moves needing final national commitment if New Zealand is not to fall behind. This deficit does not align with the perceived quality of the rest of the New Zealand Health System. Lifestyle aspects fit well with other health directions and can be leveraged against the New Zealand culture. These developments will drive the associated missing data collections, national guidelines and standards that are needed for review and audit to obtain quality.

Despite the above need and opportunity, New Zealand is currently lagging behind international developments in fracture prevention and the associated 'bone health' infrastructure. The next 2 years are likely to be critical. The advocacy and evidence are there; national commitment, national training, and perception change for an increased prioritization will hopefully be the drivers. The potential exists for New Zealand to come from behind and be one of the leading health systems for the prevention of fragility fractures.

## REFERENCES

1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Brown, P, McNeill, R, Radwan, E & Willingale, J 2007, 'The Burden of Osteoporosis in New Zealand 2007-2020', *Osteoporos New Zealand*, Inc.
3. *Rural population (% Of Total Population) in New Zealand 2013*, *Trading Economics*, viewed 07 October 2013, <<http://www.tradingeconomics.com/new-zealand/rural-population-wb-data.html>>.
4. Horwath, C, Parnell, WR, Wilson, NC & Russell, DG 2001, 'Attaining optimal bone status: lessons from the 1997 National Nutrition Survey', *The New Zealand Medical Journal*, vol. 114, no. 1128, pp. 138-140.
5. Osteoporosis New Zealand 2012, *Bone Care 2020: a systematic approach to hip fracture care and prevention for New Zealand*.
6. *Health Priorities 2012*, Ministry of Health – Manatū Hauora, viewed 06 October 2013. <<http://www.nationalhealthboard.govt.nz/our-priorities/health-priorities>>.
7. *About PHARMAC 2013*, PHARMAC pharmaceutical Management Agency, viewed 06 October 2013. <<http://www.pharmac.health.nz/>>.
8. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat*, *World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>; Kanis, JA, data on file.

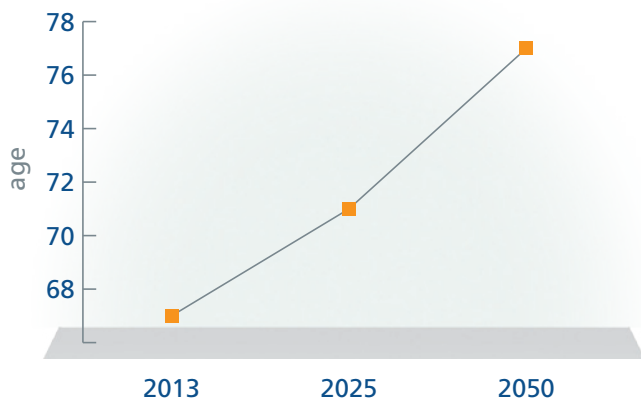


# PAKISTAN

## COUNTRY OVERVIEW

The population of Pakistan was 193.2 million in 2013 with an average life expectancy of 67 years (Figure 1). This number is expected to increase by approximately 51% between 2013 and 2050, rising to 228.3 million in 2025 and 290.8 million in 2050 (Figure 2). With an increasingly ageing population, the numbers are projected to rise much more rapidly in the over fifties age group. In just over a decade, by 2025, those aged over 50 years will increase by 50% (from 24.8 million to 37.3 million) and increase again by 134% to 87.2 million by 2050. As shown in Figure 1, in 2050, 30% of the population will be over the age of 50 years and living to an average age of 77 years (compared with today where 13% are aged over 50 years and living to 67 years)<sup>1</sup>. This is a steep growth curve occurring – in just a few decades – in the population most vulnerable to osteoporosis and this presents Pakistan with a tremendous challenge as well as an opportunity to care for its elderly.

**FIGURE 1** Life expectancy in Pakistan



## State of osteoporosis/osteopenia

Osteoporosis-related bone fractures are a significant public health problem in Pakistan. The prevalence of osteoporosis in Pakistan is high, as observed in several



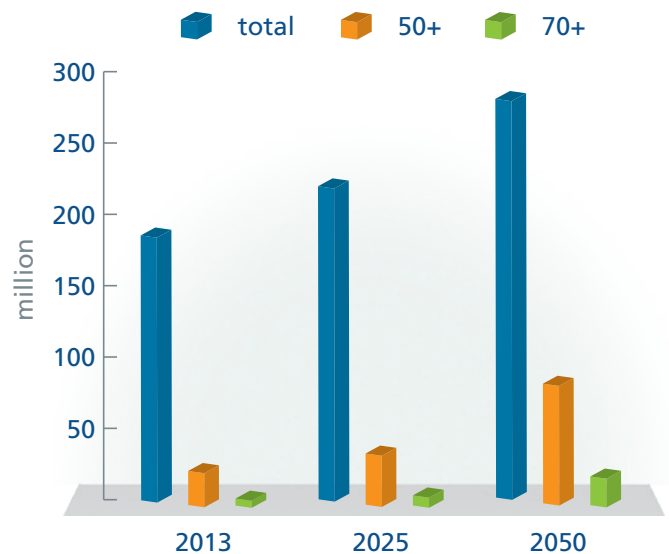
## CURRENT

Population **193.2 million**  
 Aged over 50 years **13%**  
 Life expectancy **67 years**  
 Hip fracture incidence per year **no data**  
 Cost per hip fracture **1,200–2,400 USD**  
 Number of DXA per million population **< 0.1**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **290.8 million** ↑  
 Aged over 50 years **30%** ↑  
 Life expectancy **77 years** ↑

**FIGURE 2** Population projection for Pakistan



studies measuring bone mineral density (BMD) using ultrasound. One study of 140 postmenopausal women found that 42% had osteopenia (T-score between -1 and -2.4) and 29% had osteoporosis (T-score below -2.5)<sup>5</sup>. Another study of 334 women over the age of 20 years found that 43.4% had osteopenia (BMD 0.46 g/cm<sup>2</sup>) and 12.9% were osteoporotic (BMD 0.33 g/cm<sup>2</sup>)<sup>2</sup>.

Additionally, studies have reported a high prevalence of osteopenia in young women. A study in Karachi found low BMD levels (T score < - 1.0 and > - 2.5) in 64% of women aged less than 30 years, in 55% of women aged between 31–45 years, and in 73.9% of women aged over 45<sup>3</sup>. Left untreated, these young women with poor bone health in 2013 may well become part of the osteoporotic burden in the years to come.

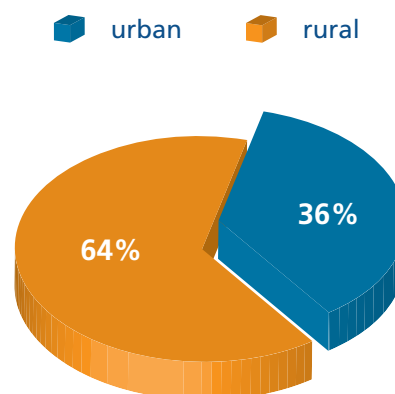
### Lifestyle

As mentioned above, cases of osteopenia have been observed in younger and premenopausal Pakistani women, who are likely to be at greater risk of developing osteoporosis in later life<sup>4</sup>. There are various factors that may contribute to this, including poor nutrition, and low vitamin D and exercise levels.

Nutritionally, as is common around the world, the modern trends towards consumption of fast food and carbonated beverages, both of which are energy dense but nutrient poor, is present in Pakistan, with calcium consumption being particularly low<sup>4</sup>. One study found that the mean calcium intake in Pakistan was 346 mg/d, which is less than 50% of the daily intake recommended by the World Health Organization (WHO)<sup>5</sup>.

With regard to vitamin D, numerous studies found widespread deficiency. A study in Karachi observed that 82.8% of premenopausal women were vitamin D deficient (<20 ng/mL)<sup>6</sup>. In another study, 90.1% of the younger women were vitamin D deficient (<50 nmol/L)<sup>7</sup>. Increasingly, Vitamin D deficiency appears more common in younger than older women suggesting that peak bone mass may not be achieved, predisposing to osteoporosis later in life<sup>7</sup>. Although Pakistan is sunny, conservative dress and air pollution in the urban areas may be factors that limit sun exposure and therefore vitamin D absorption (*Figure 3*)<sup>6,8,9</sup>. Finally, Pakistan does not have a mandatory vitamin D fortification policy in place limiting the opportunity to boost levels through diet<sup>4</sup>.

**FIGURE 3** Urban versus rural population in Pakistan<sup>9</sup>



Exercise levels have been shown to be low in Pakistan and sedentary living is high which could be due to greater hours spent indoors with computers and watching television<sup>4</sup>. The elderly in Pakistan also lead a mainly sedentary lifestyle. The lack of exercise and physical activity may play a significant role in low bone mass, immobility disorders, loss of muscle mass and falls, all of which contribute to osteoporosis and related fractures<sup>10</sup>.

### Level of awareness

An article in the *Indian Journal of Endocrinology and Metabolism*, described some health challenges in Pakistan, including inadequate knowledge of the prevalence and causes of many common diseases, including osteoporosis. This is evident from the lack of guidelines and standards as well as the low number of physicians specializing in osteoporosis prevention, diagnosis and treatment. Additionally, fracture data are not widely available which inhibits the understanding of the magnitude of the disease<sup>11</sup>.

The low awareness levels are not unique to the medical community. Some social studies have found that knowledge of osteoporosis in younger women is usually very poor compared to older females<sup>12</sup>. This is a concern since the younger women in Pakistan already display risk factors for poor bone health and vitamin D deficiency.

### FRACTURE RATES

#### Hip fracture

Fracture data are lacking in Pakistan and accurate numbers are not available.

### Other fragility fractures

Data not provided.

### Vertebral fractures

Data not provided.

### COST OF FRACTURE

The Pakistan Society for the Rehabilitation of the Disabled (PSRD), a leading provider of orthopaedic, medical and surgical health care and rehabilitation, estimates that 50–75% of hip fracture cases are treated surgically in the urban areas, and the average waiting time for surgery is 2–3 days once the patient has entered the tertiary health care system, which may be altered depending on the age and health of the patient. Costs for hip fracture treatment are approximately 1,200 USD if a dynamic hip screw (DHS) surgery is done and 2,400 USD if a total hip replacement is done (*Table 1*). These figures are estimated to be less favourable in the rural

areas since there is reduced access to health facilities and less awareness of osteoporosis outside of the cities.

**TABLE 1** Costs of hip fracture

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$1200–2400	4–6	50–75%

### FRACTURE REGISTRIES

Pakistan does not currently have fracture registries.

### FRACTURE LIAISON SERVICES

Fracture liaison services are generally not available; however the PSRD is aware of certain consultants who,



on an individual basis, may be coordinating fracture care for their patients.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis in Pakistan is primarily managed by primary care physicians (GPs, family doctors) and orthopaedic surgeons. Other physicians who are responsible for osteoporosis patients are: rheumatologists, gynaecologists and rehabilitation medicine physicians. However, these physicians are not specifically trained in osteoporosis since it is not a recognized component of medical training in Pakistan.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a national health priority in Pakistan at present and currently there are no clinical guidelines regarding this public health problem. There are many reasons for this. Traditionally in Pakistan, osteoporosis has primarily been considered a natural consequence of ageing, and in a country where the life expectancy at birth is only 67 years and only 6.4% of the population is aged over 60 years, it naturally has not figured high on the list of priorities<sup>13</sup>. Additionally, the country's financial resources are limited. The total expenditure on health in 2011 was 2.5% of gross domestic product (GDP) of which the government expenditure was only 27% of total expenditure<sup>13</sup>. This is not at all sufficient to meet the growing health needs of a large population of 193.2 million.

Additionally, the priority of international donor agencies in Pakistan is not on osteoporosis, but rather on other health issues such as HIV/AIDS, Polio, maternal and child health etc., in line with the Millennium Development Goals.

Some industry and non-governmental organizations do put effort into osteoporosis awareness and treatment. For example there is a public health programme organized by pharmaceutical companies on Maternal & Child Health (MCH) that often focuses on calcium and vitamin D. The PSRD routinely conducts bone density tests and also takes multiple steps regarding health education of high-risk patients. Seminars on osteoporosis are also major events at a local level. Dissemination of osteoporosis information leaflets among the public and osteoporosis awareness

campaigns such as that launched by PSRD in October 2012 (<http://www.psr.org.pk/default.aspx>) also help to educate the public on the growing menace of this disease.

## Guidelines

According to PSRD, it is not known if osteoporosis guidelines currently exist in Pakistan, however, there is guidance on fracture risk assessment including prior fracture, age, BMD scores and the use of FRAX.

## Audit and quality indicator systems

Pakistan does not presently have a quality indicator system in place for osteoporosis.

## TREATMENT (REIMBURSEMENT OF MEDICATION)

Pakistan's health-care system comprises government run and private health facilities, and the overall governance for health care is at the local, provincial level. Functions were transferred to the provincial health departments in 2011 when the responsibilities of the Ministry of Health were delegated. Now, the provinces are responsible for developing their own strategies and interventions based on their local needs<sup>14</sup>.

For this reason, there are no national treatment reimbursement guidelines for osteoporosis care in Pakistan, and one must look to the local level for details. In principle, treatment is free in government hospitals but depends on the availability of services. Generally, treatment is mostly focused on post-fracture care and least focused on preventive care. First-line treatments usually include alendronate, risedronate, strontium ranelate, vitamin D and calcium supplements.

## DIAGNOSTICS

Dual-energy X-ray absorptiometry (DXA) remains the 'gold standard' diagnostic tool for osteoporosis but high cost and low availability restrict its use in primary care in Pakistan, and equipment is usually available in cities only<sup>5,8</sup>.

There are approximately 16 DXA (less than 0.1 per one million in population<sup>15</sup>) and 150 ultrasound machines (0.1 per 10 000 population). DXA costs around 40 USD per scan and the average waiting time for a scan is 2–3 days (*Table 2*). Ultrasound may also be used as a diagnostic tool, with wait times of 1–2 days and costing

**TABLE 2** Access and cost of diagnostics in Pakistan

	DXA	ULTRASOUND
Waiting time (d)	2–3	1–2
Cost (USD)	\$40	\$15–20
Is it reimbursed?	depends on local governance	depends on local governance
Is reimbursement a barrier to access to treatment?	depends on local governance	depends on local governance

around 15–20 USD. Reimbursement depends on the local governance and health plan concerned.

## RECOMMENDATIONS

Action plans for prevention, treatment, diagnosis and fracture care are needed in Pakistan, such as:

- Establishing a fracture registry which compiles high-risk patients and patients presenting with hip fractures and other fragility fractures will help to develop prevention and treatment parameters for osteoporosis.
- Expanding osteoporosis awareness to the rural communities through the existing *rural health project* will help to spread awareness of the disease to the more remote areas of Pakistan.
- Increasing overall efforts to raise awareness about osteoporosis so that effective steps can be taken to prevent the first and subsequent fractures will be imperative, especially with life expectancy gradually increasing from 61 years in 1990, to: 67 years in 2011; 70 years in 2025; and 77 years in 2050.
- Supporting patients with the goal of improving the quality of life of those living with the disease will help to ease the burden on the patient and family system.
- Encouraging the government to take the lead and develop programmes for osteoporosis that are similar to the existing *Family Planning* and the *Extended Program of Immunisation (EPI)* programmes.

## REFERENCES

1. United States Census Bureau, 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Fatima, M, Nawaz, H, Kassi, M, Rehman, R, Kasi, PM, Kassi, M, Afghan, AK & Baloch, SN 2009, 'Determining the risk factors and prevalence of osteoporosis using quantitative ultrasonography in Pakistani adult women', *Singapore Med J*, vol. 50, pp. 20-28.
3. Jaleel, R, Nasrullah, F & Khan, A 2010, 'Osteopenia In The Younger Females', *J Surg Pak (Int)*, vol. 15, no.1, pp. 29-33.
4. Iqbal, R & Khan, A 2010, 'Possible Causes of Vitamin D Deficiency (VDD) in Pakistani Population Residing in Pakistan', *J Pak Med Assoc*, vol. 60, no. 1, pp. 1-2.
5. Lowe, NM, Ellahi, B, Bano, Q, Bangash, SA, Mitra, SR & Zaman, M 2011, 'Dietary calcium intake, vitamin D status, and bone health in postmenopausal women in rural Pakistan', *J Health Popul.Nutr*, vol. 29, pp. 465-470.
6. Dar, F, Iqbal, R, Ghani, F, Siddiqui, I & Khan, A 2012, 'Bone health status of premenopausal healthy adult females in Pakistani females', *Arch Osteoporos*, vol. 7, pp. 93–99.
7. Khan, A, Iqbal, R, Naureen, G, Dar, F & Ahmed, F 2012, 'Prevalence of vitamin D deficiency and its correlates: results of a community-based study conducted in Karachi, Pakistan', *Arch Osteoporos*, vol. 7, pp. 275–282.
8. Mamji, M, Hasan, J & Sabri, M 2010, 'Risk Factors For Osteoporosis In Post-Menopausal Women With Hip Fractures', *J Surg Pak (Int)*, vol. 15, no. 2, pp. 82-86.
9. *Rural Population (% Of Total Population) In Pakistan 2013*, *Trading Economics*, viewed 01 September 2013, <<http://www.tradingeconomics.com/pakistan/rural-population-percent-of-total-population-wb-data.html>>.
10. Sabzwari, S & Azhar, G 2011, 'Ageing in Pakistan—A New Challenge', *Ageing Int*, vol. 36, no. 4, pp. 423-427.
11. Raza, S 2011, 'Endocrinology in Pakistan: Transcending in care of endocrinological disorders', *Indian J Endocrinol Metab*, vol. 15, no. 1, pp. 43-45.
12. Riaz, M, Abid, N, Patel, J, Tariq, M, Khan, MS & Zuberi, L 2008, 'Knowledge about osteoporosis among healthy women attending a tertiary care hospital', *J Pak Med Assoc*, vol. 58, pp. 190-194.
13. *Middle Eastern Region: Pakistan statistics summary (2002 - present) 2013*, World Health Organization, viewed 14 October 2013, <<http://apps.who.int/gho/data/node.country:country-PAK>>.
14. Khan, A 2011-2012, 'Deputy Economic Adviser, Planning Commission of Pakistan', *Pakistan Economic Survey*.
15. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>



