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The Asian Audit Epidemiology, costs and burden of osteoporosis in Asia 2009





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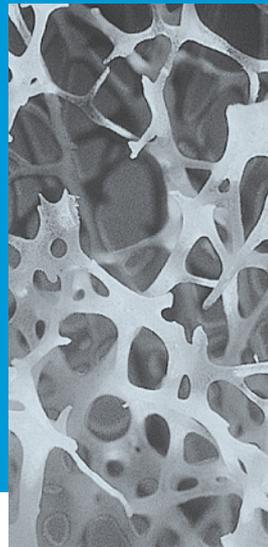
What is osteoporosis?

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.

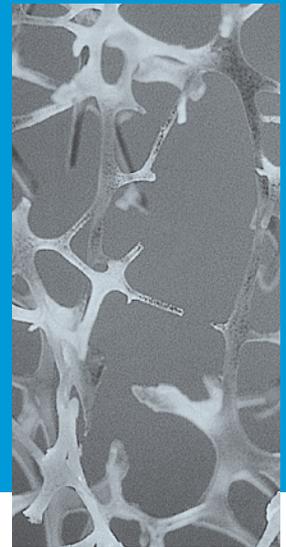
- In women over 45, osteoporosis accounts for more days spent in hospital than many other diseases, including diabetes, myocardial infarction and breast cancer¹.
- It is estimated that only one out of three vertebral fractures come to clinical attention².

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Normal bone



Osteoporotic bone

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Foreword

The purpose of this report is to provide an overview of the socioeconomic burden of osteoporosis and fragility fractures in fourteen countries, regions or territories across Asia. The authors and contributors have presented the true picture of this disease in Asia, and have attempted to identify both gaps in knowledge, as well as challenges that need to be met. Only when armed with this vital information, can we hope to change government policy and put in place appropriate measures for prevention, diagnosis and management. Today, most evidence on which recommendations are based has been derived from Caucasian populations, and the application of these evidences to Asian population requires some consideration from Asia-specific perspectives.

The population across Asia is rapidly increasing and rapidly ageing. Advancing age is clearly a major risk factor for osteoporosis and fractures. Osteoporosis is thus a growing public health concern across this region. Approximately three-quarters of the world population resides in Asia. Moreover, the percentage of the elderly (aged 65 years and above) in Asia was about 5.3% of the total population in 1995, and is projected to increase to 9.3% in 2025, which represents a 75% increase¹.

The outcome of osteoporosis is low-trauma or fragility fracture. Hip fracture has long been recognized as the most serious consequence of osteoporosis, because it incurs many subsequent complications - chronic pain, disability, diminished quality of life and premature death. Over 20% of people who sustain a hip fracture die within twelve months of sustaining the fracture; 20% require long term care and over a third of people are unable to return to their prior work. Among those who survive the fracture, quality of life is significantly reduced. Treatment of fractures involves considerable cost to the state and/or the af-

ected individual, and it will be virtually impossible even for developed economies in the region to sustain these costs in the coming years. For many countries, the goal of measuring bone density for every high risk postmenopausal woman is likely to remain elusive. Therefore, the search for cost-effective prevention strategies is an important research endeavor. Indeed, in the coming decades, one of the challenges in osteoporosis research is to develop better diagnostic tools and treatment, and to apply our current knowledge more broadly in the community.

This is the first time that a collective picture has been created of the impact of osteoporosis in this region. Both acquisition and quality of data has been an issue in many of these countries, even in those where osteoporosis is a recognized health priority. Fracture prevalence, costs and availability of diagnostic tools (DXA) and treatment, calcium and vitamin D status, health professional education, patient awareness and government support are all part of the data presented in this report. We have taken care to provide the source of the information gathered, some of which has not been formally published.

We hope that this report will be useful to individuals and societies across Asia involved in the osteoporosis movement. More specifically, we expect that it will help them in prioritizing goals to enable optimal utilization of often strained resources.

1. Prevention of osteoporosis and osteoporotic fractures in Asia: recommendation statements from the Strong Bone Asia conference, revision 2007

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Executive summary

Given the large elderly population in Asia, osteoporosis is and will be a major health problem in the coming years, and cost-effective means of identifying and treating patients at high risk of hip fracture are necessary¹. The incidence of hip fracture has risen already 2- to 3-fold in most Asian countries during the past 30 years.

The belief that osteoporosis is prevalent in the West and rare in the East is a myth. There is consistent evidence that epidemics of hip fracture occur with urbanization throughout Asia. A recent multi-national study conducted in four Asian countries revealed that the incidence of hip fracture has risen as economic development has unfolded¹. The adjusted rates in Hong Kong and Singapore were almost identical to those seen in American Caucasians (at 19 per 10 000), while the rates in Thailand and Malaysia were two-thirds and one-half, respectively, of the Hong Kong rate. In Hong Kong, the incidence of hip fracture had increased by 300% from the 1960s to the 1990s.

Table 1 Incidence of hip fracture in Hong Kong (rate per 100 000 population)

Year	Women	Men
1966	70	48
1985	273	113
2001	394	159
2006	379	169

E. Lau, unpublished data

In Singapore, the incidence of hip fracture in 1998 was 5 times the incidence observed in the 1960s. From 1991 to 1998, the incidence of hip fracture increased by 0.7% annually in men and by 1.2% annually in women. In Japan where hip fracture was believed to be among the lowest in the world, the incidence of hip fracture increased by 1.6-fold in men and 1.5-fold in women from 1986 to 1998. The incidence of hip fracture in mainland China increased by 34% in women and 33% in men from 1988 to 1992 when it was one of the lowest in the world, at 10 per 10 000 in both men and women.

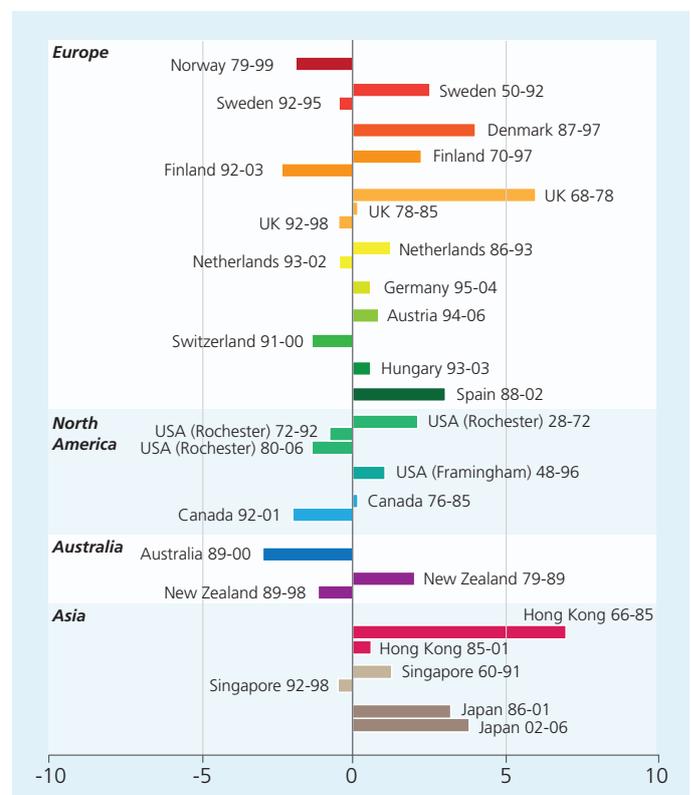
Studies in various countries have shown that the costs of osteoporosis are substantial. Hip fracture is a major cause of hospital admission in the elderly. The acute care cost associated with hip fracture is tremendous in all developed countries. In the US, the direct cost of hip fracture was approximately 13.8 billion USD in 1995. In the UK, the direct cost of hip fractures was £942 million per year in 1998. In Hong Kong, the acute hospital care cost of hip fracture in 2006 amounted to 1% of the total hospital budget (unpub-

lished data). Given the high cost associated with osteoporosis and hip fracture, early detection and treatment of high risk patients are critical.

The above evidence confirms that hip fracture will be a major health challenge in Asia in the coming decades.

However, in the West, the incidence of hip fracture is showing some signs of stabilization (*figure 1*). Melton et al. reported a downturn in hip fracture incidence in Rochester, Minnesota, between 1984 and 1987. In Hong Kong, the incidence of hip fracture had ceased to increase from 2001 to 2006. The reasons for the secular decline in hip fracture incidence are unknown but could be due to socio-economical changes, such as an increase in body mass index, or because more patients with osteoporosis are being diagnosed and treated.

Figure 1 Secular trends in hip fracture worldwide



Clearly there is an urgent need to undertake large scale epidemiological studies in Asia.

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1. Edith M. Lau, The Epidemiology of Osteoporosis in Asia, *IBMS BoneKey*, 2009 May; 6(5):190-193).
2. Cyrus Cooper et al, 2009 European Congress on Clinical and Economic Aspects of Osteoporosis and Osteoarthritis

Key findings in Asia in 2009

Major increase in fractures predicted for Asia

- The incidence of hip fracture has already risen 2- to 3-fold in most Asian countries during the past 30 years.
- By 2050 more than 50% of all osteoporotic fractures will occur in Asia.
- The incidence of hip fracture has risen as economic development has unfolded in several Asian countries.
- The incidence of hip fracture in mainland China which was one of the lowest in the world in 1988, at 10 per 10 000 in both men and women, has risen markedly. Today 69.4 million Chinese over age 50 suffer from osteoporosis with 687 000 hip fractures each year.
- It is predicted that the number of Chinese with osteoporosis and osteopenia will increase to 286.6 million in 2020 and 533.3 in 2050.
- In Hong Kong the incidence of hip fracture had increased by 300% from the 1960s to the 1990s.
- It is estimated that by 2013, the number of people in India with osteoporosis will reach 36 million.
- In Singapore, the incidence of hip fracture in 1998 was 5 times the incidence observed in the 1960s.
- In Japan where hip fracture was believed to be among the lowest in the world, the incidence of hip fracture increased by 1.6-fold in men and 1.5-fold in women from 1986 to 1998.

Prevalence of osteoporosis and fractures severely underestimated

- The belief that osteoporosis is prevalent in Western countries and rare in Asia is a myth.
- Advancing age is a major risk factor for osteoporosis and fractures – and Asia is rapidly ageing. Each country in the region (except Japan) demonstrates an expanding and ageing population.
- Vertebral fractures are as common in Asians as in Caucasian populations, with very few vertebral fractures diagnosed.

Fractures represent a huge personal, social and economic burden in all countries

- In Thailand, mortality after hip fracture for women and men is 1 in 3, making it the sixth leading cause of death.
- 19-26% of post-menopausal women in China have a vertebral deformity.
- In Hong Kong, the acute hospital care cost of hip fracture in 2006 amounted to 1% of the total hospital budget (unpublished data).
- In China, the average length of hospital stay (19-24 nights) for a hip fracture exceeds that for treating breast cancer, ovarian cancer, prostate cancer or heart disease.
- In India, as possibly in other countries in the region, only a minority of people have private or government health insurance to cover hospitalization costs following hip fracture. This implies that many hip fracture sufferers must pay out of pocket at great personal cost or remain untreated.

DXA technology is not widely accessible

- DXA technology, considered the gold standard for measurement of bone mineral density,

is relatively expensive and not widely available or easily accessible in most developing Asian countries.

- In most countries the limited number of DXA machines are available primarily in urban areas.
- In areas without reimbursement, the cost of DXA is often prohibitively high for the average wage earner.

Widespread vitamin D deficiency and low calcium intake

- Vitamin D deficiency is prevalent throughout the 14 countries involved in the Audit, particularly in South and South East Asia.
- Adequate calcium, whether through food or supplementation, is an important way to maintain bone health. Nearly all Asian countries outlined in this Audit report are far below the FAO/WHO recommendations for calcium intake ranging from 1000-1300 mg/day for adults. The average dietary calcium intake for the adult Asian population is approximately 450 mg/day.
- Rickets (a childhood disease causing deformity due to 'soft bones') appears to be common in China (40°N) – probably the result of poor vitamin D status and low calcium intake.

Osteoporosis is a neglected disease

- Osteoporosis is greatly under diagnosed and under treated in this region, even in the most high risk patients who have already fractured.
- The under recognition of osteoporosis is mainly due to a lack of structured government sponsored awareness programs for both physicians and the public.
- Health professional awareness is not optimal given the extent of the problem. In China, for example, osteoporosis prevention and treatment is not included in medical college education. Training is carried out by academic societies with the approval of the Ministry of Health.
- In several countries, including China, there are as yet no official government approved national guidelines on osteoporosis diagnosis and treatment.
- In several countries, lack of solid epidemiological and economic data is a major hindrance in convincing health authorities about the importance of osteoporosis.
- In many countries, osteoporosis competes with other serious health issues for scarce health care resources.

- There is lack of funding to support professional training and public education programs.

A great rural and urban divide

- In the most populous countries like China and India, the majority of the population lives in rural areas (60% in China), where hip fractures are often treated conservatively at home instead of surgical treatment in hospitals.
- At present, most treatments, prevention and education efforts are limited to cities, whereas people in rural areas have little knowledge about this disease.
- In all countries (and especially in widely dispersed countries such as Indonesia) access to diagnostic testing or treatment in rural areas poses a particular challenge.

Some positive trends

Despite the formidable deficits and challenges still facing osteoporosis prevention and management in Asia, there has been a trend towards:

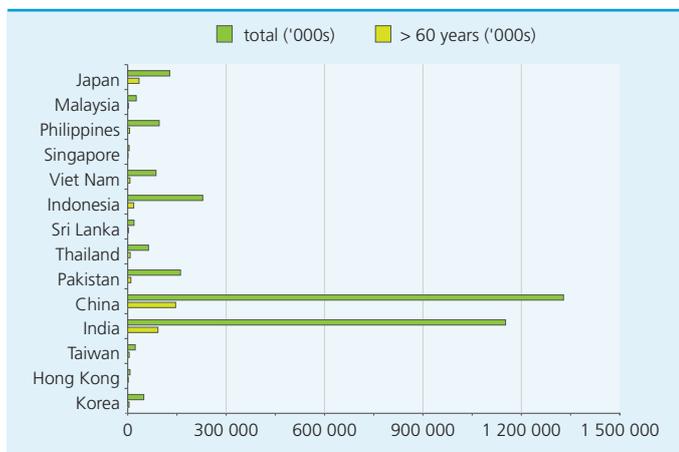
- Governments beginning to recognize osteoporosis as a major health problem (4 of 11 giving feedback)
- A decade ago only 6 osteoporosis-related non governmental societies in Asia were members of the International Osteoporosis Foundation, today it is 28. As shown in this report, these societies are doing admirable work in public and health professional education, publishing and disseminating medical guidelines, and carrying out important research.
- Successful education and awareness initiatives are being co-organized by non profit organizations with industry support.

Key comparisons

Epidemiology/demographics

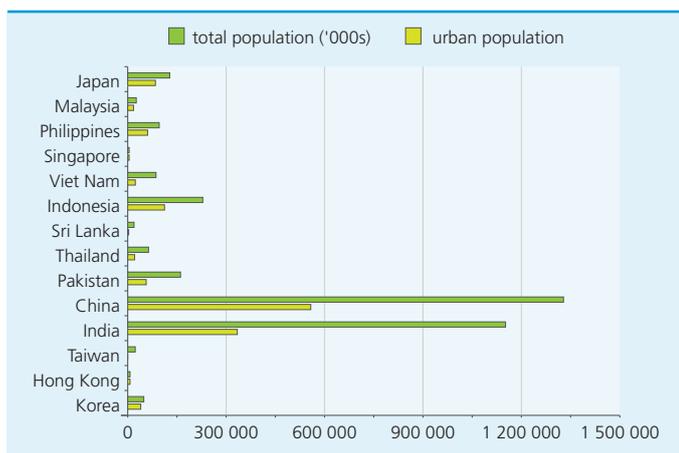
Osteoporosis and its consequence of fracture is increasingly becoming a major public health threat in Asian countries, regions or territories due mainly to the size and rapid aging of the population.

Figure 1 Overview of total population and population over 60 years in the observed countries/territories



WHO World Statistics 2006

Figure 2 Repartition of the population in the observed countries/territories

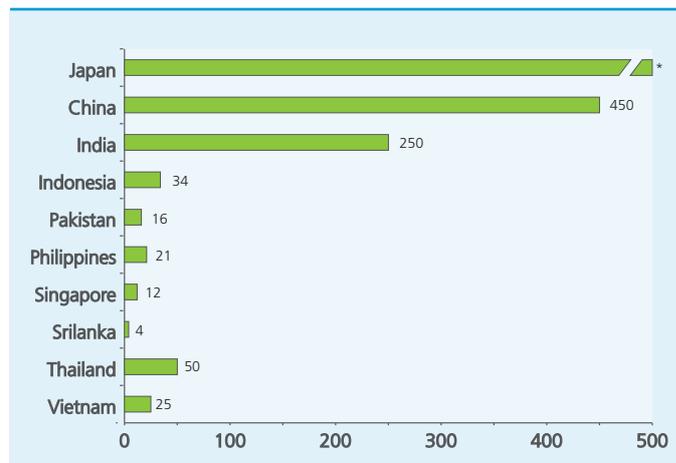


WHO World Statistics 2006

Diagnostic tools and cost

Bone mineral density (BMD) measured by dual-energy X-ray absorptiometry (DXA) is the standard diagnostic technique for osteoporosis. DXA technology is relatively expensive and is not widely available in most developing Asian countries as demonstrated on *figure 3*. Additionally, in most countries the limited number of DXA machines available are confined to urban areas.

Figure 3 Number of DXA machines per country/territory



With 10 369 DXA machines (0.8 per 10 000), Japan is far above the standard level of the region regarding available diagnostic tools such as DXA machines.

Because of the limited availability of DXA in most developing Asian countries (*figure 4*), a number of clinical prediction tools, including the Osteoporosis Self-Assessment Tool for Asians (OSTA) and the Khon Kaen Osteoporosis Study Score (KKOS), have been developed to identify 'candidates' for a BMD scan.

The generally recommended number of DXA per 10 000 population is 0.11 in Europe. It is clear that most of the countries in this audit fall well below this recommendation.