Philippines

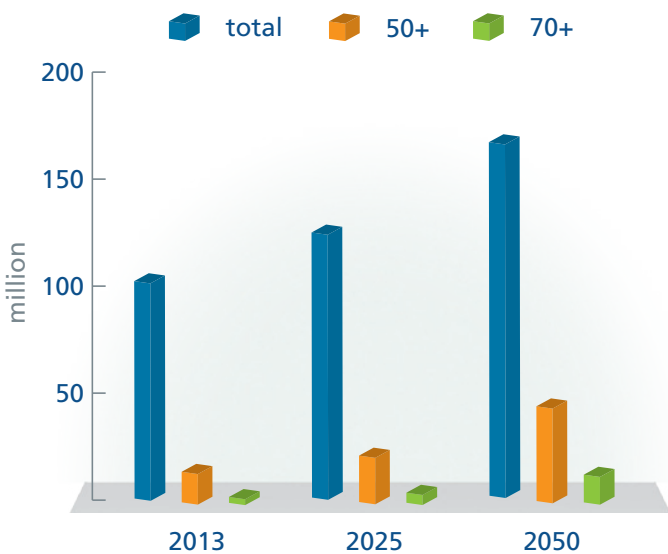
## CURRENT

Population **105.7 million**  
 Aged over 50 years **14%**  
 Life expectancy **72 years**  
 Hip fracture incidence per year **93/100,000**  
 Cost per hip fracture **2,200 USD**  
 Number of DXA per million population **0.1**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **171.9 million** ↑  
 Aged over 50 years **27%** ↑  
 Life expectancy **80 years** ↑

**FIGURE 2** Population projection for the Philippines

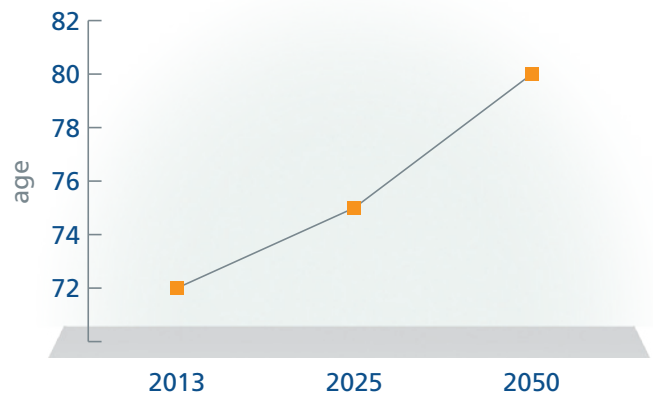


# PHILIPPINES

## COUNTRY OVERVIEW

The population is ageing in the Philippines, similar to the demographic changes observed in the rest of Asia and elsewhere in the world (Figure 1). In 2013, the overall Filipino population was 105.7 million. It is projected to increase by 22% to 128.9 million by 2025 and by 63% to 171.9 million by 2050 (Figure 2). These figures pale in comparison with the projected increases in the elderly. The proportion of the Filipino population aged over 70 years is predicted to increase by 372%, from 2.8 million in 2013 to 13.4 million in 2050. In a population where the life expectancy is projected to increase by 11% from the current 72 years to 80 years in 2050 (Figure 1), these statistics highlight the need to focus on osteoporosis awareness, diagnosis and treatment in the Philippines<sup>1</sup>.

**FIGURE 1** Life expectancy in the Philippines



## State of osteoporosis/osteopenia

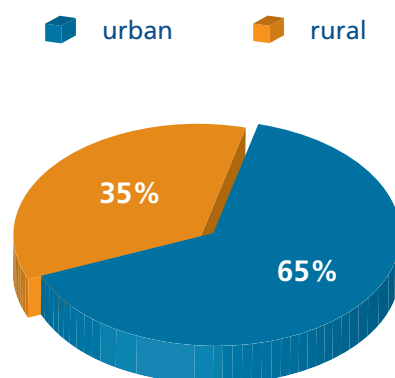
According to National Nutrition and Health Survey (NNHeS) 2003 data, 26% of women and 11.4% of men aged between 60–69 years are considered at high risk for osteoporosis. This is also true for 79.1% of women and 62.2% of men aged over 70 years. From these numbers it has been projected that the number of Filipinos at high risk for osteoporosis will reach 4 million by 2020 and 10.2 million by 2050<sup>2</sup>.

To give perspective on more recent data, the Osteoporosis Society of the Philippines Foundation Inc. (OSPFI), provided Tables 1 and 2 to summarize 2008 data gathered by the NNHeS. Using ultrasound, it was found that the prevalence of low bone mass (T-score < -2.0) in Filipino women aged over 50 years was 65.2% and 68.8% in men (Table 1). Using the Osteoporosis Self-Assessment Tool for Asians (OSTA), the prevalence of osteoporosis was estimated and found to be an intermediate risk in 45.9% of women and in 43.4% of men (Table 2). This translates to millions of individuals at risk of osteoporosis.

### Lifestyle

The Philippines is highly urbanized with over 60% of the population living in cities (Figure 3), with 44% of the population of low income<sup>1,3</sup>. The sixth national nutrition survey of the Philippines in the year 2003, using the food weighing method, found the mean daily calcium intake per person to be 440 mg which is just 57% of the recommended calcium intake for Filipinos<sup>3</sup>. Another study found the average calcium intake to be 250 mg per

**FIGURE 3** Urban versus rural population in the Philippines



day. Nutrition surveys have found some possible reasons for low calcium levels. For example, the diet of urban Filipinos may be predominately based on highly energy dense foods lacking micronutrients such as calcium and vitamin D. Another reason could be the lower consumption of dairy products because they tend to be imported and are expensive.

**TABLE 1** Prevalence of low bone mass using T-Score, adults aged ≥50 years

AGE (YEARS)	MALES		FEMALES	
	< -2.0 % (n)	≥ -2.0 % (n)	< -2.0 % (n)	≥ -2.0 % (n)
50-59	80.49% 33	19.51% 8	73.12% 68	26.88% 25
60-69	60% 24	40% 16	67.07% 55	32.92% 27
≥ 70	55.56% 5	44.44% 4	43.9% 18	56.10% 23
<b>total</b>	<b>68.89% 62</b>	<b>31.11% 28</b>	<b>65.28% 141</b>	<b>34.72% 75</b>

**TABLE 2** Proportion of adults at risk for osteoporosis using OSTA, adults aged ≥50 years

AGE (YEARS)	MALES			FEMALES		
	LOW % (n)	INTERMEDIATE % (n)	HIGH % (n)	LOW % (n)	INTERMEDIATE % (n)	HIGH % (n)
50-59	84.38% 27	15.63% 5	0% 0	73.53% 50	26.47% 18	0% 0
60-69	18.92% 7	70.27% 26	10.81% 4	18.03% 11	73.77% 45	8.2% 5
≥ 70	14.29% 1	28.57% 2	57.14% 4	0% 0	33.33% 10	66.67% 20
<b>total</b>	<b>46.05% 35</b>	<b>43.42% 33</b>	<b>10.53% 8</b>	<b>38.36% 61</b>	<b>45.91% 73</b>	<b>15.72% 25</b>

Good sources of calcium, however, are readily available in the Filipino diet including small fish such as sardines, which are eaten with bones intact, and green leafy vegetables<sup>4</sup>. Additionally, some good news was indicated in one study suggesting that vitamin D deficiency in the Philippines may not be a main contributor of postmenopausal osteoporosis since the majority (64%) of participants were found to have adequate levels of vitamin D<sup>5</sup>.

### Level of awareness

In the Philippines osteoporosis is largely seen as a natural process of ageing so the overall level of urgency and concern about the disease is not high. This is further reinforced in that osteoporosis is not a national health priority nor is its treatment reimbursed.

## FRACTURE RATES

### Hip fracture

Analysis of the national health insurance system database in the Philippines revealed that there were a total of 17,875 hip fractures from 2007 to 2012 in those aged over 50 years.

The IOF hip fracture incidence map indicates the Filipino hip fracture incidence is 93/100,000 per year (133/100,000 per year in women and 48/100,000 per year in men)<sup>6</sup>.

The average waiting time for hip surgery is greater than 3 days in the Philippines and the proportion of hip fractures treated surgically is 25–50% (*Table 3*). The long wait times and low surgery rate are likely due to the low (if any) reimbursement offered for inpatient fracture care.

### Other fragility fractures

Current data from the national health insurance system recorded 27,340 fractures (non-hip, non-spine) from 2007–2012 in individuals aged 50 years and older. Previous data from 2003 NNHeS indicated the overall prevalence of fragility fractures was 11.23% in women and 8.97% in men<sup>7</sup>.

### Vertebral fractures

The fracture data collected from the national health system found 4,610 cases of vertebral fractures from 2007 to 2012 in those aged 50 years and over.

## COST OF FRACTURE

An analysis of data from 2007–2012 of the current costs of fracture was conducted through collaboration between OSPFI and the Philippine Health Insurance Corp (PhilHealth). The study found direct hospital costs of hip fracture to be approximately 2,200 USD (94,611 PhP), and less than half all hip fractures are treated surgically (*Table 3*).

**TABLE 3 Hip fracture in the Philippines**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$2,200	information not available	25-50%

## FRACTURE REGISTRIES

Fracture registries exist in the Philippines on both the national and hospital levels. PhilHealth tracks fractures through the International Classification of Diseases (ICD) codes. The fracture data from 2001–2005 were used to calibrate FRAX for the Filipino population, and data from 2006–2010 are currently being gathered and analyzed. Additionally, the Trauma Registry of the Philippine Orthopaedic Association (POA) tracks fractures at the hospital level. Both registries track hip and all other fracture data in men and women aged over 40 years.

## FRACTURE LIAISON SERVICES

There are no fracture liaison services in the Philippines.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis is managed by many specialities in the Philippines and training specific to osteoporosis is included in the medical curriculum for: rheumatologists, orthopaedic surgeons, endocrinologists, geriatricians, rehabilitation medicine physicians, and internal medicine physicians. Sometimes gynaecologists are responsible for osteoporosis management, but this is not very common.



## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not currently a national health priority in the Philippines. Since the government focuses more on communicable diseases, funds are prioritized to these conditions, and there are no large-scale epidemiologic data on fracture rates or vitamin D deficiency/insufficiency. Further, as mentioned later, diagnoses and treatment for osteoporosis is not covered by insurance.

A few efforts, however, have been put into place to increase awareness of the disease. Proclamation No. 19, a mandate signed in 1998, declared every second week of October as National Osteoporosis Awareness Week. However, more support is needed from national and local governments to increase proactive awareness programmes, activities and education about this condition.

The government has also put into place a food fortification programme fortifying milk products with calcium and vitamin D in local and imported brands. Additionally, the NNHeS 2013 is ongoing in the Philippines. It is hoped that enough funds will be generated to analyze the status of Vitamin D in the Filipino population in national and regional reports.

The national society OSPFI is active in promoting osteoporosis awareness and has been actively joining NNHeS since 2003 for collaborative data collection on nutrition and its relationship to metabolic bone disease and other conditions of the general population.

### Guidelines

The guidelines, ‘Consensus Statement on Osteoporosis Diagnosis, Prevention, and Treatment among Postmenopausal Filipino Women in the Philippines’ were published in 2011 by OSPFI. They have been published in a supporting paper in the *International Journal of Rheumatic Diseases*.

Despite the presence of local practice guidelines, they have not been used to modify the reimbursement policies to cover osteoporosis treatments.

### Audit and quality indicator systems

Currently there are no audit or quality indicator tracking systems in place in the Philippines.

## TREATMENT

The national health insurance system and the private insurance companies in the Philippines cover a very small portion of hospitalization costs related to fractures, and once discharged patients pay out-of-pocket for all treatments, with no reimbursement offered. This is mainly due to osteoporosis being considered as a natural process of ageing, hence, treatments are not included in the health benefit packages, and patients have to settle the costs themselves.

## DIAGNOSTICS

There is a low density of dual-energy X-ray absorptiometry (DXA) equipment in the Philippines at less than 0.1 per one million of the general population<sup>8</sup>. Where scans are available, the waiting time to receive a DXA scan is just a few days however the costs are not reimbursed which poses a barrier to access (*Table 4*).

**TABLE 4** Diagnostics access and cost in the Philippines

	DXA	ULTRASOUND
Waiting time (d)	2-3	not routinely used in clinics
Cost (USD)	\$55-135	free
Is it reimbursed?	no	n/a
Is reimbursement a barrier to access to treatment?	yes	n/a

N/A information not available

## RECOMMENDATIONS

In a country where the proportion of the Filipinos aged over 70 years will increase by a dramatic 372% over the next four decades, rising from 2.8 million in 2013 to

13.4 million in 2050, there is little debate whether the burden of osteoporosis will be felt. Efforts to change the point of view that osteoporosis is just a natural process of ageing will likely result in benefits to the millions affected by the disease. Utilizing the current fracture registries to conduct epidemiological studies could aid in lobbying efforts with policy makers for better osteoporosis health-care delivery, such as reimbursing DXA and osteoporosis treatments and increasing the percentage of hip fractures that are treated surgically. Finally, getting osteoporosis on the radar for consideration as a national health priority could catapult the efforts of the national societies towards osteoporosis awareness, prevention and treatment.

## REFERENCES

1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Aban, M 2013, Healthway Medical, Alagang pamilya, alagang Healthway, <<http://www.healthway.com.ph/?p=417>>.
3. Miura, S, Saavedra, OL & Yamamoto, S 2008, 'Osteoporosis in urban post-menopausal women of the Philippines: prevalence and risk factors', *Arch Osteoporos*, vol. 3, pp. 17-24.
4. Miura, S, Nakamori, M, Yagi, M, Saavedra, O, Ikemoto, S & Yamamoto, S 2009, 'Daily calcium intake and physical activity status in urban women living on low incomes in Davao, Philippines: a primary study for osteoporosis prevention', *J Med Investigation*, vol. 26, pp. 130-135.
5. Raso, AA, Navarra, SV, Li-Yu, J & Torralba, TP 2009, 'Survey of vitamin D levels among post-menopausal Filipino women with osteoporosis', *Int J Rheum Dis*, vol. 12, pp. 225-229.
6. *Hip fracture incidence map*, International Osteoporosis Foundation, viewed 20 November 2013, <<http://www.iofbonehealth.org/facts-and-statistics/hip-fracture-incidence-map>>.
7. Li-Yu, J, Perez, E, Canete, A, Bonifacio, L, Llamado, L, Martinez, R, Lanzon, A & Sison-Peña, CM 2012, 'On behalf of the Osteoporosis Society of the Philippines Foundation, Inc. (OSPFI) and Philippine Orthopedic Association (POA) Clinical Practice Guidelines Task Force Committee on Osteoporosis. Summary of the Consensus Statement on the Prevention, Diagnosis and Treatment of Postmenopausal Osteoporosis in the Philippines', *JAFES*, vol.27, no. 2.
8. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>: Kanis, JA, data on file.

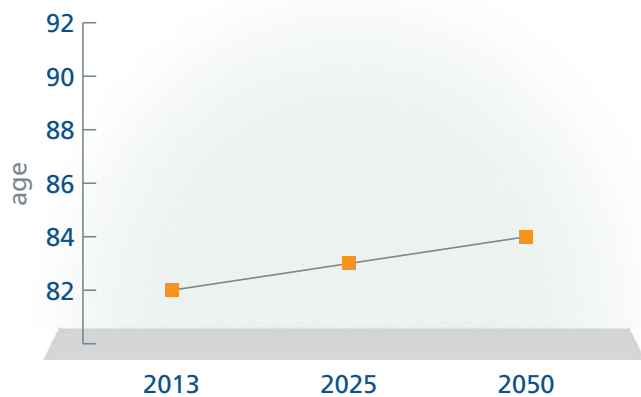


# REPUBLIC OF KOREA

## COUNTRY OVERVIEW

In 2013, the population of Korea was 48.9 million and an 11% decrease is expected by 2050. However, the proportion of the population in the age group most at risk for osteoporosis is expected to increase. Life expectancy will also rise from 80 years to 84 years (Figure 1). While currently 33% of the Korean population is aged over 50 years, in 2050 this will increase to 57%. Those aged over 70 years are projected to go from just 8% of the population today (4 million) to 28% in 2050 (12.2 million) – representing an increase of 200%<sup>1</sup> (Figure 2). Given the rate of increase seen in the elderly population in Korea is one of the highest in the world, the burden of osteoporosis is expected to escalate dramatically<sup>2</sup> (Figure 1).

**FIGURE 1** Life expectancy in the Republic of Korea



## State of osteoporosis/osteopenia

Korea is able to make fairly accurate determinations of disease prevalence in its population due to the national health insurance system that collects all health-care claims data into a central database, the *Health Insurance Review and Assessment Service (HIRA)*. According to the data collected in 2009, the number of people aged over 50 years being treated for osteoporosis was 6.1% for men, and 33% for women. Additionally, since 1989



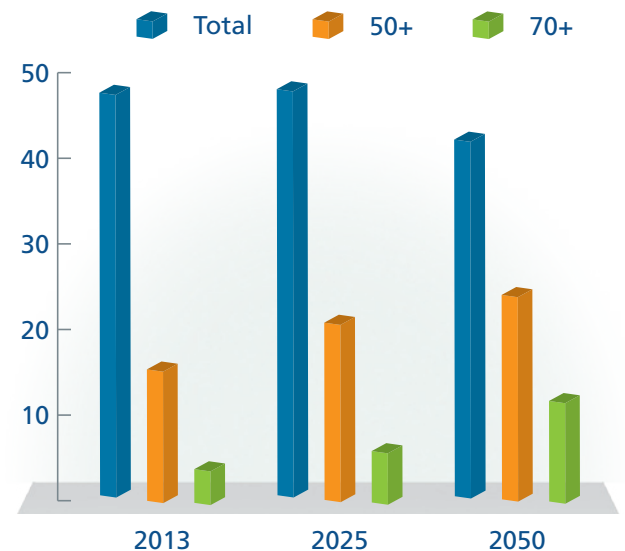
## CURRENT

Population **48.9 million**  
 Aged over 50 years **33%**  
 Life expectancy **80 years**  
 Hip fracture incidence per year **207/100,000** (women)  
 Cost per hip fracture **no data**  
 Number of DXA per million population **24.5**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **43.4 million** ↓  
 Aged over 50 years **57%** ↑  
 Life expectancy **84 years** ↑

**FIGURE 2** Population projection for the Republic of Korea



Korea's Ministry of Health and Welfare has been conducting – at a nationwide level – the *Korea National Health and Nutrition Examination Survey (KNHANES)* at three to four year intervals. The KNHANES is a national screening programme targeting chronic disorders in the population (aged 1 year and above). This national screening programme provides data on which to develop studies and research about various diseases, including osteoporosis, in the Korean population<sup>3</sup>.