Figure 4 Number of DXA machines per 10 000 population

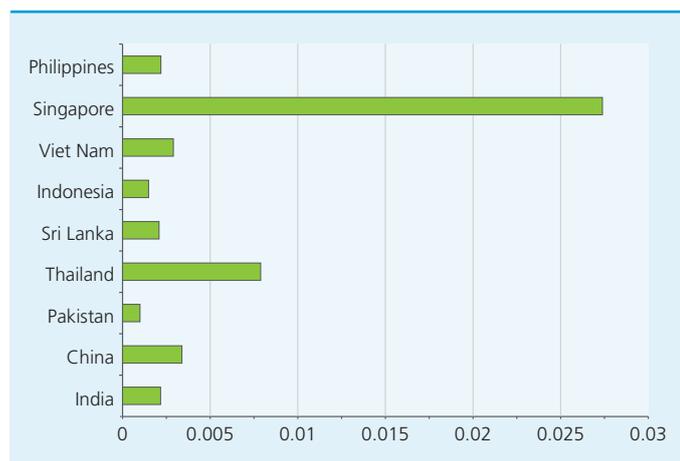
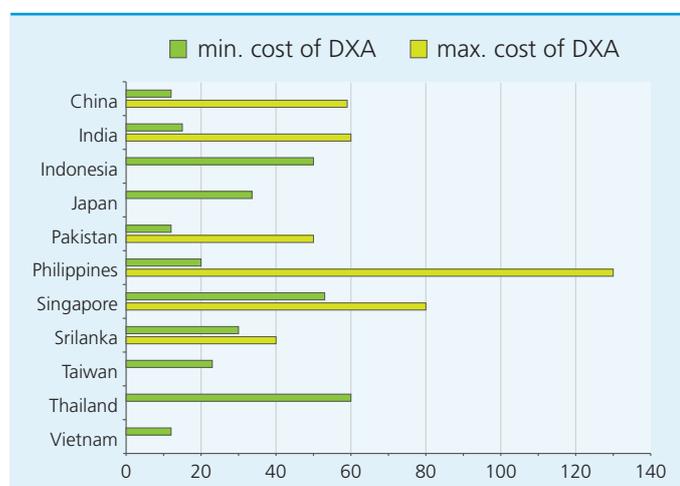


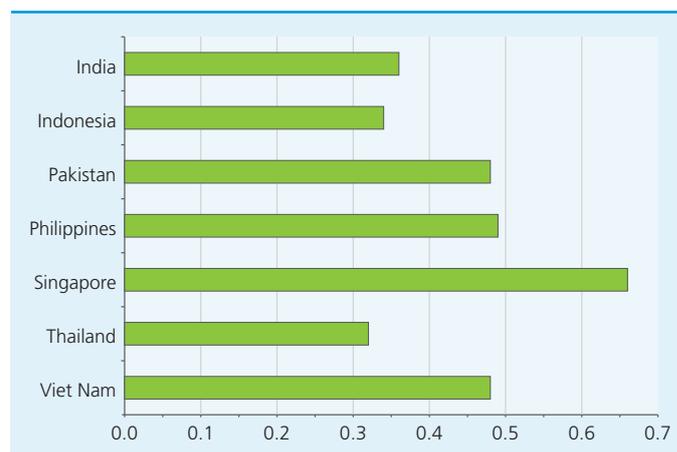
Figure 5 Cost (USD) of a DXA scan



Calcium intake

Adequate calcium, whether through food or supplementation, is an important and practical way to help maintain bone health. Lau and colleagues have demonstrated that adult Chinese women with lower calcium intake were associated with greater risk of hip fracture, and that calcium supplementation appears to improve BMD. Therefore, it is recommended that

Figure 6 Average dietary calcium intake (g) per country (1-5)



The values are from different studies which reflect variably low calcium intake.

adequate daily calcium intake should be maintained throughout life. Western recommendations regarding calcium intake are approximately 1000-1300 mg/day, and nearly all Asian countries observed in this report are far below these recommendations.

These data clearly show that the calcium intakes across the Southeast Asian population are in general less than half those recommended despite differences in age, gender, ethnicity or country of residence. With a median dietary calcium intake for the adult Asian population of approximately 450 mg/day, the potential detrimental impact on bone health should be considered. Standardised recommendations for Asian populations should be considered by individual governments and greater efforts put towards effective education campaigns that help to increase daily calcium intake across the region⁶.

Treatment

Most treatments are available throughout Asia as shown in *table 1*.

Table 1 Available treatments throughout Asia

	China	India	Indonesia	Japan	Pakistan	Philippines	Singapore	Sri Lanka	Taiwan	Thailand	Viet Nam
PTH ¹	•	•			•	•	•	•	•	•	
SERMs ²	•	•	•	•	•	•	•	•	•	•	•
HRT/ERT ³	•	•	•	•	•	•	•		•	•	•
Bisphosphonates	•	•	•	•	•	•	•	•	•	•	•
Calcitonin	•	•	•	•	•	•	•		•	•	•
Strontium ranelate	•	•				•	•		•		

1. Parathyroid hormone

2. Selective estrogen receptor modulators

3. Hormone replacement therapy

Government policy

Table 2 Overview of government policy regarding osteoporosis in the region

Countries	Government Policy
China	NOT recognized as a major health problem
India	NOT recognized as a major health problem
Japan	NOT recognized as a major health problem
Pakistan	NOT recognized as a major health problem
Philippines	NOT recognized as a major health problem
Srilanka	NOT recognized as a major health problem
Thailand	NOT recognized as a major health problem
Viet Nam	<i>Recognized</i> as a major health problem
Taiwan	<i>Recognized</i> as a major health problem
Indonesia	<i>Recognized</i> as a major health problem
Singapore	<i>Recognized</i> as a major health problem

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Given the large and growing elderly population in Asia, osteoporosis is and will be a major public threat in the coming years. Strategies for cost effective prevention, early detection and treatment of high risk patients is critical if Asia is to reduce the projected burden of fragility fractures.

Vitamin D status in Asia

Studies carried across different countries in South and South East Asia showed, with few exceptions, widespread prevalence of hypovitaminosis D, in both sexes and all age groups of the population. This widespread prevalence of vitamin D deficiency /insufficiency has a deleterious effect on bone mineral homeostasis and peak bone mass achieved, and may subsequently reflect as low bone mineral density. It should be noted that there is no common worldwide consensus on the optimum levels of serum 25(OH)D at present although it is generally accepted that the minimum accepted level is over 25 nmol/l.

Several studies have demonstrated low serum vitamin D 25(OH)D levels (measured as 25 hydroxy vitamin D - 25(PH)D) in populations across India. In North India (27°N), 96% of neonates, 91% of healthy school girls, 78% of healthy hospital staff and 84% of pregnant women were found to have hypovitaminosis D. The criteria used for defining hypovitaminosis D in most of the studies was serum 25(OH)D level below 50nmol/L. A major concern is the high prevalence of hypovitaminosis D among pregnant women and children. Maternal serum 25(OH)D levels correlated negatively with PTH levels and positively with cord 25(OH)D levels. Hypovitaminosis D is equally prevalent among rural and urban subjects but in some studies urban subjects are found to be more deficient, air pollution probably plays a role in large cities.

In South India (13°N), hypovitaminosis D is equally prevalent among different population groups. In a population-based study showing the inverse relationship between measured serum 25 (OH)D levels and PTH levels, vitamin D levels were significantly higher in rural compared to urban subjects.

Similar data have been obtained from Pakistan, most disturbingly from infants. Sri Lanka (7°N), mean values 25(OH)D among healthy females was 35.3nmol/L and 40.5% of them had 25(OH)D values below 25nmol/L.

High prevalence of hypovitaminosis in South Asia can be explained by skin pigmentation and traditional clothing. Air pollution and limited outdoor activity further compounds this problem in the urban population.

Vitamin D status of the population in South-East Asian countries has received relatively less attention. However, the problem seems to be less severe. Most studies used serum 25(OH)D level of 75nmol/L as the cut off. Prevalence of hypovitaminosis D (25(OH)D < 75nmol/L) in postmenopausal women was 47% in Thailand, 49% in Malaysia, 90% in Japan and 92% in South Korea. The mean serum 25(OH)D concentration was 48nmol/L in premenopausal women from Indonesia (6°S) and Malaysia (2°N).

Rickets appears to be common in China (40°N), and this is probably related both to poor vitamin D status and low calcium intake. In a study from north China (Beijing), 89% of Chinese adolescent girls had hypovitaminosis D (serum 25 (OH)D< 50nmol/L) and 48% of old men had severe hypovitaminosis D/frank vitamin D deficiency (<25nmol/L). Among postmenopausal women 25(OH)D level was found to be lower amongst the Malays (44±11nmol/L) than the Chinese (69±16nmol/L). The relatively lower serum 25(OH)D level among Malays can be explained by their skin pigmentation, lower outdoor activity levels or greater fat mass. In Hong Kong, the mean serum 25(OH)D was 71±27nmol/L in adults over 50 years of age but hypovitaminosis D was common among elderly patients with fracture neck of femur. A dual-centred study in China showed that more than 90% of young women in Beijing and Hong Kong had 25(OH)D levels ≤50nmol/L. However, the mean values were much lower in north (Beijing) as compared to the south (Hong Kong) (34 versus 9nmol/L; p<0.001) and 40% compared to 18% of young women in Beijing and Hong Kong respectively had 25(OH)D levels ≤25nmol/L.

Hypovitaminosis D in Japan (35°N) is more common in inactive elderly (mean 30nmol/L) and women younger compared to older than 30 years of age (mean 34nmol/L). Overall the vitamin D status in Japan is relatively better than that of the

regions in South Asia and positively related to fish consumption. Prevalence of hypovitaminosis D ($<30\text{nmol/L}$) in women over 30 years old is only 10.3% and in active elderly ($25(\text{OH})\text{D} <75\text{nmol/L}$) is below 5%.

Intervention studies with vitamin D supplements are underway in several of these populations.

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Vitamin D deficiency is prevalent in South and South East Asia, impacting negatively on bone health. The high prevalence may be explained in part by skin pigmentation and traditional clothing. Air pollution and limited outdoor activity further compounds the problem in the urban population.

China

Overview

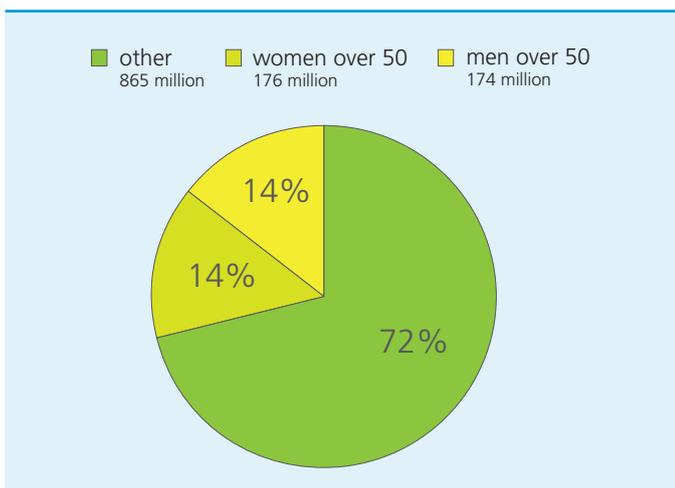
With one of the biggest populations in the world and a large and growing elderly population, osteoporosis in China is a major public health burden.

Osteoporosis is known to currently affect more than 69.4 million Chinese over age 50 and causes some 687 000 hip fractures in China each year. Morbidity and mortality from osteoporosis fractures is strikingly high. Yet the disease remains severely under-diagnosed in even the most high-risk patients who have already fractured. Vertebral fractures also carry a major burden to the Chinese community with the number of vertebral fracture patients expected to reach 36.7 million in 2020 although the true number may be much higher.

The cost of hip fractures is high in comparison to all other major diseases such as heart disease, breast cancer, prostate cancer and ovarian cancer.

With the support of IOF, the China Health Promotion Foundation launched its first White Paper on Osteoporosis in 2008¹ and supports immediate priorities for Government action on osteoporosis.

Figure 1 Chinese population (millions) in 2006

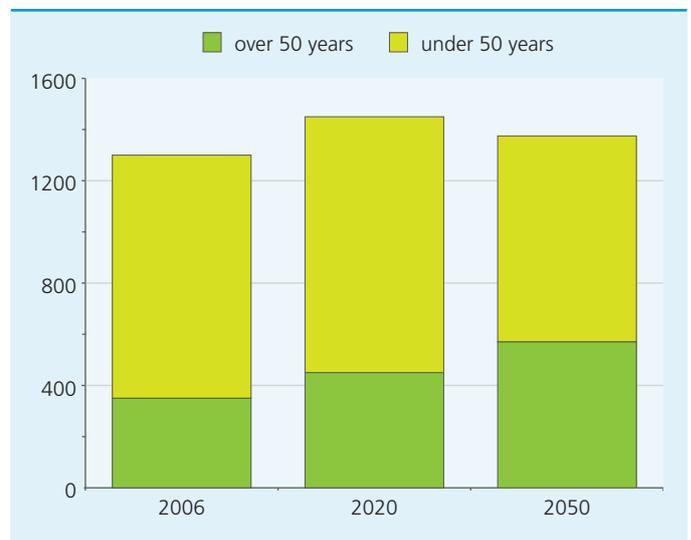


Epidemiology

China had a total population of 1.24 billion in 2000. This increased to 1.31 billion in 2006 and of this about 26.62% (350 million 176 and 174 million of women and men accordingly) are people above age of 50^{2,3}.

According to the sum of live birth annual rate (1.65-1.8) and age matched death rate, China will have a population of 1.43 billion and 1.38 billion respectively in 2020 and 2050⁴. The number will reach its peak at 1.47 billion in 2030. It is expected that people over 50 will be 469 million and 571 million in 2020 and 2050 respectively^{5,6} (figure 2).

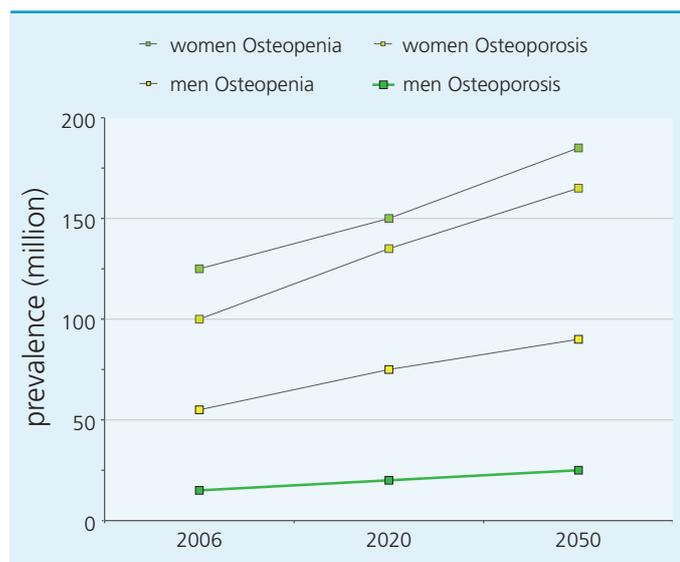
Figure 2 Population (millions) in China from 2006-2050



In the 2003-2006 survey of the China Ministry of Health, the prevalence of osteoporosis in the people age over 50 with lumbar or hip BMD T-score lower than -2.5 was 15.7% (men 8.8%, women 30.8%) which means that 69.4 million Chinese (15.3 and 54.1 million in men and women accordingly) above the age of 50 have osteoporosis. Many fractures however occur in patients with a T-score greater than -2.5, hence, it is important to take other risk factors into consideration, for example, family history, previous fracture and glucocorticoid use. Figure 3 shows the

expected increase of osteoporosis and low bone mass population to rise to 286.6 million in 2020 and 533.3 million in 2050.

Figure 3 Osteoporosis and osteopenia in China



Hip fracture

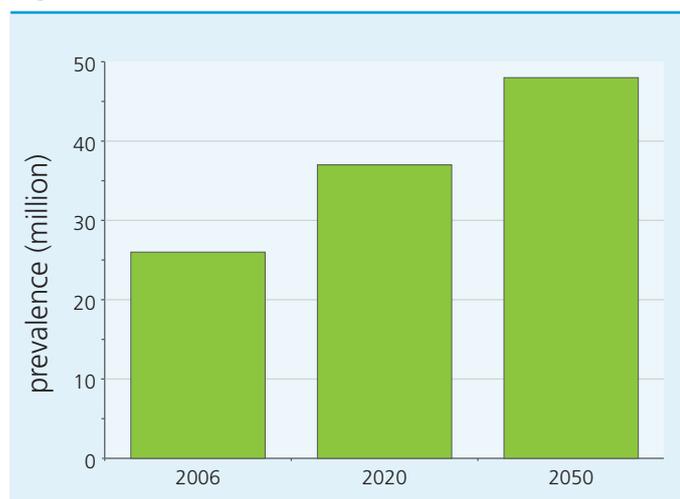
A total of 687 000 hip fractures were estimated to occur in the population over age 50 in China in 2006 (241 000 in men, 446 000 in women). A survey in Shanghai showed the incidence of osteoporotic fracture in 1990-1997 increased by 3.34 to 3.85%⁷. It is expected that the number of hip fractures in people over age 50 will increase to 1 638 000 in 2020 and 5 908 000 in 2050.

In cities, hip fractures are usually treated with surgery, while in rural areas (which comprise more than 60 percent of the total population), hip fractures are often treated at home.

Vertebral fracture

In a 1995 survey, the prevalence of vertebral fracture in the population age over 50 was 15%. The prevalence in the population aged over 80 is 36-39%⁹⁻¹¹.

Figure 4 Vertebral fracture in women over 50



According to the survey, 1.8 million new vertebral fractures occurred in 2006. The number of vertebral fracture patients is expected to reach 36.7 million and 48.5 million in 2020 and 2050. The incidence is higher in women than in men.

In China, very few vertebral fractures are diagnosed. Only 20% of people with vertebral fracture over age 50 were diagnosed⁹⁻¹¹. Once diagnosed, most of the patients receive pain relieving treatment. Kyphoplasty is a recent introduction in China and is limited to the large cities. There is no general consensus on treatment of vertebral fractures. However, the risk of future fracture is significantly increased in this population hence they should receive prophylactic treatment in addition.

Cost (hip fractures)

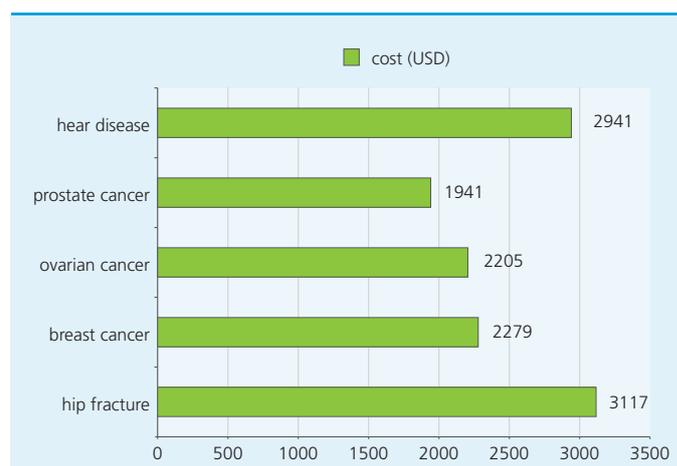
The average direct cost of hip fracture in 2007 was 3603 USD^{8,11-15}. According to the statistics of the Health Bureau of Chongqing and other cities in recent years, the cost of hip fracture increased at a rate of about 6% every year. It can be calculated that in 2020, the average costs of hip fracture will be 7600 USD. The treatment cost of hip fracture will be 44 000 USD in 2050.