The osteoporosis information collected from the KNHANES (2008-2009) indicated a similar prevalence of osteoporosis to that from the HIRA at 7.5% in men and 35.5% in women in those aged over 50 years (Figure 3). The KNHANES went a step further and estimated the prevalence of low bone density (according to World Health Organization (WHO) criteria) to be 47.2% and 46.7% in men and women respectively<sup>3</sup>.

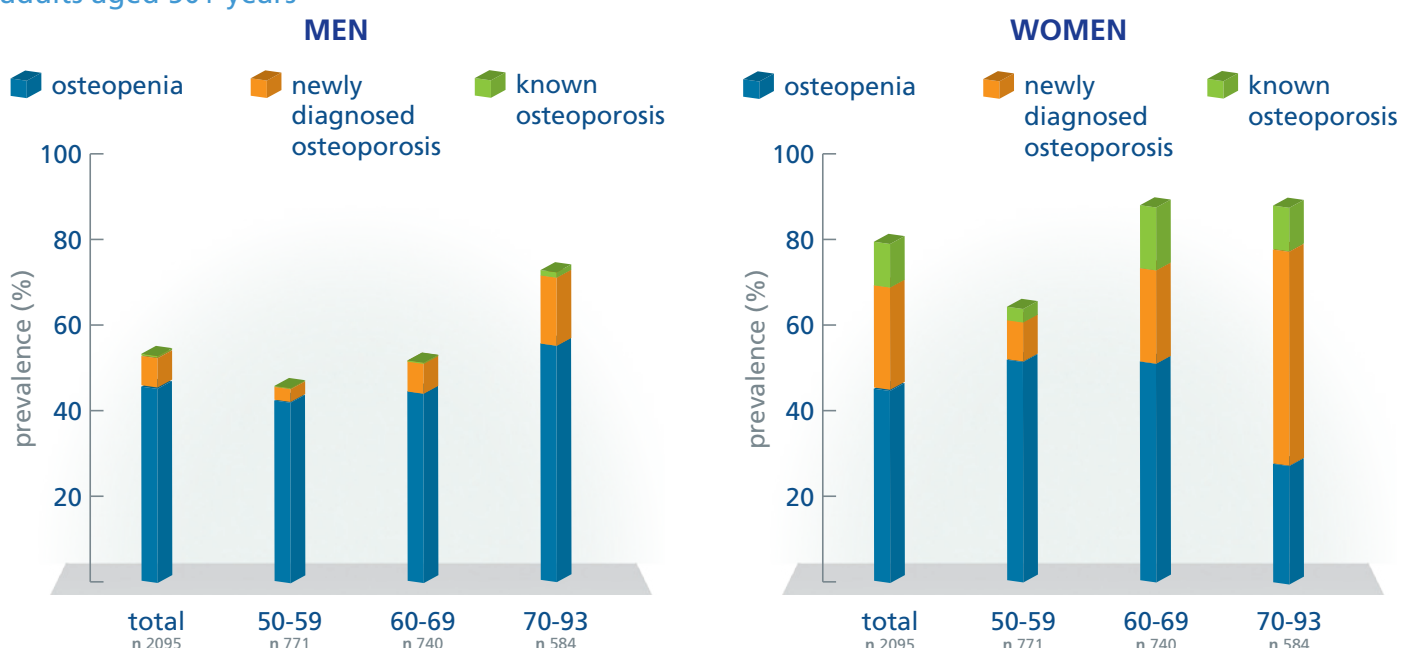
### Lifestyle

Studies have found that Korean osteopenic and osteoporotic participants share common characteristics, which include: being older in age; having a lower height, weight and bone mineral density (BMD); as well as having

a lower household income and education level. In general, among women, those with osteoporosis were found to live in less affluent residential areas, had an increased prevalence of smoking, and exercised less frequently. One analysis of post hip fracture mortality rates found that Korean men had a higher rate of death one year after hip fracture than women, and all Koreans living outside of Seoul had a higher risk of dying within the first year after hip fracture than those living within the capital<sup>4</sup>.

Regarding vitamin D levels, it is more and more evident that deficiency is common in Korea's adolescents. This is a concern in that adolescence is an important period in life for building bone mass. One study found vitamin D insufficiency/deficiency (<30ng/mL) in 98.9% of boys and 100% of girls<sup>5</sup>. An expected explanation is lack of sunlight exposure, and in adolescents a hypothesis is that time engaged in outdoor activities is limited in order to study for the highly competitive entrance exams for high school and university. Another review of the 2008 KNHANES survey of men and women aged 10 years and older found that 86.8% of men and 93.3% of women were vitamin D insufficient. These studies reveal that vitamin D insufficiency or deficiency is common in the entire population of Korea<sup>5</sup>.

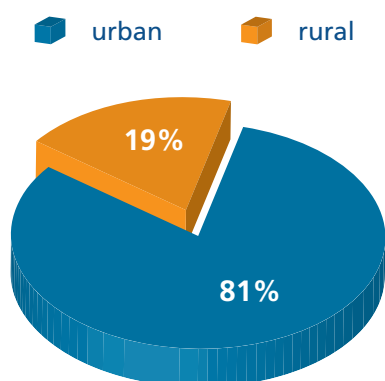
**FIGURE 3** Prevalence of known and newly-diagnosed osteoporosis and osteopenia cases in Korean adults aged 50+ years<sup>3</sup>



**SOURCE** Figure reproduced from Choi Y.C et al. (2012 The Prevalence of Osteoporosis in Korean Adults Aged 50 Years or Older and the Higher Diagnosis Rates in Women Who Were Beneficiaries of a National Screening Program: The Korea National Health and Nutrition Examination Survey 2008–2009).

Another key consideration is the impact that urbanization will have on exacerbating risk for osteoporosis given that urban living can result in decreased exposure to sunlight, people being less physical active and eating unhealthily (Figure 4).

**FIGURE 4** Urban versus rural population in the Republic of Korea<sup>6</sup>



### Level of awareness

Awareness of osteoporosis in Korea is increasing. This is especially due to the KNHANES which, in addition to its traditional collection of data, added the collection of BMD measurements in women aged 40 and 66 years, in 2007<sup>3</sup>.

Due to the increased awareness brought about by KNHANES, the number of patients being treated for osteoporosis increased substantially – by 26.7% in women and 29.9% in men – between 2005–2008. However, osteoporosis is still under-diagnosed and under-treated. According to 2009 diagnostic and claims data from Korea’s national health insurance database (the HIRA as mentioned earlier), among women aged over 50 years with osteoporosis 30.3% were diagnosed and only 14.3% reported being treated<sup>7</sup>. It has been found that the osteoporosis treatment rate is similar to that of other countries. However, the treatment rate for osteoporosis within Korea was 12.8% lower than the treatment rate for other chronic diseases<sup>3</sup>.

Additionally, physicians have become more and more aware of osteoporosis and related treatments thanks to the numerous national osteoporosis-related organizations which provide education programmes for clinicians<sup>8</sup>.

## FRACTURE RATES

### Hip fracture

Reviews of Korea’s HIRA database have tracked trends in hip fracture over time for the past decade. Hospital claims data shows an increasing incidence in hip fractures in Koreans aged over 50 years. In women, hip fracture incidence rose from 146/100,000 in 2003 to 207/100,000 in 2008, and in men the increase went from 62/100,000 in 2003 to 98/100,000 in 2008<sup>2,4</sup> (Table 1). However, when looking at the actual numbers of hip fractures over the five-year period, Koreans saw a 108% increase from 9,817 hip fractures in 2003 to 20,432 hip fractures in 2008, as the population of those aged over 50 years grew 24% during the same time period<sup>2,4</sup> (Table 2).

The one year post-hip fracture mortality rate also increased in men and women, going from 16.6% in 2003 to 17.8% in 2007, and mortality rates after hip-fracture seem greater for Korean men than women (Table 3). Studies from 2005 to 2008 found the male mortality rate to be 1.4-times higher than that for females<sup>2</sup>, and earlier studies from 2003 found the male mortality rate to be twice that of female rates<sup>4</sup>. Reasons suggested for this

**TABLE 1** Increasing hip fracture incidence per 100,000 in Korean men and women over 50 years<sup>2,4</sup>

	WOMEN	MEN
2003	146.38	61.72
2005	191.9	94.8
2008	207	97.8

**TABLE 2** Number of hip fractures in Korean men and women over 50 years, during a 5-year period<sup>2,4</sup>

	WOMEN	MEN	TOTAL
2003	6,892	2,925	9,817
2005	11,921	4,945	16,866
2006	12,843	5,134	17,977
2007	13,367	5,243	18,610
2008	14,538	5,894	20,432

**TABLE 3** Mortality rate: deaths 1-year post hip fracture in Korean men and women over 50 years<sup>2,4</sup>

	WOMEN	MEN	TOTAL	MORTALITY RATE
2003	1,065	560	1,625	16.6%
2005	2,117	1,049	3,166	18.8%
2006	2,292	1,121	3,413	19.0%
2007	2,166	1,141	3,307	17.8%

are that men have more comorbidities, higher infection rates, poorer osteoporosis management, and a higher risk of postoperative complications<sup>4</sup>.

Fracture incidence appears to be lower than in other Asian countries such as Chinese Taipei, Hong Kong, and Singapore, and also lower than in Western countries<sup>9</sup>. By contrast however, it is higher than in Malaysia and China<sup>2,4</sup>. However, according to one study, hip fractures in Korea are projected to increase dramatically because, as mentioned earlier, the rate of increase of the elderly population in Korea is one of the highest in the world<sup>2</sup>.

According to the Korean society for bone and mineral research, approximately 90% of hip fractures in Korea are managed surgically, and the average waiting-time for surgery is 1–2 days.

### Other fragility fractures

A study of HIRA from 2005–2008 found that Koreans have a moderate residual lifetime risk for osteoporosis-related fractures, and at the age of 50 years, the probability of future fracture is 59.5% for women and 23.8% for men. Findings indicated that the incidence of osteoporosis-related fracture in women was 3 times that of men and osteoporosis-related fractures increased with advancing age (*Table 4*)<sup>10</sup>.

### Vertebral fractures

A 2006–2007 community-based study of Koreans aged over 50 years living in rural areas was conducted (using vertebral morphometry) and found the standardized prevalence for vertebral fractures using the age distribution of Korean population was 8.8% in men and 12.6% in women<sup>9</sup>. The incidence of

**TABLE 4** Incidence of fractures per 100,000 men and women Koreans over 50 years, site specific, 2008 data<sup>10</sup>

	WOMEN	MEN
Total	2,373	730
Hip	207	98
Spine	1,430	431
Distal radius	647	160
Humerus	110	47

vertebral fracture, according to the 2008 HIRA, was found to be 1,430/100,000 per year in women and 431/100,000 per year in men<sup>10</sup>.

Additionally, the KNHANES (2008–2009) study found that lumbar spine BMD T-scores tended to be lower than those of the femoral neck or hip, and the prevalence of osteoporosis was higher at the lumbar spine than the femoral neck or total hip<sup>3</sup>.

### COST OF FRACTURE

Data not provided.

### FRACTURE REGISTRIES

Korea does not have specific registries for the recording of fractures. However it is possible that a fracture registry could be derived from the central database of the government-mandated national health insurance system, which collects prescription medication and claims data on the entire Korean population, including data on osteoporosis care<sup>8</sup>.

### FRACTURE LIAISON SERVICES

Korea does not have fracture liaison services implemented in its hospitals.

### SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis care in Korea is managed by multiple specialities and is included as part of the medical specialty training for orthopaedic surgeons, gynaecologists, endocrinologists, internal medicine physicians and rheumatologists. In some cases, hospitals recognize osteoporosis as a medical specialty in itself. Other physicians that may also see osteoporosis patients

are the geriatric physicians, rehabilitation medicine physicians and general practitioners.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not documented as a national health priority in Korea.

### Guidelines

While the Korean government has not produced official national guidelines on osteoporosis, the Korean Society for Bone and Mineral Research has published its own *Clinical Guidance on Management of Osteoporosis* in 2007, with updates in 2008, 2011 and 2013. The guidelines offer criteria for treatment of patients aged over 50 years, who have had a prior fracture and/or have a BMD value of  $-2.5$ . The guidelines offered are generally compatible with reimbursement policies defined by the National Health System.

### Audit and quality indicator systems

Korea does not have a system in place to measure the quality of care provided to people with osteoporosis or associated fractures.

## TREATMENT (REIMBURSEMENT OF MEDICATION)

Since 1989, all Koreans are covered under the national health insurance (NHI) system. Treatments for osteoporosis are covered by the NHI for patients who are aged 50 years or older, have had a prior fracture, or have a BMD T score of  $\leq -2.5$ . Generally, the NHI covers 70% of the cost with the patient paying the balance of around 30%. An authorization is not required for reimbursement, and there are no specifically designated first-line treatments (*Table 5*).

## DIAGNOSTICS

The Republic of Korea is well situated with dual-energy X-ray absorptiometry (DXA) equipment and has 24.5 machines per one million in population<sup>11</sup>. The NHI limits reimbursement of DXA for osteoporosis screening to women aged 65 years or older, younger women with low body weight, evidence of early menopause, surgical menopause, and a past history or family history of non-

**TABLE 5** Osteoporosis treatment availability and reimbursement levels in the Republic of Korea

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		70%
Alendronate	x		70%
Ibandronate	x		70%
Zoledronic acid	x		70%
Clodronate		x**	
Pamidronate	x		70%
Raloxifene	x		70%
Bazedoxifene	x		70%
Denosumab		x**	
Strontium Ranelate		x**	
Teriparatide		x	
PTH (1-84)		x	
Vitamin D/Ca supplements	x		70%
Calcitonin*	x		70%
Hormone Replacement Therapy	x		70%
Testosterone		x	
Alfacalcidol	x		70%

\*Elcatonin only Recently, calcitonin which extracted from salmon is out of market. Elcatonin which extracted from eel is reimbursing now.  
\*\*not available

traumatic fracture<sup>7</sup>. With these conditions met, DXA (which costs approximately 80 USD) is reimbursed by the NHI and access to a scan is usually immediate (*Table 6*).

For pre-screening, Korea has a FRAX model adapted for the Korean population to predict the 10-year probability of hip fracture. Additionally, a new screening model is under development called the Korean Osteoporosis Risk Assessment Model (KORAM), and when tested, 91.2% of patients with osteoporosis could be detected<sup>7</sup>.

## RECOMMENDATIONS

- Osteoporosis is currently under-diagnosed and under-treated. Accordingly, it is critical that further effort is given to find more effective methods for

**TABLE 6** Diagnostics access and cost in the Republic of Korea

	DXA	ULTRASOUND
Waiting time (d)	no wait	no wait
Cost (USD)	80	60
Is it reimbursed?	yes	yes
Is reimbursement a barrier to access to treatment?	no	no

the prevention, early detection and treatment of osteoporosis in both men and women<sup>7</sup>.

- Develop Korean reference BMD scores so sex-specific reference means and standard deviations for T-scores can be accurately calculated in the Korean population<sup>7</sup>.
- A national screening programme for osteoporosis in Korea may have contributed to an increased diagnosis rate in the sixties age group. Therefore, a large-scale screening programme for osteoporosis could help increase the diagnosis rate for osteoporosis<sup>3</sup>.
- Use the data collected regularly by the National Health and Nutrition Examination Survey (KNHANES) to develop quality indicators to measure the quality of care provided to people with osteoporosis and related fractures.
- Implement public health strategies to treat osteoporosis and to reduce fracture incidence. Measures should be implemented that target the indigenous elderly population in Korea<sup>4</sup>.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Yoon, HK, Park, C, Jang, S, Jang S, Lee, YK & Ha, YC 2011, 'Incidence and Mortality Following Hip Fracture in Korea', *J Korean Med Sci*, vol. 26, pp. 1087-1092.
3. Choi, YJ, Oh, HJ, Kim, DJ, Lee, Y & Chung, YS 2012, 'The Prevalence of Osteoporosis in Korean Adults Aged 50 Years or Older and the Higher Diagnosis Rates in Women Who Were Beneficiaries of a National Screening Program: The Korea National Health and Nutrition Examination Survey 2008-2009', *J Bone Miner Res*, vol. 27, no. 9, pp. 1879-1886.
4. Kang, HY, Yang, KH, Kim, YN, Moon, SH, Choi, WJ, Kang, DR & Park, SE 2010, 'Incidence and mortality of hip fracture among the elderly population in South Korea: a population-based study using the National Health Insurance claims data', *BMC Public Health*, vol. 10, pp. 230.
5. Shin, YH, Kim, KE, Lee, C, Shin, HJ, Kang, MS, Lee, HR & Lee, YJ 2012, 'High prevalence of vitamin D insufficiency or deficiency in young adolescents in Korea', *Eur J Pediatr*, vol. 171, pp. 1475-1480.
6. Rural Population (% Of Total Population) In South Korea 2013, *Trading Economics*, viewed 01 September 2013, <<http://www.tradingeconomics.com/south-korea/rural-population-percent-of-total-population-wb-data.html>>.
7. Oh, SM, Nam, BH, Rhee, Y, Moon, SH, Kim, DY, Kang, DR & Kim, HC 2013, 'Development and validation of osteoporosis risk-assessment model for Korean postmenopausal women', *J Bone Miner Metab*.
8. Choi, HJ, Shin, CS, Ha, YC, Jang, SM, Jang, SH, Park, CM, Yoon, HK & Lee, SS 2012, 'Burden of osteoporosis in adults in Korea: a national health insurance database study', *J Bone Miner Metab*, vol. 30, pp. 54-58.
9. Shin, CS, Kim, MJ, Shim, SM, Kim, JT, Yu, SH, Koo, BK, Cho, HY, Choi, HY, Cho, SW, Kim, SW, Kim, SY, Yang, SO & Cho, NH 2012, 'The prevalence and risk factors of vertebral fractures in Korea', *J Bone Miner Metab*, vol. 30, pp. 183-192.
10. Park, C, Ha, YC, Jang, S, Jang, S, Yoon, HK & Lee, YK 2011, 'The incidence and residual lifetime risk of osteoporosis-related fractures in Korea', *J Bone Mineral Metab*, vol. 29, pp. 744-751.
11. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>; Kanis, JA, data on file.