In 2006, China spent about 1.5 billion USD treating hip fracture. In 2020, it will cost over 12.5 billion. In 2050, it will be more than 264.7 billion USD.

Comparison of the cost of hip fracture with other disease

According to the State Health Department, the average hospital stay for hip fracture is 19-24 nights¹⁶ (breast cancer is 13 nights; ovarian cancer 11 nights; prostate cancer 19 nights; heart disease 10 nights). The average hospital fee for first hospitalization of hip fracture ranges from 2367 USD (average 3117 USD), that for breast cancer 2279 USD; ovarian cancer 2205 USD; prostate cancer 1941 USD; heart disease 2941 USD (*figure 5*).

Figure 5 Cost comparison of hip fracture and other diseases



Diagnostics

At present, there are 450 DXA machines and 1100 peripheral bone densitometry machines in China, which has a population of 1.3 billion. That means less than 0.35 DXA per million people. DXA machines are only available in urban centers, mainly on the south-eastern coast, the more economically developed areas of the country. Beijing, with a population of 16.33 million, has 55 DXA machines, 3.4 DXA per million people, while Shanghai with 18.58 million people has 21 DXAs, 1.5 DXA per million people.

In other medium and small sized cities, QUS (Quantitative Ultrasonography) and other peripheral bone densitometry are widely used to diagnose osteoporosis.

The waiting time for DXA scan is usually 1-2 days, ultrasound can usually be done on the same day.

X-ray radiography is also used to diagnose osteoporosis, especially for vertebral fractures. However, lack of awareness of the medical professionals results in gross underdiagnosis of the problem.

The cost of both vertebral and hip DXA scan varies from 11.7 to 58.8 USD and the cost for ultrasound varies from 4.4 to 14.7 USD. The costs are determined by regional governments under the direction of the central government. Reimbursement policies are variable.

Lifestyle Prevention

Osteoporosis prevention and awareness is restricted to urban areas in China. According to a recent Urban Residents Survey of 56 630 people (12 332 men and 44 298 women), 57.2% of them had heard about osteoporosis.

In China, due to increased advertising on TV regarding milk and milk products, milk consumption by children and youth is increasing. Calcium and vitamin D fortified products are commonly available.

Treatment

Use of pharmaceutical therapies for osteoporosis varies markedly between urban and rural areas and from south to north of the country. Hormone replacement therapy (HRT), Selective Oestrogen Receptor Modulator (SERM), various bisphosphonates and calcitonin have been used for osteoporosis treatment for 5-10 years in urban areas, especially in large cities. Clinical trials with Teriparatide (PTH) and Strontium Ranelate have been completed and these have been approved by the government. The Traditional Chinese herbal formula Xianling Gubao (XLGB) is the most widely accepted by the people to prevent osteoporosis. It is also included in the reimbursement list of state health insurance. According to the insurance policies, some of the drugs are reimbursed only for severe osteoporosis patients. Most anti-osteoporosis drugs are only reimbursed for women.

Government Policies

So far, osteoporosis is not yet recognized as a major health problem by the Chinese government. The government and non-governmental organizations (NGOs) are gradually paying more attention to osteoporosis. More continuing medical education (CMEs) and seminars are being organized. At present, there are no government public awareness programs covering prevention, diagnosis and management of osteoporosis. But the government supports NGOs in activities such as Hand-in-Hand Osteoporosis Awareness Project, Silver Ribbon Osteoporosis Prevention Action, I LOVE MILK campaign.

There are three guidelines for osteoporosis diagnosis and management in China: 1999 - 'Guidelines for osteoporosis diagnosis' by Osteoporosis Committee of Chinese Gerontology Society, 2007 - 'Guidelines for primary osteoporosis diagnosis and management' by Osteoporosis and Bone Mineral Society of Chinese Medical Association and 2008 - 'Guidelines for osteoporosis fracture management' published by Orthopedic Society of Chinese Medical Association¹⁷. There are currently no government approved guidelines.

At present, health professional training is carried out by academic societies with the support and approval of the Health Ministry, and there are no government guidelines for professional training.

So far, osteoporosis prevention and treatment is not included in medical college education. There are four national societies and foundations active in osteoporosis prevention. They are the China Health Promotion Foundation, Osteoporosis Committee of Chinese Gerontology Society, China Orthopaedic Society of CMA, Osteoporosis and Bone Mineral Society of CMA.

Setbacks/problems

Though osteoporosis prevention and treatment began in China more than 20 years ago, public awareness of this disease still needs to be raised. At present, all treatments, prevention and education efforts are limited to cities; people in rural areas have little knowledge about this disease.

1. Significant underestimation of the burden imposed by osteoporosis in China.
2. Under diagnosis and under treatment of osteoporosis.
3. Lack of funding to support professional training and public education programs

Recommendations

1. Focusing on high-risk populations to prevent osteoporosis is our main recommendation. Followed by:
2. Increase in funding for basic and clinical research on osteoporosis and public education programs.
3. Establishment of professional training programs; inclusion of osteoporosis education material in the medical curriculum.
4. Improve diagnostic capabilities by equipping hospitals with DXA in the cities and affordable, mobile and easy-to-run diagnostic equipment in community health care.
5. Issue National Guidelines on Osteoporosis Diagnosis and Treatment.
6. Expand reimbursement items for osteoporosis treatment drugs for both men and women, and people with a prior fracture.

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There is an urgent need to establish more professional training programs and to include osteoporosis education in the medical curriculum.



China, Hong Kong SAR

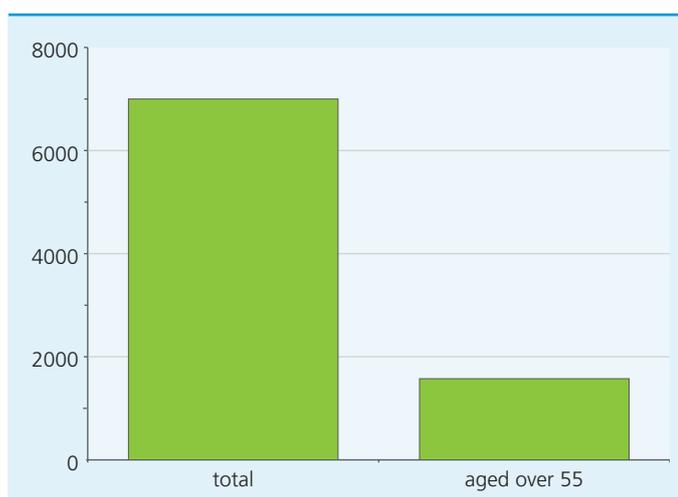
Overview

Osteoporosis and its related fractures is a major health problem in Hong Kong. Epidemiological studies found that the incidence of hip fracture had increased by 300% from the 1960's to the 1990's. In 2006, the incidence of hip fracture was 379/100 000 among women who are 50 years and over and 169/100 000 in men.

Interestingly in Hong Kong, the incidence of hip fracture had ceased to increase from 2001 to 2006 in women. The reasons for the secular decline in hip fracture incidence are unknown but some reasons are postulated below. Vertebral fracture is also a major public health problem in Hong Kong with prevalence at 30% among women and 16% among men.

Even with this stabilisation of hip fracture rates, osteoporosis will continue to have a major impact on the quality of life of older men and women in Hong Kong and continue to be a major burden on health services and society.

Figure 1 Population ('000s) in Hong Kong



Key findings

The total population in Hong Kong is approximately 7 million. Of this, 22.5% (1.58 million) is 55 years and over (2009 estimated) (*figure 1*).

With the ageing of the Hong Kong population, osteoporosis has become one of the most prevalent conditions that is associated with a great medical and socioeconomic burden. The public health impact of osteoporosis stems from its association with fractures of the hip, spine and forearm. Ten to twenty percent of hip fracture patients die within a year of the event, and of those who survive, almost two-thirds remain disabled¹. In Hong Kong, a highly urbanized city, the incidence of hip fracture had increased by 300% in women and 200% in men in the last 3 decades (*table 1*)².

Table 1 Incidence of hip fracture in Hong Kong (rate per 100 000 population)

Year	Women	Men
1966	70	48
1985	273	113
2001	394	159
2006	379	169

The projected number of hip fractures in Hong Kong in future can be calculated by applying the current age-specific rates to the future population of Hong Kong. Assuming no increase in age-specific rates, the total number of hip fractures in the year 2015 will be 5293 and 2349 in Hong Kong women and men respectively (total of 7642).

Prevalence of vertebral fracture

According to radiographic studies, 19-26% of post-menopausal women have a vertebral deformity. Vertebral fractures are as frequent in Asians as in Caucasian women.

The prevalence of vertebral fracture (based on a definition of vertebral height ratio reduction by 3 standard deviations or more) has been found to be 30% in Hong Kong women and 17% in Hong Kong men

who were 70-79 years old. These rates are much higher than those in Taiwan and Mainland China, and are comparable to those in American Caucasians⁴.

The medical cost of osteoporosis and its attendant fractures have been placed at 5.2 billion USD each year in the US and 1 billion USD each year in the UK. The majority of direct cost (95%) was incurred by hospitalized patients, due to hospital and rehabilitation expenses. In Hong Kong, the total cost for the treatment of hip fractures was 19 million USD in 1995. According to the report of the Hospital Authority in 1996, the acute hospital care cost of hip fractures amounted to 1% of the total annual hospital budget, or 17 million USD, for a population of 6 million³.

However, fracture trends in many western industrialized countries suggest that hip fracture rates appear to rise rapidly (possibly coincident with the early stages of economic development) then stabilise and eventually decline. It is possible that hip fracture rates in Hong Kong and Singapore may also be starting to stabilise. After the steep rise in incidence rates up to 1985, a later study shows that between 1985 and 1995 fracture rates in Hong Kong began to level off. A recent study analysed the trends in hip fracture rates in Hong Kong between 1995 and 2004¹ in order to predict the impact on future public health services in Hong Kong. Figure 2 shows the number of hip fractures in men and women of 50 years and more from 1995 to 2004. With the increasing size of the older population, a rising trend is observed in the number of hip fracture rates in Hong Kong, especially among women. However, age-specific hip fracture rates in men and women demonstrate that the incidence rates of all groups had declined with the most marked decrease seen in the 50-59 age group (figure 3-6).

Figure 2 Total number of hip fractures in Hong Kong from 1995 to 2004



Figure 3 Age-specific hip fracture rates in Hong Kong per 100 000 population from 1995-2004 - age 50-59 years

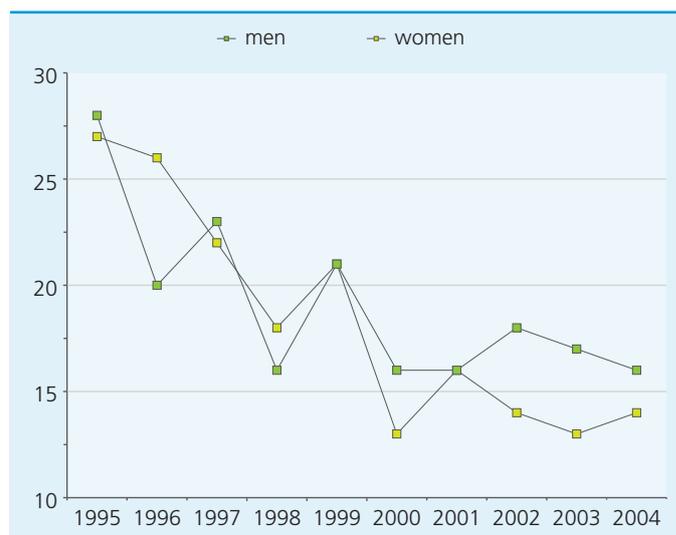


Figure 4 Age-specific hip fracture rates in Hong Kong per 100 000 population from 1995-2004 - age 60-69 years

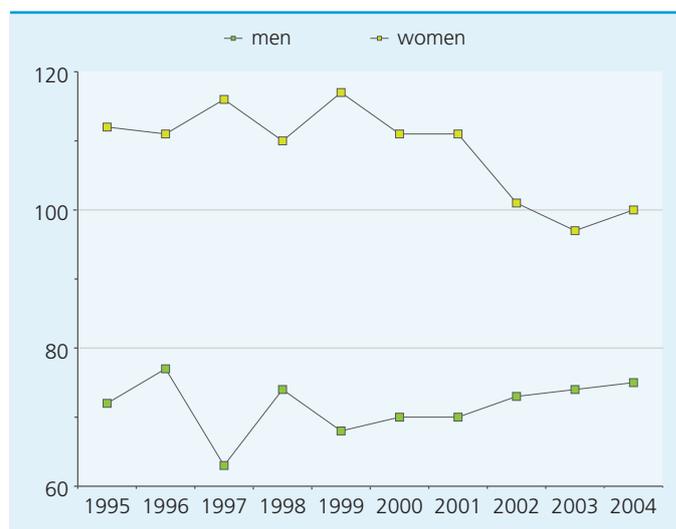


Figure 5 Age-specific hip fracture rates in Hong Kong per 100 000 population from 1995-2004 - age 70-79 years

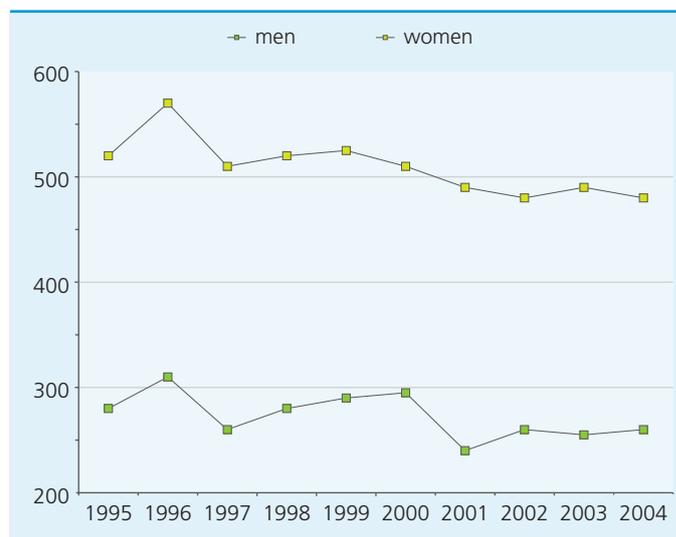
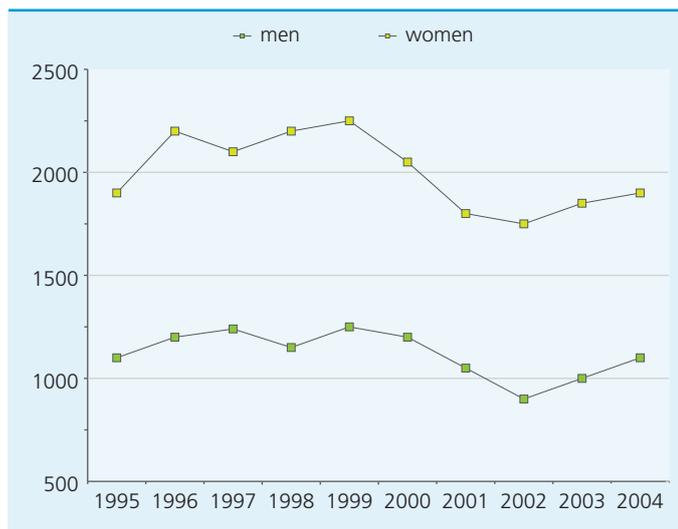


Figure 6 Age-specific hip fracture rates in Hong Kong per 100 000 population from 1995-2004 - age 80-89 years



Over the past 10 years in Hong Kong there has been a decline in fracture rates in men and women aged 50 years and above. The reasons for this are unclear but there are various possibilities:

- There has been improved availability of medical intervention to prevent osteoporosis. Bisphosphonates were made available to the general public in 1995, and to all hospitals by the Hong Kong Hospital Authority two years later. Unfortunately, there is no good information on the use of anti-osteoporosis agents to determine the magnitude of their impact on fracture reduction in Hong Kong.
- The effect of ecological changes such as an increase in body mass index.
- Since 1994 there has been increased medical attention to menopause and hormone replacement therapy (HRT) as well as increased media attention. A study carried out by Tang et al.⁵ in the 1990s shows that before 1994, the use of HRT in Hong Kong women was estimated to be around 2–3% of menopausal women. The study also revealed that there was lack of knowledge amongst the general public regarding menopause and its health consequences. Since then, public health activities on promotion of women's health were launched and guidelines have been issued on the prescription of HRT for Asian women as there is evidence that menopausal symptoms may vary considerably when comparing Asian women with their western counterparts⁶. These actions may have helped to increase the awareness of postmenopausal women and the usage of HRT in Hong Kong.
- Improved community awareness in the prevention of falls. Fall prevention is a major focus of the programs of the Community Geriatric Assessment Teams and it is likely that reduction

in falls would contribute significantly to the decline in hip fracture incidence¹.

The changing rates of hip fracture among older women and men may reflect the effects of modifications of risk factors, including physical inactivity, vitamin D insufficiency and the increasing risk of falling at a given age due to increasing frailty. Rather less likely to contribute are changes in body build, changes in nutritional pattern, changes in consumption of tobacco and alcohol, the use of post menopausal oestrogen and the more widespread risk assessment using DXA and pharmacotherapy. However, no single explanation appears to account for the different patterns seen among men and women, nor the timing of rising rates among women in different regions. Looking at attributable proportion of fractures that might be impacted by the uptake rates in the population of pharmacotherapy, these are really very small at the present time^{6,5}.

The pattern seen in Hong Kong and Singapore over the past 40 years may well apply to other developing Asian countries and give rise to public health care issues. Future work will focus on the impact that preventive measures are having on fracture incidence and whether the downward trend in incidence is likely to be continued. Epidemiological studies will need to be carried out in other Asian countries to help predict the impact on their own public health services.

In the past decade, there has been a growing awareness of osteoporosis as a major health problem both in the public community and medical profession. The Department of Health of the Hong Kong Government has incorporated educational programmes on osteoporosis in their outreach geriatric program, women's health program, and primary school health education program. These programs cover epidemiology, cause and prevention of the disease. Among the medical profession, structured programs are established by the various Colleges of the Hong Kong Academy of Medicine including the Hong Kong College of Physicians, Obstetrics and Gynaecologist, Orthopaedic Surgeons, for higher clinician training on osteoporosis.