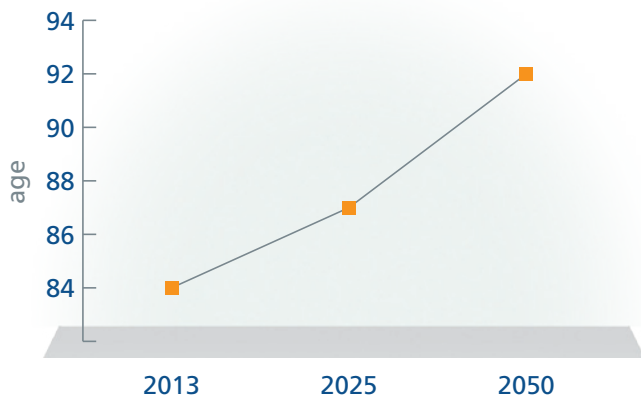


# SINGAPORE

## COUNTRY OVERVIEW

In just over a decade, the number of Singaporeans aged over 70 years will increase by 103%. Life expectancy is also increasing, rising from 84 years to 92 years by 2050 (Figure 1). The proportion of the population aged greater than 70 years is expected to rise from 289,000 in 2013 to 1.5 million in 2050 (Figure 2). The population aged over 50 years will increase from 1.3 million today to 3.9 million in 2050, making up 46% of the total population. The dramatic increase in the senior population of Singapore is especially evident when one considers that the *total* population is expected to increase just 58%, from 5.4 million today to 8.6 million in 2050<sup>1</sup>.

FIGURE 1 Life expectancy in Singapore



## State of osteoporosis/osteopenia

Age-adjusted rates of osteoporotic fractures among women over the age of 50 years in Singapore are currently among the highest in Asia and approaching those of the USA and Europe<sup>2</sup>. The IOF Asian Audit of 2009 reported on 2006 figures estimating that approximately 55,000 Singaporean women over the age of 50 years suffered from osteoporosis. With an ageing population, these figures are expected to increase several-fold.



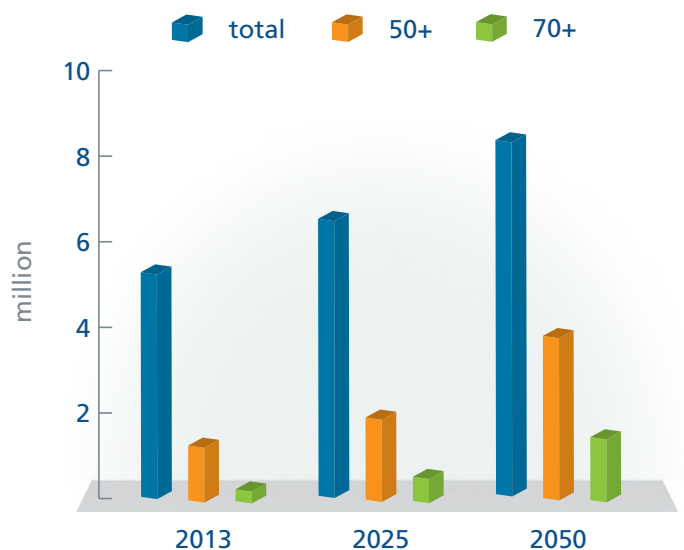
## CURRENT

Population **5.4 million**  
 Aged over 50 years **24%**  
 Life expectancy **84 years**  
 Hip fracture incidence per year **402/100,000** (women)  
 Cost per hip fracture **8,380 USD**  
 Number of DXA per million population **16.9**  
 Fracture liaison services **>50% of hospitals**  
 National health priority status **since 2009**

## PROJECTED 2050

Population **8.6 million** ↑  
 Aged over 50 years **46%** ↑  
 Life expectancy **92 years** ↑

FIGURE 2 Population projection for Singapore

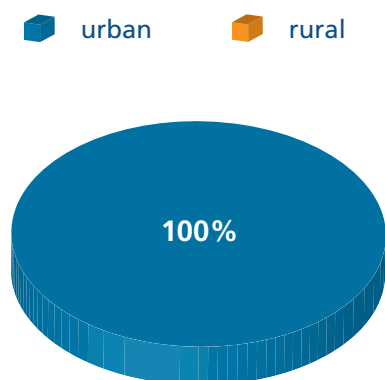


Also, recent studies have noted that secondary osteoporosis is becoming more common than previously perceived, with the overall prevalence close to 50% in postmenopausal women and older men with osteoporosis<sup>3</sup>.

### Lifestyle

Singapore has a unique ethnic population mix of Chinese (76.8%), Malay (13.9%), Indian (7.9%), and others (1.4%), and is a fully urbanized country (Figure 3)<sup>1,4</sup>. Studies from 1960-1980 showed rapidly rising fracture trends in Singapore, and it is suggested that urbanization is the culprit – leading to changes in physical activity, nutrition and sunlight exposure.

**FIGURE 3** Urban versus rural population in Singapore



Nutritionally, calcium levels are low in Singapore's men and women. The current dietary recommendation for calcium intake in Singapore is 800 mg/day, but according to the 2004 National Nutrition Survey, the average daily calcium intake of Singaporeans was 627 mg/day, just 78% of the recommended levels<sup>5</sup>.

Vitamin D insufficiency and deficiency is also prevalent in Singapore. One study found that of 275 hip fracture patients, half were vitamin D deficient (<20 ng/mL)<sup>4</sup>.

On a positive note, those with osteoporosis appear to be taking measures to manage the disease. A study of almost 800 Singaporean osteoporosis patients indicated that adherence to bisphosphonate therapy is higher in Singapore than it has been reported to be in Europeans and Americans. After one year, 78.9% of patients were

compliant with taking the correct dosage of medication and 69% were still compliant at 2 years<sup>2</sup>.

### Level of awareness

There is a fair level of awareness about osteoporosis in Singapore and there are ample resources, however it is the implementation of osteoporosis management that is lacking. A survey conducted in 2010 amongst health-care professionals showed many aspects of osteoporosis care were not being conducted, such as screening for secondary causes and use of fracture risk calculators. This suggests that physicians could be more aligned with the guidelines that are available on osteoporosis management<sup>3</sup>.

In the general population, a survey found that 39% of patients rated vitamin D as extremely important, and 55% rated calcium as extremely important. On the other hand, according to another survey, 86% of patients reported they had no or infrequent discussions with their physicians regarding vitamin D, and 76% reported the same about calcium<sup>6</sup>.

### FRACTURE RATES

#### Hip fracture

The highest incidence of hip fractures from Asia has been reported in Singapore: the study by Koh et al. revealed that hip fracture rates from 1991 to 1998 (per 100 000 per year) were 152 in men and 402 in women. These were respectively 1.5- and 5-times higher than corresponding rates in the 1960s, and approach rates seen in American and European populations<sup>7,8</sup>.

The high incidence of mortality after hip fracture does not bode well for those suffering from such events. Data from Singapore show that the mortality rate one year post-fragility hip fracture is approximately 20–27%, with another 20% semi or fully dependent, and 39% experiencing reduced mobility. Finally, the proportion of those living in a nursing home due to hip fracture increased from just 8% in 1994 to 26% in 2002<sup>5</sup>.

#### Other fragility fractures

Data not provided.

#### Vertebral fractures

Data not provided.

## COST OF FRACTURE

In general, patients with broken hips will wait approximately 2.5 days for hip surgery and over 90% will receive surgical treatment for their fracture. The median time a patient will remain in hospital is 16 days, costing approximately 8,380 USD (10,515 SGD) for the hospital stay (*Table 1*)<sup>3</sup>. Overall, one study found the total cost of managing hip fractures within the first year after fracture in Singapore to be 17 million USD in 1998, and these costs are estimated to reach 145 million USD annually in 2050<sup>8</sup>.

**TABLE 1 Hip fracture in Singapore**

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$8,380	16 (median)	>90%

## FRACTURE REGISTRIES

Singapore's Ministry of Health (MOH) maintains records, on a national level, of patients admitted to hospitals with a diagnosis of hip fracture. The number of fractures per year and the percentage of those that are surgically treated are tracked for both men and women over the age of 40 years.

## FRACTURE LIAISON SERVICES

More than half of the hospitals in Singapore have implemented a Fracture Liaison Service (FLS). This represents the highest implementation of FLS in the Asia-Pacific region.

The high density of FLS can be credited to the *Osteoporosis Patient Targeted and Integrated Management for Active Living* (OPTIMAL) programme. Implemented in 2008, OPTIMAL is a secondary fracture prevention



programme instituted in the public hospitals of Singapore. In this programme, all patients over age 50 years who have suffered a fragility fracture are offered the option to be included in an osteoporosis disease management programme aimed at preventing the occurrence of a second fragility fracture through the judicious combination of appropriate medications, physiotherapy and dedicated nurse manager follow up<sup>4</sup>.

A study performed at Singapore General Hospital (the largest tertiary teaching hospital in Singapore) showed that since the inception of the programme 5 years ago, 1,400 patients have been recruited and 476 patients are currently in active follow-up. Of the 287 patients who had completed a 2-year follow-up, 97.5% had had a dual-energy x-ray absorptiometry (DXA) scan, 62% were compliant with an exercise programme and 72.8% were still compliant with osteoporosis medications after 2 years<sup>9</sup>.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Singapore General Hospital is the only hospital in Singapore that has a dedicated Osteoporosis and Bone Metabolism Unit. However all of the hospitals, both public and private, have physicians who manage patients with osteoporosis. Orthopaedic surgeons, endocrinologists and rheumatologists are mainly responsible for managing the care of osteoporosis patients, although the geriatricians, gynaecologists, internal medicine specialists and family physicians also receive specific training on osteoporosis as part of the medical curriculum, and they also manage patients with osteoporosis.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is a national health priority in Singapore as mandated by the MOH in 2009 along with the publication of national guidelines on osteoporosis.

Many organizations are actively involved in carrying out recommendations in the guidelines by conducting public health education initiatives. Especially active are the Health Promotion Board, The Endocrine and Metabolic Society of Singapore (EMSS) and the Osteoporosis Society of Singapore (OSS).

**TABLE 2** Diagnostics access and cost in Singapore

	DXA	ULTRASOUND
Waiting time (d)	7	not recommended
Cost (USD)	87	-
Is it reimbursed?	No (however in public hospitals, it is offered at a subsidized rate)	-
Is reimbursement a barrier to access to treatment?		-

Public health programmes focus on:

- Nutrition (vitamin D/Ca)
- Exercise
- Falls prevention
- Screening

## Guidelines

The MOH Clinical Practice Guidelines on Osteoporosis were published in March 2008, and were officially launched on April 4, 2009 at a scientific meeting organized by the MOH and the Osteoporosis Society (Singapore)<sup>10</sup>.

These guidelines address population screening (through the Osteoporosis Self-Assessment Tool for Asians - OSTA) but not fracture risk assessment because a FRAX model did not exist in Singapore at the time the guidelines were published. Criteria for treatment are outlined including guidance on medication choices, prior fracture, age, and bone mineral density (BMD).

## Audit and quality indicator systems

The secondary fracture prevention programme, OPTIMAL, which is instituted in all the government hospitals and polyclinics of Singapore, has a centralized data entry system that allows for easy audit if necessary.

## TREATMENT

The Singapore health-care system does not operate on a reimbursement scheme, therefore, reimbursement is not provided for osteoporosis treatment and care, and

costs are currently borne by the individual patient. To provide some relief, the government does subsidize care based on the financial class of the patient for inpatient care and for outpatient follow-up. However, studies show that osteoporosis care, including medications, remains comparatively expensive, which may contribute to non-compliance by patients. This may then potentially increase the risk of fractures and thus indirectly contribute to health care costs<sup>3</sup>.

## DIAGNOSTICS

The diagnosis of osteoporosis in Singapore is made mainly through assessment by DXA scan, and ultrasound is rarely used (*Table 2*). DXA is widely available in Singapore, and currently there are 16.9 DXA machines available per one million in population<sup>11</sup>. The waiting time for a scan is approximately a week and the cost is approximately 87 USD – which is not reimbursed but may be subsidized according to the patient's financial state.

## RECOMMENDATIONS

- The unmet needs in osteoporosis care and barriers need to be identified in order to find out whether the focus should be shifting from education and preventive measures amongst the public to support for physicians through provision of more resources and modification of existing systems of care<sup>3</sup>. This includes evaluating the effectiveness of the 2008 Clinical Practice Guidelines and to increase engagement of both primary care as well as specialist physicians in the adoption of the guidelines<sup>3</sup>.
- Now that the secondary fracture prevention programme, OPTIMAL, is in its fifth year, Singapore can now begin to look at the cost effectiveness of this programme, and document consequent health benefits<sup>3</sup>.
- Newer studies are needed on fracture incidence and osteoporosis prevalence to assess the current care burden imposed by osteoporosis and its complications in Singapore.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Cheen, MHH, Kong, MC, Zhang, RF, Tee, FMH & Chandran, M 2012, 'Adherence to osteoporosis medications amongst Singaporean patients', *Osteoporos Int*, vol. 23, pp. 1053-1060.
3. Zhen, M, Tan, W, Bee, CS & Chandran, M 2012, 'A Review of the 2008 Singapore Ministry of Health Clinical Practice Guidelines on Osteoporosis and an Update', *J ASEAN Fed Endocrine Soc*, vol. 27, no. 2, pp. 159-169.
4. Chandran, M, Howe, TS, Goh, SK, Li, HH, Ng, A, Zhang, RF & Koh, J 2012, 'Vitamin D Levels, Physical and Biochemical Characteristics of South East Asian Patients with Osteoporotic Hip Fractures', *J ASEAN Fed Endocrine Soc*, vol. 27, no. 2, pp. 185-190.
5. Chandran, M, Howe, TS, Goh, SK, Li, HH, Ng, A, Zhang, RF & Koh, J 2012, 'Vitamin D Levels, Physical and Biochemical Characteristics of South East Asian Patients with Osteoporotic Hip Fractures', *J ASEAN Fed Endocrine Soc*, vol. 27, no. 2, pp. 185-190.
6. Chan, SP, Scott, B & Sen, S 2010, 'An Asian viewpoint on the use of vitamin D and calcium in osteoporosis treatment: Physician and patient attitudes and beliefs', *BMC Musculoskelet Disord*, vol. 11, p. 248.
7. Dhanwal, D, Dennison, E, Harvey, N & Cooper, C 2011, 'Epidemiology of hip fracture: Worldwide geographic variation', *Indian J Orthop*, vol. 45, no. 1, pp. 15-22.
8. Mithal, A & Kaur, P 2012, 'Osteoporosis in Asia: A Call to Action', *Current Osteoporosis Reports*, vol. 10, no. 4, pp. 245-247.
9. Chandran, M, Tan, MZ, Cheen, M, Tan, SB, Leong, M & Lau TC 2013, 'Secondary prevention of osteoporotic fractures-an "OPTIMAL" model of care from Singapore', *Osteoporos Int*, [Epub ahead of print].
10. Ministry of Health Singapore 2009, viewed 14 November 2013, <[http://www.moh.gov.sg/content/moh\\_web/healthprofessionalsportal/doctors/guidelines/cpg\\_medical/2009/cpgmed\\_osteoporosis.html](http://www.moh.gov.sg/content/moh_web/healthprofessionalsportal/doctors/guidelines/cpg_medical/2009/cpgmed_osteoporosis.html)>.
11. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>.



Sri Lanka

## CURRENT

- Population **21.6**
- Aged over 50 years **24%**
- Life expectancy **76 years**
- Hip fracture incidence per year **no data**
- Cost per hip fracture **no data**
- Number of DXA per million population **0.1**
- Fracture liaison services **not implemented**

## PROJECTED 2050

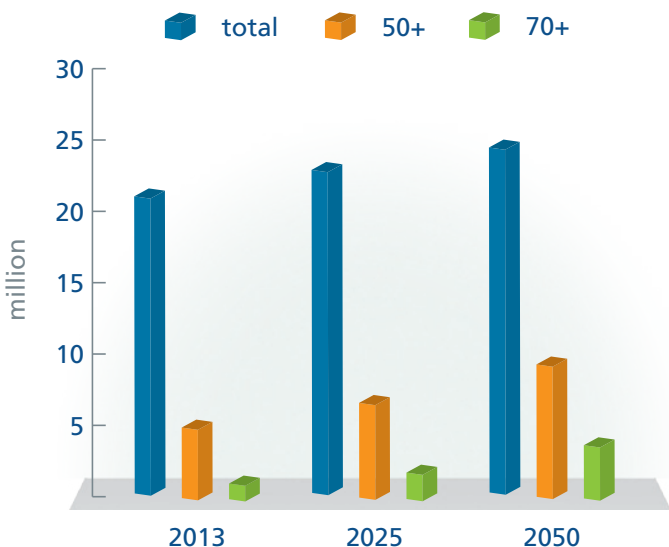
- Population **25.1 million** ↑
- Aged over 50 years **38%** ↑
- Life expectancy **82 years** ↑

# SRI LANKA

## COUNTRY OVERVIEW

Sri Lanka's population was 21.6 million in 2013, and is expected to increase by approximately 16% between 2013 and 2050, rising to 23.5 million by 2025 and to 25.1 million by 2050<sup>1</sup>. Life expectancy will also increase from age 76 years to 82 years (*Figure 1*). With an ageing population, the proportion of those aged over 50 years, currently making up 24% of the population, will increase to 29% of the population by 2025 and 38% by 2050. There will be a dramatic 245% rise in those aged over 70 years by 2050, from 1.1 million in 2013 to 3.8 million (*Figure 2*). Thus, 15% of Sri Lanka's population will be over the age of 70 years in 2050. Although not currently well documented in Sri Lanka, the incidence of osteoporosis and related fractures are certain to increase along with the ageing population.

**FIGURE 2** Population projection for Sri Lanka



**FIGURE 1** Life expectancy in Sri Lanka



## State of osteoporosis/osteopenia

A study of 1,642 postmenopausal women from seven of the nine provinces in Sri Lanka estimated the prevalence of osteoporosis to be 45%<sup>2</sup>. Other studies tested men for osteoporosis with one finding 5.8% prevalence in men aged over 50 years<sup>3</sup>, and another finding 4% prevalence in men aged between 41–47 years<sup>4</sup>.

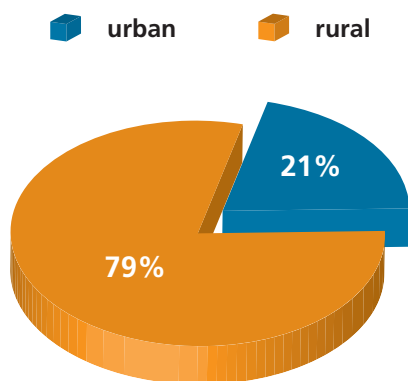
## Lifestyle

Available data is insufficient to make a firm conclusion on the adequacy of calcium (Ca) in the Sri Lankan diet. Green leaves, milk curd and small fish are the main sources of dietary Ca. In addition ground water in many parts of the country has a high Ca content and it can be a potential source of Ca in the Sri Lankan population.

Vitamin D deficiency or insufficiency, however, may be common. A recent study of 434 community-dwelling, healthy middle-aged women found severe vitamin D deficiency (<12.5 nmol/L) in 21.4% of subjects, whereas 19.1% subjects had moderate (12.5–25.0 nmol/L) and 15.7% had mild (25.1–35.0 nmol/L) vitamin D deficiency<sup>5</sup>.

Perhaps, however, low vitamin D levels may not be linked to urbanization (like they are in other Asian countries) since Sri Lanka is 80% rural (*Figure 3*)<sup>6</sup>, and further investigation is needed to shed light on the specific reasons.

**FIGURE 3** Urban versus rural population in Sri Lanka<sup>6</sup>



Additionally, physicians have reported that drug compliance is a serious concern as many patients discontinue medications without medical advice. Unsupervised continuation of oral bisphosphonates beyond the recommended period is also sometimes observed.

## Level of awareness

While Sri Lanka has a national health system that allows for cost-efficient access to osteoporosis treatment, many

challenges exist, including the lack of priority given to the disease. As mentioned later, limited amount of osteoporosis related epidemiologic data exists, drug compliance is low, less than half the hip fractures are treated surgically and disease management does not exist. Currently, disease education in Sri Lanka focuses mainly on heart, lung and contagious diseases. In an ageing population, the effects of osteoporosis are bound to affect Sri Lanka, and improvements are needed in overall public awareness as are educational enhancements in the medical community to ensure optimal patient care.

## FRACTURE RATES

### Hip fracture

According to the national societies, the number of patients presenting with osteoporosis-related fractures, especially hip and vertebral fractures, has increased in recent decades in Sri Lanka. Although this could partly be due to increased ascertainment secondary to improved orthopedic services, the majority of clinicians believe there has been a definite increase in fracture incidence over the years. One study using FRAX estimated the 10-year probability of a major osteoporotic fracture in Sri Lankans aged over 65 years to be 11% in men and 14% in women<sup>7</sup>. This categorized Sri Lankans as being at intermediate risk when compared to other countries<sup>7</sup>. However, the dearth of good quality epidemiological data remains a major barrier to deriving accurate estimates of disease impact.

When a Sri Lankan experiences a hip fracture they are likely to wait over 3 days for surgery, if surgery is even an option, since just 25–50% of hip fractures are treated surgically.

### Other fragility fractures

Data not provided.

### Vertebral fractures

Data not provided.

## COSTS OF FRACTURE

Information not currently available.

## FRACTURE REGISTRIES

Some of the hospitals in Sri Lanka have organized fracture registries through their individual institutions. Generally the registries capture information on hip fractures for both men and women over the age of 40 years.

## FRACTURE LIAISON SERVICES

Fracture liaison services are not part of osteoporosis management in Sri Lankan hospitals.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis is mainly managed by endocrinologists and internal medicine physicians in Sri Lanka; however specific training on managing osteoporosis is also offered to the orthopaedists and rheumatologists. Other physicians who may care for patients include family doctors and rehabilitation medicine physicians.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a national health priority in Sri Lanka. The current health-care system gives priority to non-communicable diseases (NCDs) such as those of the heart and lungs, together with diabetes and cancer. Additionally, approximately 35% of deaths are from communicable diseases and infections such as dengue and leptospirosis<sup>8</sup>. With such a large contribution to national morbidity and mortality figures from infectious diseases, resources available to focus on the silent disease of osteoporosis are scarce.

While osteoporosis is not a focus, the disease may receive some indirect benefit from the activities implemented for the other priority NCDs such as the promotion of a healthy diet, physical activity and the reduction of alcohol intake and smoking. Additionally, the Ministry





of Health recognizes falls as one of the five major categories of unintentional injuries (along with road traffic injuries, burns, poisoning and drowning)<sup>8</sup>. Again, it is possible that those with osteoporosis may benefit from programmes implemented in these areas for the population as a whole.

The national society Osteoporosis Sri Lanka targets policy makers regarding osteoporosis-related fractures and lobbies for sensible and economical ways to overcome the disease burden. The society makes significant efforts toward providing accurate information and raising osteoporosis awareness among the general public, media and health authorities.

### Guidelines

Guidelines for the management of osteoporosis were first available in Sri Lanka in 2007 and are being updated. The guidelines cover osteoporosis in postmenopausal women and glucocorticoid-induced osteoporosis. The fracture risk assessment and treatment guidance includes prior fracture, age and FRAX.

### Audit and quality indicator systems

Audit and quality indicator systems are not available in Sri Lanka for the management of osteoporosis.

## TREATMENT

Sri Lanka is one of the only developing nations to provide universal health care to its population. Coverage is provided by a combination of government and private-sector insurance and allows Sri Lankans to access services and treatments at low out-of-pocket cost (*Table 1*).

Access and cost do not appear to be an issue for osteoporosis treatment. However, drug compliance and disease management are an issue, especially in the area of secondary fracture prevention. Often, specific drugs are not routinely prescribed after the first fragility fracture, and when prescribed many patients discontinue medications without medical advice. This is mainly due to the lack of a widespread liaison service to cover this part of the patient care. Typically, bisphosphonates are the first-line treatment but a concern here is the often unsupervised continuation of treatment beyond the recommended period.

**TABLE 1** Treatments available in Sri Lanka and reimbursement levels

	YES	NO	IF YES, % REIMBURSED
Risedronate	x		private sector only
Alendronate	x		100%
Ibandronate	x		private sector only
Zoledronic acid	x		100%
Clodronate		x*	
Pamidronate		x*	
Raloxifene	x		private sector only
Bazedoxifene		x*	
Denosumab		x*	
Strontium Ranelate		x*	
Teriparatide	x		private sector only
PTH (1-84)		x*	
Vitamin D/Ca supplements	x		100%
Calcitonin	x		private sector only
Hormone Replacement Therapy	x		private sector only
Testosterone	x		100%
Alfacalcidol	x		100%
Calcitriol	x		private sector only

\*not available

## DIAGNOSTICS

There is limited access to bone mineral density (BMD) testing with the number of dual-energy x-ray absorptiometry (DXA) scanners at 0.1 machines per one million people<sup>11</sup>. When DXA is accessed, reimbursement is not a problem since the cost of 27 to 67 USD is covered by the government and/or private health insurance (*Table 2*).

## RECOMMENDATIONS

The national society Osteoporosis Sri Lanka believes that the introduction of a Sri Lankan FRAX model would improve patient care across the country. It would provide a way to estimate fracture risk in areas where access to DXA is limited. Country-specific intervention thresholds have been published recently and it will

**TABLE 2** Diagnostics access and cost in Sri Lanka

	DXA	ULTRASOUND
Waiting time (d)	immediate	n/a
Cost (USD)	27-67	n/a
Is it reimbursed?	yes	n/a
Is reimbursement a barrier to access to treatment?	no	n/a
N/A data not available		

provide a uniform platform for clinicians to make treatment decisions<sup>9</sup>.

Sri Lanka could benefit from a mechanism to capture all patients presenting with the first fragility fracture and offering them proper secondary prophylaxis. Additionally, improvements are needed in overall osteoporosis awareness in the general public and education needs to be improved in the medical community about proper patient care.

## REFERENCES

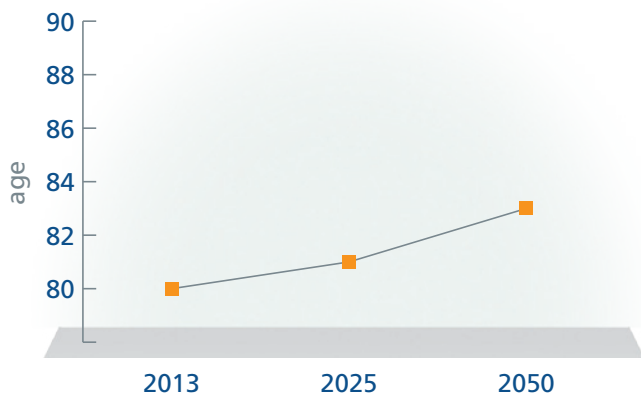
1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Lekamwasam, S, wijayarathne, L, rodrigo, M, hewage, U 2007, 'Prevalence of osteoporosis among postmenopausal women in Sri Lanka: a cross-sectional community study', *Int J Rheum Dis*, vol. 10, no. 3, pp. 234–238.
3. Lekamwasam, S, Wijayarathne, L, Rodrigo, M & Hewage, U 2009, 'Prevalence and determinants of osteoporosis among men aged 50 years or more in Sri Lanka: a community-based cross-sectional study', *Arch Osteoporos*, vol. 4, no. 1-2, pp. 79–84.
4. Siribaddana, SH, Komas, Y, Fernando, DJS 2008, 'Quantitative ultrasound of bone and calcium intake in suburban males in Sri Lanka', *Int J Rheum Dis*, vol. 11, no. 4, pp. 407–413.
5. Rodrigo, M, Hettiarachchi, M, Liyanage, C, Lekamwasam, S 2013 'Low serum vitamin D among community-dwelling healthy women in Sri Lanka', *Health*, vol. 5, no. 12A5 (In press).
6. *Rural Population (% Of Total Population) In Japan 2013*, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/japan/rural-population-percent-of-total-population-wb-data.html>>.
7. Kanis, JA, Odén, A, McCloskey, EV, Johansson, H, Wahl, DA & Cooper, C 2012, 'A systematic review of hip fracture incidence and probability of fracture worldwide', *Osteoporos Int*, vol. 23, no. 9, pp. 2239–2256.
8. *Ministry of Health Sri Lanka 2013*, <<http://www.health.gov.lk/en/>>.
9. Lekamwasam, S 2013, 'Sri Lankan FRAX model and country-specific intervention thresholds', *Arch Osteoporos*, vol. 8, no.148, pp. 147–152.
10. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat*, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp/>>: Kanis, JA, data on file.

# CHINESE TAIPEI

## COUNTRY OVERVIEW

Thirty-two per cent (32%) of Chinese Taipei's men and women were aged over 50 years in 2013; equivalent to 7.5 million (of the 23.3 million total population) who are most at risk for osteoporosis. The average life expectancy of 80 years in 2013, is predicted to increase to 81 years and 83 years in 2025 and 2050 respectively (Figure 1). Projections show that while the total population will decrease by approximately 10% by the year 2050 to 20.8 million, the proportion of men and women aged over 50 years will increase drastically by 31% in 2025 and 59% in 2050 (Figure 2). This means that 42% of the Chinese Taipei population will be aged over 50 years in 2025, and over half (57%) will be aged over 50 years in 2050<sup>1</sup>.

FIGURE 1 Life expectancy in Chinese Taipei



The population aged over 70 years is expected to increase by 189% by 2050, growing from 1.92 million in 2013 to 5.5 million in 2050. Combined with the fact that one in three women and one in five men over age 50 years are predicted to experience a fragility fracture in their remaining lifetime, the burden of osteoporosis will continue to grow in Chinese Taipei<sup>2</sup>.



Chinese Taipei

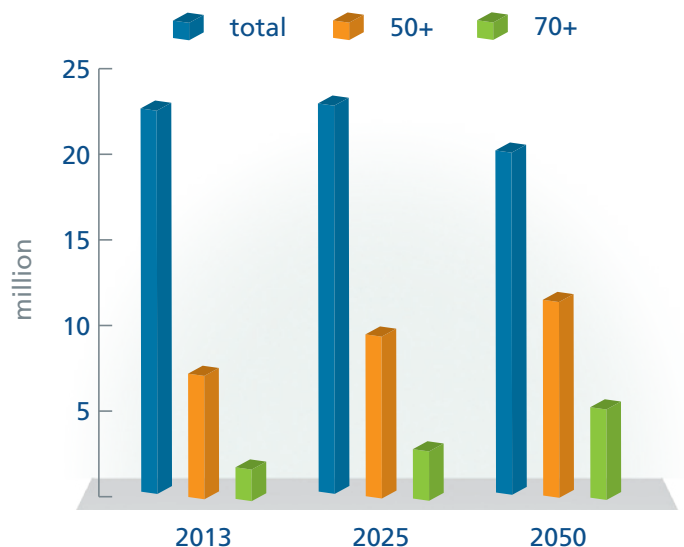
## CURRENT

Population **23.3 million**  
 Aged over 50 years **32%**  
 Life expectancy **80 years**  
 Hip fracture incidence per year **392/100,000** (women)  
 Cost per hip fracture **3,242 USD**  
 Number of DXA per million population **8.7**  
 Fracture liaison services **10-25% of hospitals**  
 National health priority status **since 2005**

## PROJECTED 2050

Population **20.8 million** ↓  
 Aged over 50 years **57%** ↑  
 Life expectancy **83 years** ↑

FIGURE 2 Population projection for Chinese Taipei



## State of osteoporosis/osteopenia

The Taiwanese Osteoporosis Association states that approximately 1.6 million people in Chinese Taipei, including 950,000 postmenopausal women, suffer from osteoporosis. Many studies have been conducted and their findings support this estimated prevalence. The latest study using bone mineral density (BMD) was conducted by the 2004-2008 National Nutrition and Health Survey in Chinese Taipei (NAHSIT) and reported that 41.2% of women and 22.6% of men older than 50 years of age have osteoporosis<sup>5</sup>. Unfortunately, most patients with osteoporosis, including those presenting with fragility fractures, were not diagnosed, evaluated or treated, and the prevalence appears to be rising since the year 2000<sup>2,8</sup>. One study of community-dwelling women aged over 50 years indicated that the prevalence of osteoporosis was 12% in 2001 and 14% in 2006<sup>3,4</sup>. Another study estimated mild to severe osteoporosis (T-score of  $< -2.5$ ) in 54% of the population aged over 50 years, and another study reported low BMD (T-score of  $-1.0$  to  $-2.5$ ) in 47% of women and in 57.1% of men in this age group<sup>6</sup>. These figures would translate into increased hip fracture risk, in which Chinese Taipei ranks as one of the highest in Asia and may be higher than the world average<sup>7</sup>.

## Lifestyle

Similar to Mainland China and Hong Kong, Chinese Taipei has been experiencing urbanization over recent decades and with it comes lifestyle changes such as lower physical activity and less exposure to sunlight, both of which are contributors to osteoporosis risk<sup>4</sup> (Figure 3). One study of middle-aged Taipei City women found that

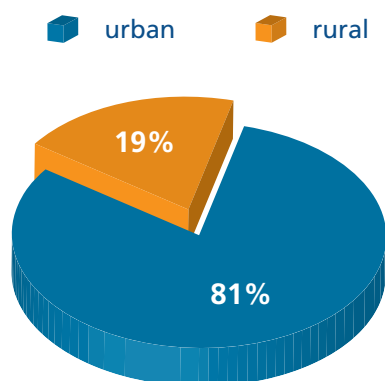
about 50% had low vitamin D levels and low bone density levels, and the data from the NAHSIT found vitamin D levels below 20ng/mL in 61.1% of men and in 71.3% of women aged older than 19 years<sup>7,14</sup>. Another study found that the average daily calcium intake was just 622 mg and 628 mg for older men and women respectively, which is lower than the daily recommended intake of 1,000 mg<sup>4</sup>. Additionally, the Chinese Taipei population may have low rates of adherence to anti-osteoporosis drugs. One study found that men and women from Chinese Taipei were less likely to comply with bisphosphonate prescriptions due to the inconvenience of taking the medication (remaining upright and avoiding food for 30 minutes)<sup>2</sup>. This is another lifestyle aspect that may be contributing to the increase in osteoporosis and fractures in Chinese Taipei.

## Level of awareness

Health care in Chinese Taipei is improving, partially due to the introduction of the National Health Insurance (NHI) system, and patients are experiencing an increase in life expectancy. The transition into an ageing society has caught the attention of policy makers who are now interested in diseases that affect the elderly<sup>7</sup>. These include osteoporosis, which was officially documented as a national health priority in 2005 in conjunction with the Health Promotion Administration's osteoporosis prevention and public awareness campaigns.

Having the government on board is a step in the right direction, but awareness of osteoporosis still has a long way to go to reach individuals at the community level. The Taiwanese Osteoporosis Association recently released a report saying that as many as 74% of the public is unaware that a loss of body height is a likely sign of osteoporosis in women<sup>9</sup>. Another study found that that 58% of participants believed that osteoporosis is a serious condition, 60% believed they were at risk and 50% believed they would benefit from preventive osteoporosis behaviour, but 60% indicated that they had difficulty taking action<sup>3</sup>. Finally, a study on drug compliance concluded that many patients and doctors are not aware of the importance of taking osteoporosis medications to reduce fracture risk. This study pointed out that bisphosphonate therapy has been available in Chinese Taipei since the early 1990s; however, the cumulative re-fracture rates were increased among those not adhering to medications<sup>2</sup>. The awareness of osteoporosis management among patients and physicians clearly needs to be improved<sup>9</sup>.

**FIGURE 3** Urban versus rural population in Chinese Taipei<sup>8</sup>



## FRACTURE RATES

### Hip fracture

A recent systematic review indicated that the annual hip fracture rate (392/100,000 for women and 196/100,000 for men, standardized for the world population in 2010) in Chinese Taipei was among the highest worldwide and the highest among Asian nations, especially for men<sup>7,10</sup>. With low bone mass in 47.5% of women and 57.1% of men aged over 50 years, the incidence of hip fracture is similar to, if not higher than, rates in Western countries, especially in elderly men<sup>6</sup>. One study showed increases in hip fracture incidence in those aged over 65 years from 49.6 per 100,000/year to 64.4 per 100,000/year from 1996–2002<sup>2</sup>. From this, it was estimated that the annual number of hip fractures in 2009 was approximately 16,000, with women over 70 years having a 10% risk of fracturing at least one hip<sup>7</sup>. Furthermore, 15% of women and 22% of men in Chinese Taipei die within the first year after hip fracture from infections related to being bedridden<sup>9</sup>. There is some good news; in patients followed through 2009, consistent with trends over the last decade from other countries it was found that the age-related hip fracture incidence in Chinese Taipei declined in men and women aged over 60 years<sup>11</sup>. However, this decline in incidence over time will be offset by an increase in absolute number of fractures due to an ageing population.