The Osteoporosis Society of Hong Kong (OSHK), a non-government organization formed by the medical profession in Hong Kong, works closely with the various Colleges to promote education, training and research in Osteoporosis. A Clinical Management Guideline was established by the OSHK to advise on the clinical practice for prevention and management of osteoporosis in Hong Kong. The Society also organizes annual scientific conference for clinicians, as well as Train-the-Trainer Workshops for para-medical and allied health professionals. The Hong Kong Osteoporosis Foundation (HKOF) was established in Hong Kong with a mission to promote public awareness on osteoporosis. It organizes activities and campaigns around World Osteoporosis Day to arouse

Taiwan, China

Overview

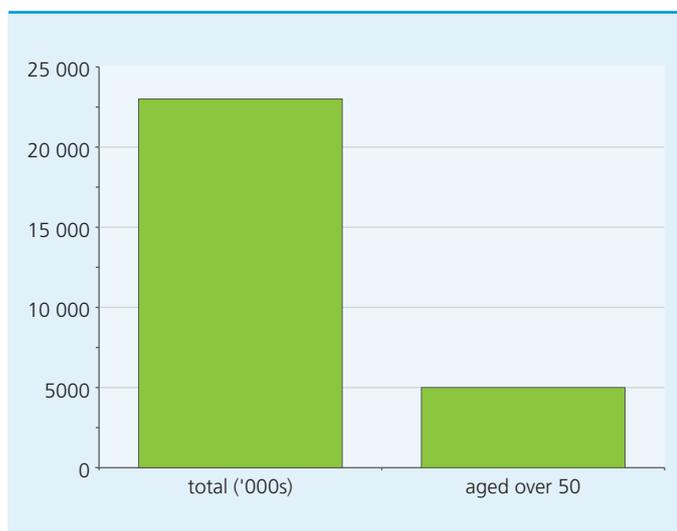
Currently, there are more than 4.9 million people over 50 years of age in Taiwan.

According to projections to 2020, over three billion USD will be spent treating 29 453 persons having osteoporotic hip fractures. By 2050, the cost will increase to five billion USD for treating 58 896 persons.

In Taiwan, the ratio of DXA machines to the general population is 0.3:10,000 and ultrasound machines to population ratio is 1.2:10 000, respectively. These scans are reimbursed by national health insurance; people need to pay 22 USD for DXA and 15 USD for ultrasound.

Medical treatment including bisphosphonates, hormone replacement therapy, selective oestrogen receptor modulators (SERMs), calcitonin, parathyroid hormone, and strontium ranelate are available and reimbursed with restricted criteria by national health insurance.

Figure 1 Taiwan population over 50 years



Because osteoporosis is recognized as a major health problem in Taiwan, The Taiwanese Osteoporosis Association (TOA) promotes a health program called *Bone Care* and a diagnostic program with *mobile DXA*. TOA was authorized to amend the guidelines for osteoporosis drug therapy by the government.

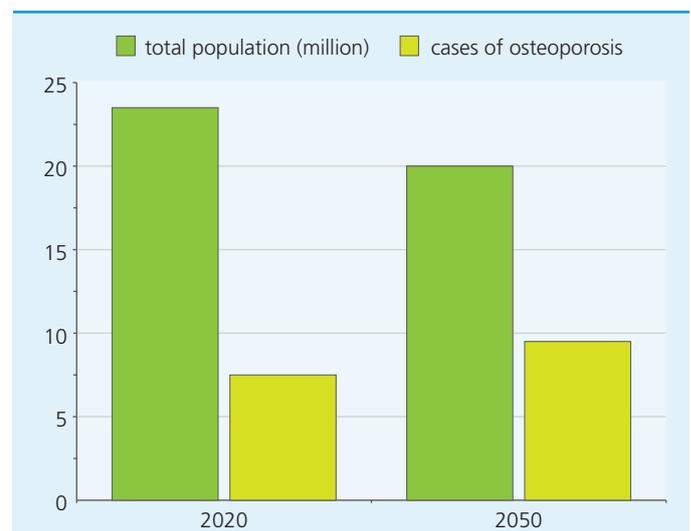
Key findings

The total population in Taiwan is approximately 23 million, 22% of this population is over 50 years (2 519 184 women and 2 460 577 men). It is estimated that the Taiwanese population will be 23.5 million in 2020 and around 20 million in 2050 (*figure 1*).

Due to the industrialization of this region and the rapid ageing of the population, it is expected that the number of persons afflicted with osteoporosis will be 7.5 million in 2020 and will reach 9.5 million in 2050. Consequently, the number of osteoporotic hip fractures will increase to 29 453 cases in 2020 and 58 896 in 2050.

A retrospective study based on the National Health Insurance Research Database of Taiwan has estimated the incidence of hip fracture in Taiwan from 1996 to 2000¹. The incidence of hip fracture in this population increased with increasing age and was about 1.6 times higher among women than men in all age

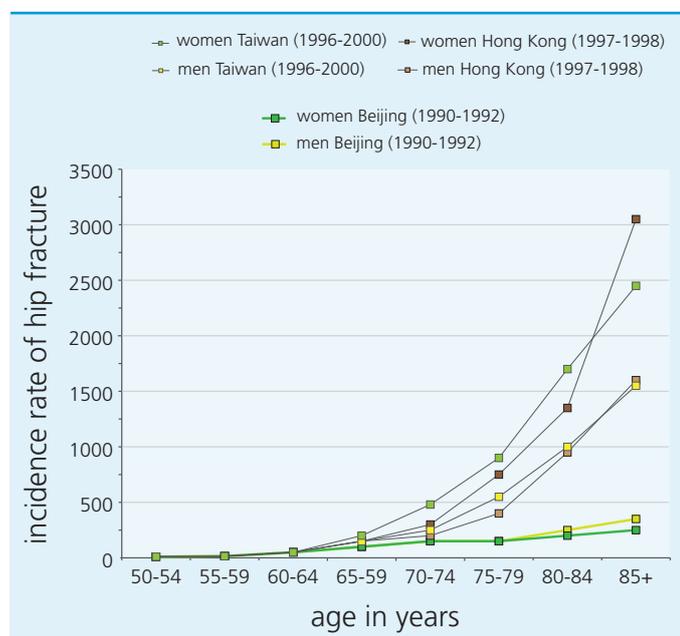
Figure 2 Taiwan population and osteoporosis cases



groups. *Figure 1* shows the age- and gender-specific annual incidence of hip fracture estimated among this population and the results from Hong Kong (1997-1998) and Beijing (1990-1992).

After standardization according to the age distribution of the US white population, the incidence rates of both genders were substantially higher than those of Beijing (3-5 times) and Hong Kong (1.2 times), except after age 85. The incidence rates of Taiwanese women were close to those of Western countries but the age-specific incidence rates of hip fracture of elderly Taiwanese men was even higher, compared with US white men in 1989. The age-specific incidence rate of hip fractures for men was about 65% of that for women, which is a higher male to female ratio than those reported elsewhere for various ethnic groups.

Figure 3 Age-specific incidence rates (10^5 person-year) of hip fractures in Taiwan, Hong Kong and Beijing



All hip fractures are treated surgically and the average hospital stay is 11.2 nights. Actual direct hospital costs are estimated at 2079 USD per case and global costs for 1 year are over 2.9 million USD. It is projected that global cost for hip fractures will reach 3 billion USD in 2020 and 5 billion USD in 2050.

Table 1 Hip fracture treatment and cost

% surgically treated	average hospital stay (nights)	direct hospital cost (USD)	global cost for 1 year (USD)
100	11.2	2079	2.9 million

Regarding vertebral fracture, 13 388 cases have been reported but it is estimated that only 15% of vertebral fractures are treated by any doctor.

The number of DXA machines is 0.3 per 10 000 population, while it is 1.2/10 000 for ultrasound. The cost for a DXA scan is 23 USD, and that of ultrasound is 16 USD. DXA is reimbursed in case of endocrine disorders or if an osteoporotic fracture has been diagnosed previously.

Table 2 Diagnostic tools and cost

DXA machine / 10 000	US machine / 10 000	cost of DXA scan (USD)	cost of US (USD)
0.3	1.2	23	16

The usual approved drug therapies for osteoporosis are available in Taiwan but reimbursement is limited to hormone replacement therapy; bisphosphonates and SERMs are reimbursed with certain conditions.

Osteoporosis is recognized as a major health problem in Taiwan and the Taiwanese Osteoporosis Association is active in providing guidelines for osteoporosis prevention and treatment and organizing prevention campaigns (Mobile DXA examination).

Although patient and health care professional awareness about osteoporosis is reasonably good in Taiwan, there is still a need to increase individuals' awareness by frequent education about prevention and treatments of osteoporosis. Financial support is needed from the government or other communities, mainly for CME meetings, media and public education sessions.

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India

Overview

As the second most populous country in the world, India is home to a very large population of osteoporosis patients. Although rather late off the block in terms of economic reforms and development, a steady increase in life expectancy to 66 years is rapidly leading to a very large ageing population, which is at risk of osteoporosis. Serious attention to osteoporosis in India started only a little over a decade ago- the first DXA machine was installed in 1997. Recent years have witnessed a flurry of activity in this area, which, however, is yet to translate into any discernible changes in government policy or recommendations.

The exact hip fracture incidence remains a challenge to investigators, but data from expatriate Indians, places their incidence somewhat lower than white Caucasians and Chinese, and higher than Malays. Lack of hip fracture data is the biggest impediment to influencing government policy (vertebral fracture data is expected soon). A series of studies from across the country have established vitamin D deficiency as a key factor influencing the bone health of Indians and suggest that supplementation may be required to achieve optimal vitamin D levels in urban Indians. BMD normograms are in the final stages of development; available data shows lower bone density in Indians as compared to Western Caucasians. Diagnostic facilities -DXA scanners- although steadily increasing in numbers, remain confined to urban areas. Most drugs used in treatment of osteoporosis are available in generic and branded formulations.