In Chinese Taipei, approximately 90% of hip fractures are managed surgically, and the average waiting time for hip surgery after fracture is 1–2 days. After 2010, Diagnosis Related Group (DRG) payments were introduced for orthopaedic procedures, and as a result some evidence suggested length of stay decreased by about 10%. Detailed analyses of the NHI database are in progress.

### Other fragility fractures

In Chinese Taipei, approximately one in three women and one in five men over age 50 are expected to experience an osteoporotic fracture in their remaining lifetimes<sup>2</sup>. It has been found that the prevalence of osteoporosis and related fractures in Chinese Taipei is similar to that of the United States<sup>7</sup>. Access to treatment could be partially to blame for these high numbers. According to the 2006–2007 Chinese Taipei NHI hip fracture data, only 27% of hip fracture patients received bone density examinations, and 34% received drug

treatment for osteoporosis, showing that many patients were not given the opportunity to have appropriate testing to diagnose osteoporosis and are therefore not being treated<sup>9</sup>.

### Vertebral fractures

A study measuring osteoporosis through BMD scanning reported vertebral fractures in 31% of postmenopausal women aged 45–64 years, 53% of those aged 65–74 years, and 69% of those aged older than 75 years<sup>12</sup>.

## COST OF FRACTURE

The direct hospital costs of treating hip fractures in Chinese Taipei were approximately 3,242 USD with an average of 13 hospital bed days<sup>13</sup>. Additionally there were a significant amount of family and social resources that go into the care for a hip fracture patient<sup>9</sup> (*Table 1*).

TABLE 1 Hip fracture in Chinese Taipei

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$3,242 USD	13	95%

## FRACTURE REGISTRIES

A fracture registry in Chinese Taipei can be derived from the inpatient healthcare utilization and reimbursement database collected by the Chinese Taipei NHI administration. This enables fracture specific information to be sorted out and collected through analysis of the NHI's database. Also, Chinese Taipei's Ministry of Health and Welfare has published an annual report of the NHI healthcare resource utilization sorted by ICD9-CM codes since 1997 with free access at <http://www.mohw.gov.tw/CHT/Ministry/Index.aspx>.

In 2010, the NHI annual report collected inpatient fracture data that showed:

- 21,337 hip fractures in those aged over 40 years (assuming hospitalization admission = hip fracture number, utilizing ICD9-CM code 820).

- 44,787 other fractures (assuming hospitalization admission = fracture number utilizing ICD9-CM code 820 (hip), 806 (vertebral), 812 (humerus) and 813 (wrist). Given that only a minority of vertebral, wrist and humerus fractures would be hospitalized the total fracture numbers are significantly underestimated.

## FRACTURE LIAISON SERVICES

Formal fracture liaison services (FLS) in Chinese Taipei are rare and approximately just 10–25% of hospitals have implemented an FLS. However, at the individual physician level, many orthopaedic surgeons do hire private assistants to serve as a coordinator to collect patient information, arrange for treatment and manage osteoporosis patients so that secondary fractures can be prevented. And recently in 2013, the Taiwanese Osteoporosis Association began offering courses designed specifically for the training of nurses as osteoporosis care managers.

## SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

In Chinese Taipei, osteoporosis care is not primarily devolved to primary care physicians, mainly because the NHI does not require primary care gatekeeping for specialty referral. This results in multiple specialities managing osteoporosis. Mainly, it is the orthopaedic surgeons who look after most cases. Other specialists that also care for osteoporosis patients include: family doctors, rheumatologists, gynaecologists, endocrinologists, geriatricians, rehabilitation medicine physicians and internal medicine specialists.

For those listed specialists, osteoporosis is a recognized component of their speciality medical training. Additionally, osteoporosis as a recognized medical speciality in itself is gaining traction in Chinese Taipei. Since 2010 the Taiwanese Osteoporosis Association has been issuing certificates to osteoporosis specialists, and as of May 2013, there were 148 osteoporosis specialists



in Chinese Taipei. This is a huge step in the right direction, and the next step is to bring Chinese Taipei's Ministry of Health and Welfare on board towards recognizing osteoporosis as an independent medical speciality as well.

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is an officially documented national health priority in Chinese Taipei. The Health Promotion Administration in the Ministry of Health and Welfare made it official in 2005, along with prioritizing osteoporosis prevention and public awareness. In fact, several important osteoporosis education materials for nurses, menopausal women, and the general public were published in recent years and are available online at <http://health99.doh.gov.tw/default.aspx>

Action plans linked to the Health Promotion Authority focus on four main areas, including:

- Designing osteoporosis educational material for health care professionals and the general public
- Establishing national osteoporosis practice guidelines
- Hosting community and mass media campaigns to increase awareness and disseminate knowledge
- Subsidizing osteoporosis research or educational projects initiated by domestic organizations such as the Taiwanese Osteoporosis Association, or other experts in the field

Every year the Health Promotion Administration in collaboration with the Taiwanese Osteoporosis Association hosts public health programmes focusing on osteoporosis and nutrition, exercise and prevention, and offers these to the public through health symposiums and patient educational campaigns. For example, during key annual events such as Mother's day or World Osteoporosis Day, press conferences and media exposure about osteoporosis-related topics are always organized by both parties. Also, the Health-99 website operated by the Health Promotion Administration always posts updated information on osteoporosis for public access at <http://health99.doh.gov.tw/default.aspx>

## Guidelines

The 'Taiwan Osteoporosis Practice Guidelines' were published in Chinese in 2011 and in English in 2012. Collaboration between the Health Promotion Administration, National Health Research Institute and the Taiwanese Osteoporosis Association, these guidelines were then accepted for publication in 2013, and became the first guidelines from Chinese Taipei to be published in the National Guideline Clearing house<sup>7</sup>.

To disseminate them to health care professionals, 10 nationwide educational courses were offered in 2012 to 2028 physicians, nurses, and pharmacists. The courses significantly improved their knowledge and skills about caring for osteoporosis patients. In 2013, another 11 courses were extended to other health care professionals including dietitians, radiation technologists, and physical therapists – with three of the courses designed specifically for the training of nurses as osteoporosis care managers.

Additionally, the Taiwanese Osteoporosis Association published a summary version of the 2007 practice guidelines as a quick reference for health care professionals. The Chinese version was updated in 2011 and the English version was updated in 2012<sup>15</sup>.

The guidelines include the following elements: population-based screening (women aged over 65 years and men aged over 75 years should have dual-energy X-ray absorptiometry (DXA) testing for BMD status), suggested use of FRAX, prior fracture, age, BMD, and the Osteoporosis Self-assessment Tool for Asians (OSTA). These elements are broader than the reimbursement policies offered. For example, whereas the guidelines recommend that all women aged over 65 years and men aged over 70 years receive BMD testing, the NHI only reimburses BMD if there is prior history of a low-trauma fracture. Additionally, the guidelines recommend that a high-risk FRAX score in itself is a reason to start treatment for osteoporosis; however the NHI places many more requirements for reimbursement for osteoporosis treatment - such as evidence of prior hip or vertebral fracture plus T- score of bone mineral density by DXA  $\leq -2.5$ .

## Audit and quality indicator systems

Chinese Taipei quality indicators for the treatment of osteoporosis include the *Taiwan Quality Indicator Project*.

This is initiated by Chinese Taipei's Joint Commission on Hospital Accreditation and covers topics such as inpatient falls, falls associated injuries, and severity of injury. The quality indicator is reported quarterly.

## TREATMENT

Generally, treatment for osteoporosis in Chinese Taipei does not require a prior authorization and is reimbursed in full by the NHI; however conditions for reimbursement are extensive. Private insurance is available and will cover costs that are not covered by NHI (Table 2).

The conditions on which reimbursement is based include: prior fracture, age, BMD, secondary prevention,

first-line treatment, second-line treatment. These conditions do interfere with what physicians would normally recommend to patients, for example:

- First-line medications are only reimbursed for secondary prevention (one fracture plus  $T \leq -2.5$  or 2 fractures plus  $T \leq -1$ )
- Second-line medications (Teriparatide) have very strict reimbursement regulations since 2011 ( $T \leq -3 + \geq 2$  fractures + use first line agents for more than 1 year)
- Patients have to pay out-of-pocket for primary prevention (e.g.:  $T < -2.5$ , no fracture) or having one fracture but  $T > -2.5$
- Male patients have restriction on treatments: first-line agents are alendronate and zoledronic acid. Second line agent is teriparatide

**TABLE 2** Treatments available in Chinese Taipei and reimbursement levels

	YES	NO	IF YES, % REIMBURSED
Risedronate		x	
Alendronate	x*		100%
Ibandronate	x*		100%
Zoledronic acid	x*		100%
Clodronate		x	
Pamidronate		x	
Raloxifene	x*		100%
Bazedoxifene	x*		100%
Denosumab	x*		100%
Strontium Ranelate		x	
Teriparatide	x*		100%
PTH (1-84)		x	
Vitamin D/Ca supplements**		x*	10%
Calcitonin	x*		100%
Hormone Replacement Therapy	x		100%
Testosterone	x		100%
Alfacalcidol	x		100%
Calcitriol		x	

\* first line treatment

\*\* Only certain brands of calcium and active vitamin D3 were covered by the NHI.

## DIAGNOSTICS

Along with FRAX, DXA is used for diagnosing osteoporosis in Chinese Taipei. There are approximately 8.7 DXA machines per one million in general population<sup>16</sup>, and scans cost approximately 40 USD with a general waiting time of less than 2 weeks (Table 3). Reimbursement for DXA is limited and does pose a barrier to access. For example, the NHI has placed limits on reimbursement for BMD testing. Reimbursement occurs only if:

- The health status of the patient is associated with certain endocrine diseases
- There has been a non-traumatic fracture

**TABLE 3** Diagnostics access and cost in Chinese Taipei

	DXA	ULTRASOUND
Waiting time (d)	< 2 weeks	not used
Cost (USD)	40	
Is it reimbursed?	limited if conditions are met	
Is reimbursement a barrier to access to treatment?	yes	



- The patient is a man with prostate cancer before and after androgen deprivation therapy
- The patient is a postmenopausal woman undergoing osteoporosis treatment

Further, only three BMD examinations can be performed within the lifetime of a patient, and the interval between these examinations must exceed one year<sup>3</sup>.

Ultrasound is not considered a standardized diagnostic tool for osteoporosis in Chinese Taipei. It is only used for patient education campaigns as a means to attract more participants. All costs are paid by the sponsoring organizations for the campaigns.

## RECOMMENDATIONS

Establishing population specific FRAX intervention cut-points is essential in Chinese Taipei since the current FRAX calculator used, although launched in 2010, is still using the American cut-points for fracture risk because of lack of domestic, cost-effective analysis and data. As in other countries, data on hip fractures were mostly available; but epidemiological data on incidence, healthcare resource utilization, quality of life (utility) and mortality for other osteoporotic fractures are still scarce and limit the ability to perform cost-effective analysis. More nationwide data are needed to address this issue.

Additionally, since 2011, the new NHI reimbursement policy for osteoporosis medications required BMD data. The availability of DXA machines in the rural areas as well as the costs for the tests (only limited reimbursement) became an issue for acquiring needed medications. Medication cost drops of roughly 15% were noted with reimbursement policy changes. A suggestion by the Taiwanese Osteoporosis Association is to move toward a new cut off points-based reimbursement scheme when more data are available.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>.
2. Soong, YK, Tsai, KS, Huang, HY, Yang, RS, Chen, JF, Wu, PCH & Huang, KE 2013, 'Risk of refracture associated with compliance and persistence with bisphosphonate therapy in Taiwan', *Osteoporos Int*, vol. 24, pp. 511–521.
3. Chang, SF, Hong, CM & Yang, RS 2011, 'Global computer-assisted appraisal of osteoporosis risk in Asian women: an innovative study', *J Clin Nursing*, vol. 20, pp. 1357–1364.
4. Lan, TY, Hou, SM, Chen, CY, Chang, WC, Lin, J, Lin, CC, Liu, WJ, Shih, TF & Tai, TY 2010, 'Risk factors for hip fracture in older adults: a case-control study in Taiwan', *Osteoporos Int*, vol. 21, pp. 773–784.
5. Lin, YC & Pan, WH 2011, 'Preliminary Analysis of Bone Mineral Density among Taiwanese Adults from 2007-2008.'
6. Kruger, M, Todd, J, Schollum, L, Kuhn-Sherlock, B, McLean, D & Wylie, K 2012, 'Bone health comparison in seven Asian countries using calcaneal ultrasound', *BMC Musculoskeletal Disord*, vol. 14, p. 81.
7. Bureau of health Promotion, Department of Health, 2011, 'Taiwan Osteoporosis Practice Guidelines', viewed 20 November 2013 <<http://cebm.tmu.edu.tw/web/archive.php?class=101>>.
8. Taiwan 2013, Encyclopædia Britannica, viewed 01 September 2013, <<http://www.britannica.com/EBchecked/topic/580902/Taiwan>>.
9. The Taiwanese Osteoporosis Association, 2011-2013, 'Taiwanese Guidelines for the Prevention and Treatment of Osteoporosis'.
10. Kanis, JA, Oden, A, McCloskey, EV, Johansson, H, Wahl, DA & Cooper, C 2012, 'A systematic review of hip fracture incidence and probability of fracture worldwide', *Osteoporos Int*, vol. 23, no. 9, pp. 2239-2256.
11. Wang, CB, Lin, CFJ, Liang, WM, Cheng, CF, Chang, YJ, Wu, HC, Wu, TN & Leu, TH 2013, 'Excess mortality after hip fracture among the elderly in Taiwan: 3 A nationwide population-based cohort study', Epub ahead of print.
12. Kung, A, Fan, T, Xu, L, Xia, WB, Park, IH, Kim, HS, Chan, SP, Lee, JK, Koh, L, Soong, YK, Soontrapa, S, Songpatanasilp, T, Turajane, T, Yates, M & Sen, S 2012, 'Factors influencing diagnosis and treatment of osteoporosis after a fragility fracture among postmenopausal women in Asian countries: a retrospective study', *BMC Women's Health*, vol. 13, p.7.
13. Wong, CW & et al. 2008, 'Epidemiology and Medical Costs of Patients with Hip Fracture at a Medical Center in Central Taiwan', *J Emerg Med*, Taiwan, vol. 10, no. 3, pp. 81-86.
14. Lee, MS & et al. 2011, 'Preliminary Analysis of Taiwanese Vitamin D Status: From (NAHSIT) 1993-1996 to 2005-2008'.
15. International Osteoporosis Foundation 2012, 'Taiwanese Guidelines for the prevention and treatment of Osteoporosis', viewed 14 November 2013, <[http://www.iofbonehealth.org/sites/default/files/PDFs/National%20Guidelines/Taiwanese\\_guidelines\\_prevention\\_treatment\\_osteoporosis.pdf](http://www.iofbonehealth.org/sites/default/files/PDFs/National%20Guidelines/Taiwanese_guidelines_prevention_treatment_osteoporosis.pdf)>.
16. Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>.



Thailand

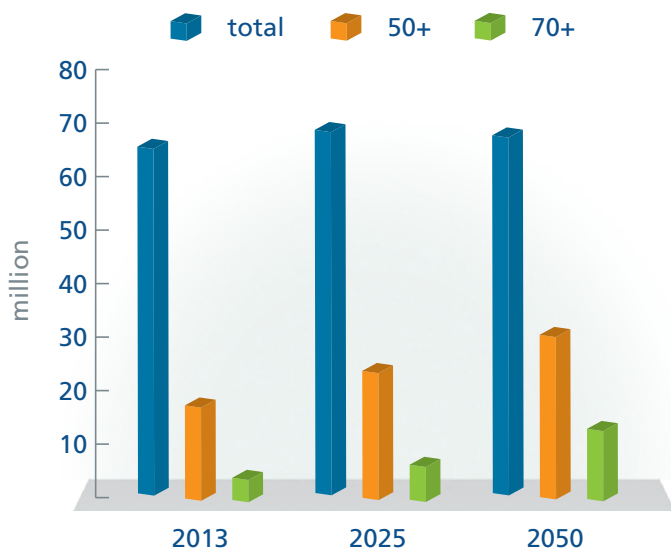
## CURRENT

Population **67.4 million**  
 Aged over 50 years **27%**  
 Life expectancy **74 years**  
 Hip fracture incidence per year  
**368/100,000** (women)  
 Cost per hip fracture **2,064 USD**  
 Number of DXA per million population **1.5**  
 Fracture liaison services **not implemented**

## PROJECTED 2050

Population **69.6 million** ↑  
 Aged over 50 years **45%** ↑  
 Life expectancy **81 years** ↑

FIGURE 2 Population projection for Thailand

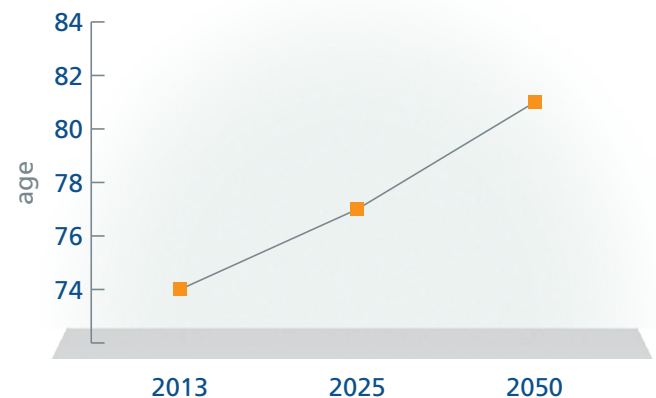


# THAILAND

## COUNTRY OVERVIEW

The population of Thailand, currently 67.4 million, is expected to increase by 5% to 70.6 million by 2025 and then taper off to approximately 69.6 million by 2050. Longevity is expected to increase by 9% from 74 years today to 81 years in 2050 (Figure 1). The population of those aged over 50 years, however, is projected to increase by 74% between 2013 and 2050, rising from 18.1 million to 31.5 million and will represent 45% of the population. Even more drastic is the predicted 216% increase in those aged over 70 years. This group totals 4.3 million today and will increase to 13.6 million by 2050 (Figure 2). Similar to the rest of Asia and elsewhere in the world, Thailand has an ageing population that will require a greater focus on osteoporosis and general healthcare over the coming years<sup>1</sup>.

FIGURE 1 Life expectancy in Thailand



## State of osteoporosis/osteopenia

It has been estimated that one-fifth of women aged between 40–80 years in Thailand have osteoporosis<sup>2</sup>. As reported in the IOF Asian Audit of 2009, the most current estimation of osteoporosis prevalence in Thailand comes from the 2000-2001 nationwide survey which found that the prevalence of osteoporosis

in Thai women aged over 40 years was 13.6% at the femoral neck and 19.8% at the lumbar spine. The age-specific prevalence was shown to increase with age from 0.4%–1.7% at age 40–44 years, to more than 50% after 70 years of age<sup>3</sup>.

## Lifestyle

One study showed that calcium intake was low (<400 mg/day) in almost all of the Thai postmenopausal women studied. The low dietary calcium levels were attributed to food limited in calcium and low consumption of milk due to it not being part of the traditional diet<sup>4</sup>.

A study of the Thai 4th National Health Examination Survey (2008–2009) found vitamin D insufficiency (low serum 25(OH)D levels) to be highly prevalent in the general adult population aged over 15 years. The severity varied throughout the country with the highest rate of vitamin D insufficiency found in the cities (threshold of 75 nmol/L). The overall prevalence of vitamin D insufficiency was 64.6% in Bangkok, 46.7% in other cities and 33% in rural areas<sup>5</sup>. Despite the abundance of sunshine, contributing factors may be limited outdoor sunshine exposure due to conservative dress, air pollution due to greater urbanization<sup>6</sup> (Figure 3), and increased use of sunblock. Additionally, as seen in some other regions of the Asia-Pacific, vitamin D insufficiency in Thailand was very prevalent in young females, which raises concern about the future bone health of these women<sup>5</sup>.

Despite low calcium intake from non-dairy food sources and reports of high prevalence of vitamin D insufficiency, Thai women have lower fracture rates and few reports

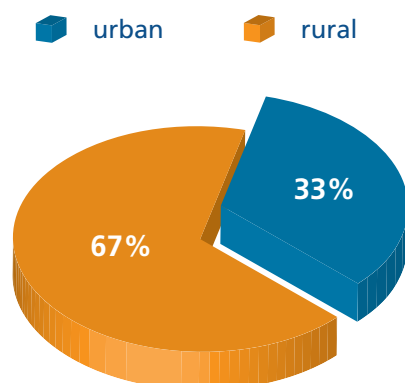
of osteomalacia when compared to their Caucasian counterparts who consume more dairy products and have lower prevalence of vitamin D insufficiency. Interestingly, one study of the traditional diet in the north-eastern part of Thailand found that insect-derived foods are a rich source of calcium though their bioavailability is untested.

## Level of awareness

It can be inferred from the literature that there is moderate awareness of osteoporosis among the medical community in Thailand. But it is clear that the diagnosis and treatment of this disease is not a priority amongst government officials and administrators of Thailand's national health insurance. Although guidelines on osteoporosis treatment have been published, the very limited access to diagnostic scans and low levels of reimbursement for treatment are inhibiting factors that restrict the general population's access to timely management of this silent disease.

Nevertheless, osteoporosis is a preventable condition and the Thai Osteoporosis Foundation (TOPF) has devoted efforts to creating public prevention campaigns. These highlight the need for appropriate exercise programmes, adequate calcium intake (particularly from food sources), and exposure to sufficient sunlight for vitamin D production. Guidelines for screening of those who have clinical risk factors for osteoporosis and fracture have been developed and distributed. The health authorities, in cooperation with various specialty societies and the TOPF, have been trying to reach a consensus on recommendations to treat osteoporosis cost-effectively and within the available budget, appropriate for the national gross domestic product (GDP).

**FIGURE 3** Urban versus rural population in Thailand



## FRACTURE RATES

### Hip fracture

A 2006–2007 hip fracture survey in Chiangmai, the northern capital of Thailand, found the age adjusted incidence of hip fracture in women aged over 50 years was 368/100,000 and in men was 136/100,000<sup>7</sup>. Compared to a similar study in 1997, the incidence of hip fracture in all men and women aged over 50 years increased by an average of 2% per year. In women aged over 50 years in particular, hip fractures increased 27% from 289/100,000 per year in 1997 to 368/100,000 per year in 2006. The 2006–2007 incidence of hip fracture was also shown to increase with age, from 26/100,000

per year in women aged 50–54 years to 1,407/100,000 per year in women older than 84 years of age<sup>7</sup>.

Death after hip fracture is a concern in Thailand. The mortality rate post hip fracture was 2.1% during hospitalization, increasing to 17% during the first year, with men at an increased risk of dying compared to women<sup>3</sup>. Studies show that Thai patients who do not receive surgery have almost double the risk of dying post hip fracture. This is a problem in Thailand because only 53% of hip fracture patients are treated surgically. For those who do have surgery, there is a 1–2 day waiting period<sup>3</sup>.

As reflected by the grim statistics earlier, most fracture patients are still not being identified and treated for osteoporosis in Thailand. The literature indicates that less than 1% of hip fracture patients receive bone mineral density (BMD) measurements and only 7% of hip fracture patients were diagnosed as osteoporotic. Moreover, less than 50% of patients received treatment for osteoporosis, such as calcium, vitamin D and/or antiresorptive agents<sup>3</sup>.

### Other fragility fractures

Data not provided.

### Vertebral fractures

While information is not available about the prevalence or incidence of fragility fractures in general, it has been reported that the incidence of vertebral fractures in men and women aged over 50 years evaluated morphometrically between 1997 and 2002 was 32.1/1000 in women and 54.5/1000 in men. Interestingly, the incidence in men was found to be higher than in women with the possible explanation that many of the male fractures could be trauma-related, attributed to the physical working environment that is more likely to suit men, rather than osteoporosis-related fractures<sup>8</sup>.

### COST OF FRACTURE

The median total cost of treating each hip fracture in Thailand is 3,645 USD (116,459 THB)<sup>3</sup>. According to the TOPE, the direct hospital costs are approximately 2,064 USD (65,941 THB). The average number of bed days a patient spends in the hospital is approximately 20.6 (Table 1).

**TABLE 1 Hip fracture costs in Thailand**

DIRECT HOSPITAL COSTS PER CASE (USD)	INDIRECT HOSPITAL COSTS PER CASE (USD)	AVERAGE HOSPITAL BED DAYS
\$2,064	\$1,951	20.6

### FRACTURE REGISTRIES

Thailand does not presently have fracture registries.

### FRACTURE LIAISON SERVICES

The hospitals in Thailand have not implemented fracture liaison services.

### SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Management of osteoporosis is devolved to specialty physicians and is included in the medical training for endocrinologists, orthopaedics, gynaecologists, rehabilitation physicians and internal medicine physicians. In some cases and hospitals, osteoporosis is recognized as a medical speciality in itself. Other physicians who also look after osteoporosis patients are rheumatologists and geriatricians.

### GOVERNMENT POLICIES

#### Osteoporosis as a documented national health priority

Osteoporosis is not yet documented as a national health priority in Thailand. Though the problem of osteoporosis and fractures is looming large over Thai society, it is not yet considered to be a high on the list of health priorities. This may be due to the disease's silent nature and the fact that fracture incidence is not felt to be high in a country of women with life expectancy of 75 years. With the foreseeable consequences of osteoporotic fractures, the TOPF has issued several guidelines successively to reflect the updated information. The latest guidelines are currently being used nationwide, and the health authorities are looking for an appropriate solution to follow the practice recommendations under the limited budget.

## Guidelines

The *Clinical Practice Guideline for Osteoporosis 2010* was published by the TOPF and Royal College of Orthopaedics of Thailand<sup>9</sup>. The guidelines cover osteoporosis in postmenopausal women, glucocorticoid-induced osteoporosis and osteoporosis in men. They provide screening guidance for patients who have indications for osteoporosis or osteoporotic fractures, and the guidelines address fracture risk assessment including evaluation of prior fracture status, age, BMD, and FRAX score. The guidelines are not always compatible with Thailand's reimbursement policy since osteoporosis treatment and drugs are not included in the national health insurance reimbursement policies.

## Audit and quality indicator systems

Thailand does not currently have any quality or audit indicators in place tracking the care of osteoporosis patients.

## TREATMENT

Thailand has a national health system covering health-care costs for its population; however the national essential list of reimbursable items does not include osteoporosis drugs, diagnostics and treatment to be automatically reimbursed, with the exception of calcium, vitamin D, hormone replacement therapy and testosterone. This situation is unlikely to change in the near future since a recent study determined that osteoporosis screening and treatment are not cost effective and should not be included in the public health benefit packages. This may result in many Thai osteoporosis patients foregoing diagnosis and treatment<sup>2</sup>.

In some cases it is possible to receive reimbursement if the physician writes to the government giving clear indications and need for treatment, after which, if approved, the patients will continue to be monitored and treated by their physician without the need for additional justifications to the government. Due to this policy, physicians cannot always prescribe what they would normally recommend for their osteoporotic patients.

While anti-osteoporosis drugs are not included in Thailand's National List of Essential Medications, first-line treatments that physicians generally prescribe are: alendronate, which is the most prescribed medication (39%), followed by raloxifene (26%), nasal calcitonin

(13%) and risedronate (2%)<sup>2</sup>. Again, these must be documented with clear indications for reimbursement, but most Thai patients end up paying for the medications out of pocket, if they choose to receive the treatment at all (*Table 2*).

## DIAGNOSTICS

There is limited availability to access either dual-energy x-ray absorptiometry (DXA) or ultrasound for the diagnoses of osteoporosis in Thailand, and neither is offered under the public health insurance scheme<sup>2</sup>. Further, according to a 2006 survey there are only 50 DXA machines available in the entire country so access is very limited<sup>3</sup> (an approximate density of 1.5 machines

**TABLE 2** Treatments available in Thailand and reimbursement levels

	YES	NO	IF YES, % REIMBURSED
Risedronate		x	
Alendronate		x	
Ibandronate		x	
Zoledronic acid		x	
Clodronate		x	
Pamidronate		x	
Raloxifene		x*	
Bazedoxifene		x	
Denosumab		x	
Strontium Ranelate		x*	
Teriparatide		x*	
PTH (1-84)		x	
Vitamin D/Ca supplements	x		100%
Calcitonin		x**	
Hormone Replacement Therapy	x		100%
Testosterone	x		100%
Alfacalcidol		x	
Calcitriol		x	

\* may be reimbursed by government with physician documentation of the indications for treatment

\*\* withdrawn as osteoporosis treatment

per one million of the population<sup>10</sup>). For those who do receive diagnostic care, reimbursement is not guaranteed since patients must have indications for reimbursement as documented by the physician and determined by the government. When accessed, waiting time for a DXA scan is under 7 days and costs from 70–140 USD depending on the body site scanned. Ultrasound can be accessed immediately and costs around 17 USD (Table 3).

**TABLE 3** Diagnostics access and cost in Thailand

	DXA	ULTRASOUND
Waiting time (d)	0-7	immediately
Cost (USD)	70 for one site 140 for LS and hip	17
Is it reimbursed?	yes, if patient has indications	yes, if patient has indications
Is reimbursement a barrier to access to treatment?	yes	yes

A FRAX model calibrated for Thailand is available for fracture risk assessment as is the Osteoporosis Self-Assessment Tool (OSTA) which is validated for the Asian population<sup>2</sup>. Furthermore, DXA-derived T score criteria and FRAX derived 10-year fracture probability treatment thresholds have yet to be clarified for the Thai population and validated in terms of clinical utility and cost-effectiveness.

## RECOMMENDATIONS

At present, approximately 80–90% of individuals at high risk for osteoporosis are not identified or treated. From both clinical and economic perspectives, aggressive measures to detect osteoporosis in its early stage are warranted. This reality calls for major steps, including operational research and identification of risk factors, to remove barriers and to seek more effective preventive measures<sup>3</sup>.

## REFERENCES

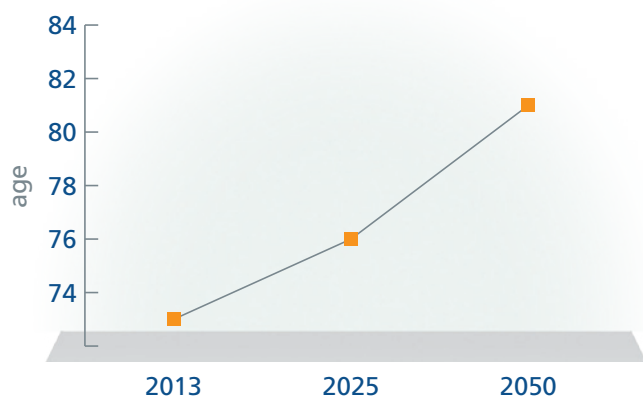
1. *United States Census Bureau 2013*, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>
2. Kingkaew, P, Maleewong, U, Ngarmukos, C & Teerawattananon, Y 2012, 'Evidence to Inform Decision Makers in Thailand: A Cost-Effectiveness Analysis of Screening and Treatment Strategies for Postmenopausal Osteoporosis', *Value in Health*, vol. 15, pp. 520-528.
3. Pongchaiyakul, C, Songpattanasilp, T & Taechakraichana, N 2008, 'Burden of osteoporosis in Thailand', *J Med Assoc Thai*, vol. 91, pp. 261-267.
4. Rajatanavin, R, Chailurkit, L, Saetung, S, Thakkinstian, A & Nimitphong, H 2013, 'The efficacy of calcium supplementation alone in elderly Thai women over a 2-year period: a randomized controlled trial', *Osteoporos Int*, [Epub ahead of print].
5. Chailurkit, LO, Aekplakorn, W & Ongphiphadhanakul, B 2011, 'Regional variation and determinants of vitamin D status in sunshine-abundant Thailand', *BMC Public Health*, vol. 11, p. 853.
6. *Rural Population (% Of Total Population) In Thailand 2013*, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/thailand/rural-population-percent-of-total-population-wb-data.html>>.
7. Wongtriratanachai, P, Luevitoonvechkij, S, Songpattanasilp, T, Sribunditkul, S, Leerapun, T, Phadungkiat, S & Rojanasthien, S 2013, 'Increasing incidence of hip fracture in Chiang Mai, Thailand', *Journal of Clinical Densitometry*, vol. 16, no. 3, pp. 347-352.
8. Jitapunkul, S, Thamarpirat, J, Chaiwanichsiri, D & Boonhong, J 2008, 'Incidence of vertebral fractures in Thai women and men: A prospective population based Study', *Geriatric Gerontology International*, vol. 28, pp. 251–258.
9. 2010 'Royal College of Orthopaedic Surgeons of Thailand and Thai Osteoporosis Foundation', Clinical practice guideline for osteoporosis.
10. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat*, World Population Prospects: The 2008 Revision, viewed March 28, 2011, <<http://esa.un.org/unpp>>: Kanis, JA, data on file.

# VIETNAM

## COUNTRY OVERVIEW

The population of Vietnam in 2013 was 92.4 million. Life expectancy was 73 years and is projected to increase by 11% by 2050, at which time the Vietnamese will be living to an average age of 81 years (Figure 1). The population is expected to grow to 102.4 million by 2025, and reach 111.1 million by 2050 (Figure 2)<sup>1</sup>. Population projections by age group show that by the year 2025 and 2050 the number of people aged above 50 years will be 25.9 million and 45.8 million respectively, with women accounting for approximately 50.5%. Most notably, the population aged over 70 years is expected to increase by 46% in just over a decade from 3.5 million in 2013 to 5.2 million in 2025. From 2025 to 2050 the number of individuals in this demographic of the population will increase by 202% to reach 15.87 million, comprising 14% of the total population in Vietnam.

**FIGURE 1** Life expectancy in Vietnam



## State of osteoporosis/osteopenia

Detecting the prevalence of osteoporosis has been difficult in Vietnam, due in part to the lack of ethnic-specific criteria for diagnosis; in many cases it is based on reference levels from the Western population<sup>2</sup>.

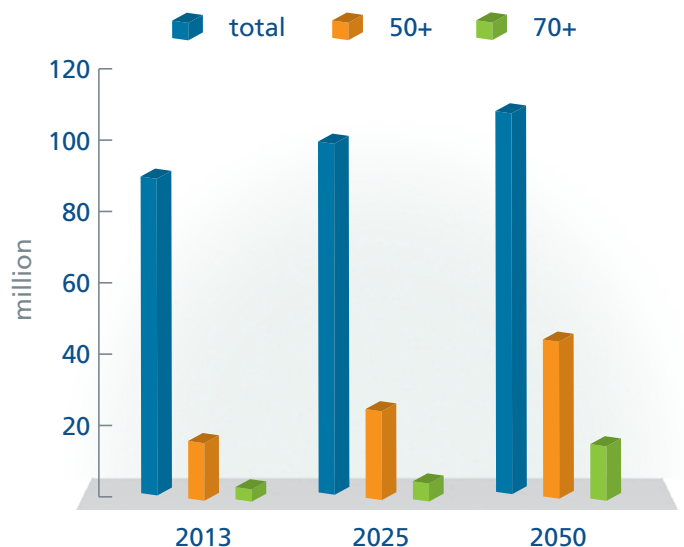
**CURRENT**

- Population **92.4 million**
- Aged over 50 years **18%**
- Life expectancy **73 years**
- Hip fracture incidence per year **no data**
- Cost per hip fracture **1,000–4,000 USD**
- Number of DXA per million population **< 0.1**
- Fracture liaison services **not implemented**

**PROJECTED 2050**

- Population **111 million** ↑
- Aged over 50 years **41%** ↑
- Life expectancy **81 years** ↑

**FIGURE 2** Population projection for Vietnam



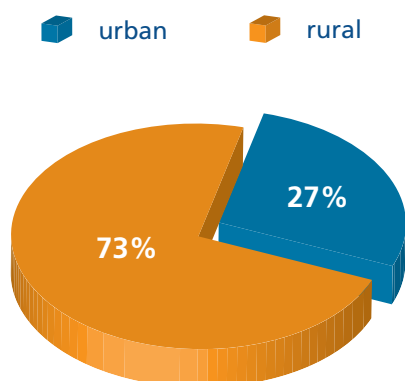
Notwithstanding this lack of data, it is likely that osteoporosis is one of the most common bone diseases in Vietnam. Previous studies estimated that prevalence of osteoporosis in the general population was 4.7%, similar to the prevalence of other common rheumatic diseases such as rheumatoid arthritis and osteoarthritis<sup>3</sup>. A more recent study on osteoporosis in women and men aged over 50 years reported the disease as highly prevalent and similar to that in developed countries at 30% and 10% respectively<sup>2</sup>. According to the Vietnam Rheumatology Association, assuming that the prevalence of osteoporosis in the general population in Vietnam is similar to the findings of these studies, the number of women with osteoporosis aged 50 years and above would likely be more than 7 million by the year 2050.

### Lifestyle

Investigation of urban and rural Northern Vietnamese of all ages demonstrated that vitamin D deficiency was highly prevalent and associated with low bone mineral density (BMD), particularly in women where prevalence of vitamin D deficiency (below 20 ng/mL) was 30%, compared with a figure of 16% in men<sup>4</sup>.

Although 73% of Vietnam’s population is still living in rural areas, the country is beginning to become more urbanized (*Figure 3*)<sup>5</sup>. As has occurred in other Asian countries with increasingly urbanized lifestyles, this too will become a risk factor for vitamin D deficiency due to indoor lifestyles resulting in less exposure to sunlight. Moreover, the highest prevalence of vitamin D deficiency was found in young Vietnamese women under the age of 30 years, and this held true for both rural and urban areas. A possible explanation for this

**FIGURE 3** Urban versus rural population in Vietnam<sup>5</sup>



is a current trend towards sun avoidance in this group, who may feel that fair, rather than tanned, skin is aesthetically more desirable<sup>6</sup>.

### Level of awareness

A study in Ho Chi Minh City found that awareness of vitamin D and its bone health benefits was inadequate overall; however younger participants and those with higher education levels had better knowledge of the benefits and sources. In general, information about vitamin D was obtained from the media such as newspapers, radio and TV but still as many as 17% of those surveyed did not know how they could increase their levels of vitamin D<sup>6</sup>.

Another study found low awareness among postmenopausal women when asked about the local calcium-rich food sources that are abundant in Vietnam (i.e. small fish and crabs). After providing nutrition education, the calcium consumption increased and bone loss slowed in the participants<sup>7</sup>. In a country such as Vietnam where calcium consumption is much lower than the recommended dietary allowance, studies such as this are important in pointing out the basic educational needs that will have a big impact on bone health.

## FRACTURE RATES

### Hip fracture

In the 2009 IOF Asian Audit, it was reported that annual hip fractures were projected to reach 47,652 by the year 2050. A 2013 survey of the national societies reported that between 10–25% of hip fractures in Vietnam are managed surgically, and the average waiting-time for hip surgery is more than 3 days. Treating hip fractures costs between 1,000 to 4,000 USD per treatment and account for an approximate hospital stay of 14 nights (*Table 1*).

**TABLE 1** Hip fracture in Vietnam

HOSPITAL COSTS PER HIP FRACTURE (USD)	AVERAGE HOSPITAL BED DAYS	SURGICALLY TREATED
\$1,000–4,000	14	10-25%



### Other fragility fractures

Data not provided.

### Vertebral fractures

A study, using spine radiographs, estimated, based on quantitative measurements of vertebral heights, that the prevalence of clinically undiagnosed vertebral fracture in Vietnamese men and women aged 50 years or older was 23% and 26%, respectively<sup>8</sup>. It is even higher in the elderly. Among those aged over 70 years, 41% of men and 42% of women had a vertebral fracture. These figures are similar to the vertebral fracture prevalence in Caucasian populations and pose a serious threat to the Vietnamese ageing population given that the 5-year risk of mortality after a vertebral fracture is increased by 20%<sup>8</sup>.

### COST OF FRACTURE

See hip fracture.

### FRACTURE REGISTRIES

Vietnam does not currently have a fracture registry.

### FRACTURE LIAISON SERVICES

Fracture liaison services have not been implemented in Vietnam.

### SPECIALISTS RESPONSIBLE FOR OSTEOPOROSIS

Osteoporosis in Vietnam is mainly managed by the country's rheumatologists. Other healthcare professionals who also take responsibility for osteoporosis care in Vietnam are the general practitioners, orthopaedic surgeons, endocrinologists, and internal medicine and rehabilitation physicians.

Of the specialities listed above, osteoporosis is a recognized component of speciality medical training for rheumatologists, geriatricians and internal medicine physicians.



**TABLE 2** Treatments available in Vietnam and reimbursement levels

	YES	NO	IF YES, % REIMBURSED
Risedronate		x	
Alendronate	x		depends on medical insurance plan
Ibandronate		x	
Zoledronic acid	x		depends on medical insurance plan
Clodronate		x	
Pamidronate		x	
Raloxifene		x	
Bazedoxifene		x	
Denosumab		x*	
Strontium Ranelate		x	
Teriparatide		x	
PTH (1-84)		x	
Vitamin D/Ca supplements	x		depends on medical insurance plan
Calcitonin	x		depends on medical insurance plan
Hormone Replacement Therapy		x	
Testosterone		x	
Alfacalcidol		x	
Calcitriol	x		depends on medical insurance plan

\*not available

## GOVERNMENT POLICIES

### Osteoporosis as a documented national health priority

Osteoporosis is not a national health priority in Vietnam.

### Guidelines

In 2012, the Vietnam Rheumatology Association published the, ‘Diagnosis and treatment of osteoporosis in guidelines for diagnosis and treatment of rheumatic diseases’. These guidelines in general are compatible

with the country’s reimbursement system and they address criteria for treatment of osteoporosis such as, prior fracture, age, BMD and FRAX.

### Audit and quality indicator systems

Vietnam does not have audit or quality indicators in place for osteoporosis care.

## TREATMENT

The Vietnamese national health-care scheme covers approximately 60% of the population with approximately 35 million people remaining uninsured. Private insurance is also offered to those who can afford it. The amount that patients pay out-of-pocket for osteoporosis treatment varies by the type of coverage, and these cost variations do interfere with what physicians in Vietnam would normally recommend to patients. For example, for the 40% without health-care coverage, physicians can prescribe a greater choice of medication (albeit at the patient’s cost); however, for those patients who have health-care coverage, physicians are limited to prescribing medications from a drug formulary that often has inflated prices.

In general, reimbursement by the national health-care system or state medical insurance for osteoporosis treatment requires a prior authorization, is limited to patients with BMD (T<-2.5 SD) and may vary between first-line and second-line treatments.

A handful of medications are offered for osteoporosis treatment, and generally the designated first-line treatments are vitamin D, calcium supplements and bisphosphonates. *Table 2* details the treatments offered and reimbursement levels.

## DIAGNOSTICS

When dual-energy x-ray absorptiometry (DXA) is used for diagnosing osteoporosis, the average waiting time for a scan is one day. However, there are very few DXA machines in Vietnam with a density of less than 0.1 per million of the population<sup>9</sup>. A scan costs approximately 10 USD and is reimbursed in part which can cause a barrier to access (*Table 3*). There is no information provided on the use of ultrasound for diagnosing osteoporosis.

**TABLE 3** Diagnostics access and cost in Vietnam

	DXA	ULTRASOUND
Waiting time (d)	immediate	n/a
Cost (USD)	10	n/a
Is it reimbursed?	in part	n/a
Is reimbursement a barrier to access to treatment?	sometimes	n/a
N/A data not available		

## RECOMMENDATIONS

Although osteoporosis is a devastating disease due to its consequences on individuals and society, it is not considered a national health priority in Vietnam. The Vietnam Rheumatology Association and its affiliates in Hanoi and Ho Chi Minh City are trying to raise awareness among the government and community on the importance of the disease. However, as insufficient data have been gathered about the state of osteoporosis, its risk factors and consequences, it is difficult to persuade authorities to consider osteoporosis as a priority in their agenda. Also, it will be beneficial for national societies and associations to launch programmes and/or campaigns focused on osteoporosis prevention such as: bone health education, exercise, nutrition including vitamin D and calcium intake, and falls prevention. To achieve these goals it will take a joint effort between the associations, the government and the international osteoporosis community. Vietnam needs to establish specific plans about tackling osteoporosis in the country, and call for international support and assistance from osteoporosis-focused individuals and organizations who can share successes and learning opportunities.

As a start, pending the availability of funding, the Vietnam Rheumatology Association would like to conduct osteoporosis studies in local communities across the nation. This is an important step since currently information about osteoporosis and bone diseases in Vietnam are not systematically and widely collected. Conducting national-scale research covering all aspects of bone health will enable Vietnam to develop programmes and deploy activities focusing on desired objectives for short- and long-term goals.

## REFERENCES

1. United States Census Bureau 2013, Census.Gov, viewed 01 September 2013, <<http://www.census.gov/population/international/data/idb/informationGateway.php>>
2. Ho-Pham, LT, Nguyen, UDT, 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*, vol. 12, p. 182.
3. Minh Hoa, TT, Darmawan, J, Chen, SL, Van Hung, N, Thi Nhi, C & Ngoc An, T 2003, 'Prevalence of the rheumatic diseases in urban Vietnam: a WHO-ILAR COPCORD stud', *J Rheumatol*, vol. 30, no. 10, pp. 2252–2256.
4. Nguyen, HT, Von Schoultz, B, Nguyen, TV, Dzung, DN, Duc, PT, Thuy, VT & Hirschberg, AL 2012, 'Vitamin D deficiency in northern Vietnam: prevalence, risk factors and associations with bone mineral density', *Bone*, vol. 51, no. 6, pp. 1029–1034.
5. *Rural Population (% Of Total Population) In Vietnam 2013*, Trading Economics, viewed 01 September 2013, <<http://www.tradingeconomics.com/vietnam/rural-population-percent-of-total-population-wb-data.html>>.
6. Ho-Pham, LT & Nguyen, MTT 2012, 'Survey on Knowledge and Attitudes on Vitamin D and Sunlight Exposure in an Urban Population in Vietnam', *J ASEAN Fed Endocrine Soc*, vol. 27, no. 2, pp. 191–195.
7. Hien, VTT, Khan, NC, Mai, LB, Lam, NT, Phuong, TM, Nhung, BT, Nhien, NV, Nakamori, M & Yamamoto, S 2009, 'Effect of community-based nutrition education intervention on calcium intake and bone mass in postmenopausal Vietnamese women', *Public Health Nutrition*, vol. 12, no. 5, pp. 674–679.
8. 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*, vol. 7, pp. 257–266.
9. *Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision*, viewed March 28, 2011, <<http://esa.un.org/unpp>>.

# CONCLUSIONS AND RECOMMENDATIONS

It is clear that osteoporosis and its outcome – fragility fractures – represent a major health problem which will dramatically increase in significance in the coming decades due to the ageing of the population.

It is projected that by 2050, 50% of all osteoporotic fractures will occur in Asia. By then the 16 countries represented in this audit will have a combined population of 1.7 billion people aged over 50 years of which 606 million will be aged over 70 years. The number of individuals over age 70 years will increase by 230% compared with 2013, and this is the population most vulnerable to costly hip fractures. Consequently, we can expect the number of hip fractures to at least double with a corresponding impact in terms of disability, lost quality of life years, and early death.

As well as the ageing of the population, other factors that will contribute to the rising burden of osteoporosis are the high prevalence of vitamin D insufficiency, urbanization, sedentary lifestyles, high levels of smoking, and low levels of calcium intake. The concern too is that the urban sedentary lifestyles and low levels of calcium and vitamin D will have an impact on the future bone health of children and adolescents, predisposing them to osteoporosis in later life.

The four years since the publication of the first Asian Audit in 2009 have seen some welcome progress. For example, in 2009 FRAX algorithms to assess individual 10-year risk of fracture were only available for China and Japan, whereas today this important assessment tool is available for 10 of the 16 countries in the report. As evidenced by China, Republic of Korea, Japan, Indonesia, Chinese Taipei and Thailand, more doctors are specializing in osteoporosis and there is greater awareness among health professionals in general. Guidelines for treatment and management have been published in the majority of the countries surveyed. As in other parts of the world, hip fracture incidence has seen a plateau in Hong Kong, Japan, Chinese Taipei and Australia – even though these secular trends will be offset by the marked increase in life expectancy and the ageing of the population.

Despite these and other signs of progress, this report indicates that osteoporotic fractures remain vastly under-diagnosed and under-treated in the Asia Pacific. There is a lack of solid epidemiological data on fractures and research is still scarce in many countries. There are often no formal standards of care and access to dual-energy X-ray absorptiometry (DXA) is limited in many countries or unavailable in rural areas. Reimbursement of medication is not available in all countries, and even when available may be only partial, limited to private health care, or subject to various restrictions including age or prior fracture. Health professional education in osteoporosis needs to be expanded in most countries, guidelines distributed and implemented, and fracture liaison services need to be established for secondary fracture prevention.

The Asia Pacific is a vast, multiethnic region with great disparities in economic development and health-care resources. Each country surveyed in this report faces special challenges and has specific approaches to the delivery of health care. Nevertheless, we can identify several clear recommendations which are the essential pillars of all effective long-term strategies to improve musculoskeletal health and prevent osteoporosis and related fractures:

## CAPACITY BUILDING, EDUCATION AND TRAINING OF HEALTH PROFESSIONALS

- Address gaps in knowledge among primary health-care professionals by including osteoporosis in the medical curriculum.
- Broadly disseminate and implement up-to-date medical guidelines for the prevention, diagnosis and treatment of osteoporosis.
- Disseminate knowledge of FRAX as a cost-effective alternative for fracture risk assessment if bone mineral density (BMD) is not indicated or DXA services are not available.
- Engage health-care providers and allied health professionals through regular training, and required certification, where applicable.

## **QUALITY IMPROVEMENT AND SECONDARY FRACTURE PREVENTION**

- Establish fracture liaison services in clinics and hospitals to systematically identify and treat fracture patients and thus help prevent secondary fractures.
- Implement adequate medical infrastructures and make available surgery protocols, especially to treat hip fractures. Hip fracture patients require timely surgery, after-care and rehabilitation to reduce risk of death and long-term disability.
- Institute and monitor quality assurance protocols for DXA measurements and vitamin D assays.

## **MUSCULOSKELETAL DISEASE PREVENTION: A PRIORITY HEALTH-CARE ISSUE**

- Policy makers must commit to the prevention of musculoskeletal diseases and fractures as a priority health-care issue.
- Specifically address widespread vitamin D insufficiency and consider fortification strategies.
- Establish nutritional guidelines to address low calcium intake in the population, which, as with low levels of vitamin D, have a detrimental impact on bone and muscle health.

## **SUPPORT RESEARCH TO GATHER REQUIRED EVIDENCE**

- Establish a national hip fracture registry to acquire accurate data on fracture prevalence and cost burden.
- Support and promote large-scale epidemiological studies, including on the prevalence and incidence of fractures, relevant country-specific risk factors, ethnic-specific data, information about health care resource utilization, quality of life and mortality for other osteoporotic fractures.
- Increase the number of studies on the cost-effectiveness of osteoporosis treatment and fracture prevention.
- In countries without a FRAX model, multi-centre, large-scale hip fracture incidence studies are needed for the validation of a FRAX tool. Also, data is

needed to establish population-specific FRAX intervention thresholds where none are available.

- Evaluate the impact of low levels of vitamin D on musculoskeletal health, including in high risk groups.

## **IMPROVE ACCESSIBILITY AND REIMBURSEMENT OF DIAGNOSIS AND TREATMENT**

- Health authorities should improve reimbursement levels and reduce restrictive criteria which may prevent those in need from receiving approved treatment.
- The problem of disparities in rural versus urban areas must be addressed in order to ensure equity of access to DXA and treatment in all areas of the country.
- DXA availability and accessibility should be raised to adequate levels to meet the existing and increasing needs for diagnosis given the ageing of the population.

## **ESTABLISH NATIONWIDE PREVENTION PROGRAMMES AND IMPROVE PUBLIC AWARENESS**

- Focus on promotion of healthy lifestyle (smoking cessation, exercise, healthy nutrition) to benefit not just musculoskeletal health, but a wide spectrum of age-related chronic diseases.
- Focus on childhood and adolescent bone health to promote the attainment of peak bone mass, through intensive and sustained awareness and intervention programmes at the school or community level.
- Public awareness campaigns should fight the myth that osteoporosis is a non-avoidable aspect of ageing and raise awareness of risk factors and prevention strategies.
- Falls prevention should be integrated into public and health professional awareness campaigns.
- Outreach to rural populations should be considered in all prevention and awareness campaigns.
- Government support of patient societies to aid their important work in increasing awareness and providing patient support.

# NOTES



## International Osteoporosis Foundation IOF

IOF is an international non-governmental organization, which is a global alliance of patient, medical and research societies, scientists, healthcare professionals and the health industry. IOF works in partnership with its members and other organizations around the world to increase awareness, improve prevention, early diagnosis and appropriate care of osteoporosis and related musculoskeletal diseases. With more than 200 member societies in 93 locations worldwide, IOF member societies represent millions of osteoporosis sufferers and others who are affected by this silent disease.

# THE ASIA-PACIFIC REGIONAL AUDIT

Epidemiology, costs & burden of osteoporosis in 2013

*This Asia-Pacific Audit provides new and updated information about the status of osteoporosis in the region. In addition to the 14 countries in the 2009 version, it now includes Australia and New Zealand, giving more comprehensive coverage of this geographical area. What is alarmingly clear is that some of the projections made in 2009 clearly underestimated the disease burden and the situation will dramatically worsen if immediate action is not taken.*

*Over the past few decades, the Asia Pacific has had one of the strongest overall improvements in health and prosperity of any region in the world. However the hard-won gains threaten to be undermined by an enormous rise in musculoskeletal diseases and the looming epidemic of fragility fractures in a rapidly ageing population. It has been projected that more than 50% of fractures in the world will occur in Asia by 2050. The other worrying trends impacting on musculoskeletal health include urbanization and widespread vitamin D insufficiency.*

*This Audit not only underscores the care gaps and future disease burden but also presents cost-effective evidence-based solutions. It is intended as a tool to catalyze action at the national health policy level and calls on health care professionals and medical authorities to diagnose and treat osteoporosis in a timely manner.*

*Urgent action must be taken to avoid catastrophic socio-economic costs and to avoid the unnecessary pain, suffering and death of millions of people in the future.*

## **Professor Cyrus Cooper**

Chair of the Committee of Scientific Advisors, IOF



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