The Indian Society of Bone and Mineral Research (ISBMR) runs structured programs to enhance awareness and set standards of care for health professionals, which have had a significant impact on osteoporosis care in India. There has been substantial progress in public awareness in urban areas,

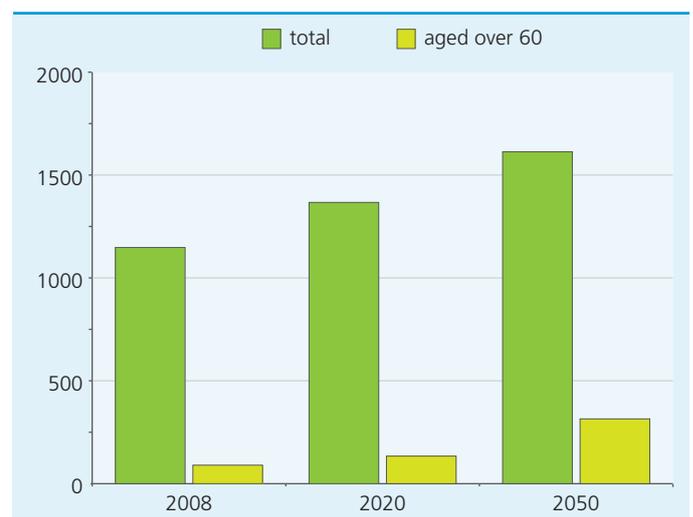
thanks largely to media interest and individual efforts of opinion leaders.

A two pronged approach is required to tackle this growing problem in India. One, a public health approach which emphasizes nutrition, exercise and sunlight exposure beginning in childhood, so as to achieve a better peak bone mass; and a clinic based approach which allows greater accessibility and affordability of DXA scanning as well as widespread use of appropriate pharmacologic therapy through inclusion in government programs or reimbursement policies.

Key findings

The population of India in the year 2008 was 1148 million¹. It is expected to increase to 1214 million by 2010; of this 7.5%, i.e. 91 million will be adults over 60 years of age. The population will increase to 1367 million by 2020 and 1613 million by 2050 (figure 1); of which 9.8 % (134 million) and 19.6 % (315 million) respectively will be adults over 60 years². These staggering numbers give some idea of the population at risk for osteoporosis in India in the years to come. In 2003 a highly conservative estimate by a group of experts suggested that 26 million Indians suffer from osteoporosis, and this number is expected to reach 36 million by 2013³.

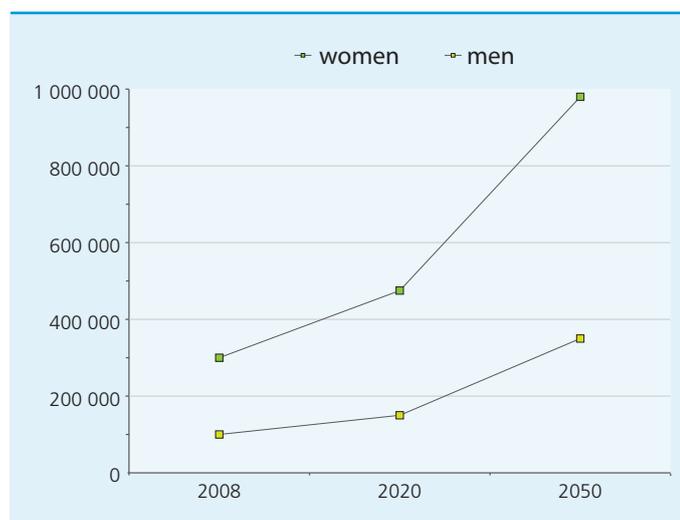
Figure 1 Population prediction for India until 2050



Although community based epidemiological data is lacking, hospital based studies suggest that hip fractures are common in India. Data on 1393 patients with hip fractures from 3 large Delhi hospitals indicated that hip fracture was common in both sexes with an average age of fracture 60-70 years⁴. It is likely that both the earlier peak age of fracture and male/female ratio in earlier reports may be misleading. As the population is living longer, the average age of fracture is also increasing, i.e, the so called earlier age at fractures could be just a reflection of poor longevity. The traditional belief that men are more commonly affected in India could be related to men seeking and getting better medical attention. This is brought out in the recent study on hip fractures in Delhi where 30% of hip fractures occurred between 60-69 years, 31% between 70-79 years, 9% between 80-89 years, and 4% over 90 years of age. The male/female ratio was 43:57. In this study the risk factors which had positive correlation with hip fracture were caffeine intake and decreased agility⁵.

A 2001 study on expatriate Indians in Singapore showed that the incidence of hip fracture was higher in women than in men; and the Indian population had higher incidence of hip fractures i.e. 361 women and 128 men per 100 000 population as compared to Malays but less than the Chinese population. The peak age of occurrence of fractures was over 70 years in all these populations⁶. If one were to extrapolate these numbers for the current Indian population as a whole, the number of hip fractures every year would be more than 440 000, with a female:male ratio of about 3:1. Following the same criterion the projections are more than 600 000 in 2020 and more than 1 million in 2050 (*figure 2*).

Figure 2 Estimated number of hip fractures projected for 2020 and 2050



A recently completed multicentre study by the Indian Council for Medical Research confirms data from smaller, single centre studies, which showed that In-

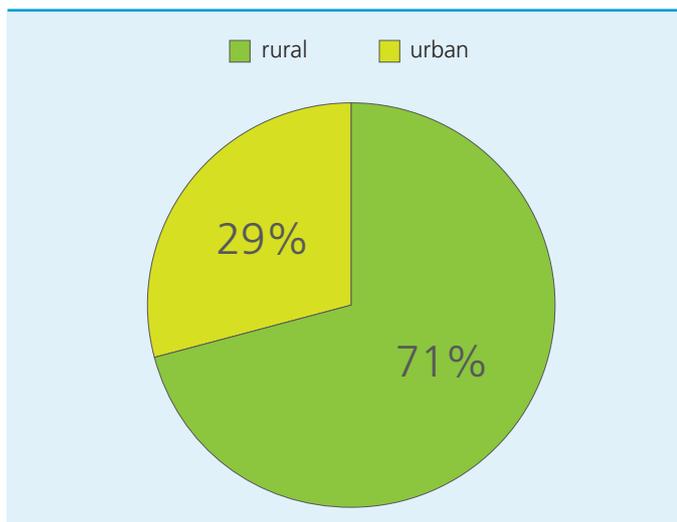
dians have lower BMD than their North American counterparts. The reason for the difference could be genetic, smaller skeletal size and most importantly, nutritional. A recent study on risk factors for low bone mass in Indians suggested lower education (defined less than class 12), duration of menopause greater than 5 years, menarche age (after 14 years), menopause age (before 45 years), parity more than 3, could be significantly correlated to low bone mass⁷. Whether this lower BMD translates into increased fracture risk is being investigated currently.

A survey carried out by the ISBMR among orthopaedic surgeons across the country, revealed that in government hospitals about 80-85% hip fractures are surgically treated whereas in private hospitals almost 100% receive surgical treatment. Direct cost for surgical treatment to the patient in government hospitals is approximately only 150 USD (the cost for the prosthesis), whereas in private hospitals the direct cost for surgical treatment is about 2500-3000 USD. There are no realistic estimates of indirect costs and burden to individuals, family or society. Costs of hospitalization are reimbursed to those who have private or government insurance, but they constitute a minority of the population.

Table 1 Hip fracture treatment - public/private hospital comparison

	% surgically treated	Direct hospital costs (USD)
public	80-85	150
private	100	2500-3000

There are approximately 250 DXA machines available in the country (about 0.2 DXA machines per million), but the number is growing rapidly. While a large proportion of DXA machines are available in the metropolitan areas, there is an increasing spread to middle sized towns all over the country, but only 29% of the Indian population is located in cities (*figure 3*). The number of ultrasound machines is several fold higher. The average cost for a DXA scan is 50-60 USD (average income per capita per month 205 USD) and for an ultrasound is 20 USD. There is no waiting for these tests, but issues of poor standardization, inaccurate technique and variations in reporting need to be addressed systematically on a national scale. Generally these are out patient procedures and do not get reimbursed by any government or private insurance policy. Vitamin D deficiency is widespread in India, despite abundant sunshine. This is due to factors such as skin pigmentation, clothing habits and absence of vitamin D fortification. A recent IOF report on the global status of Vitamin D nutrition highlights South Asia (especially India) as one of the most deficient regions⁸. Calcium intakes in India are also far below western recommendations⁹.

Figure 3 Repartition of the Indian population

Numerous varieties of calcium supplements are available over the counter: Calcium carbonate is the most popular salt. Citrate and citrate maleate are also commonly used. All calcium preparations contain some amount of vitamin D - between 200-400 IU. Vitamin D preparations like cholecalciferol (60 000 units/sachet) are also available separately and are widely used nowadays. The availability of fortified food is very limited. Recently certain types of dairy products as well as biscuits fortified with vitamin D or calcium have appeared in the market.

Virtually all approved drug therapies are available, as follows: Bisphosphonates (alendronate, risedronate, ibandronate (oral and IV), zoledronic acid), raloxifene, parathyroid hormone, HRT, calcitonin and strontium ranelate. These are available on prescription in branded and/or generic forms. There is also widespread use of unproven treatments like vitamin D analogs.

Although the overall level of awareness regarding osteoporosis is still below optimum, a series of education programs undertaken by ISBMR over the last few years is helping to change the scenario. The level of awareness among specialists - endocrinologists, rheumatologists is high. Considerable progress has been made in the level of awareness amongst gynaecologists and internists. However, most patients visit orthopaedic specialists for their bone related problems, hence the ISBMR launched an orthopaedic initiative last year, and a far greater number of orthopaedic surgeons, especially key opinion leaders, are now actively involved in spreading the message. Among allied health professionals, greater interest and participation is evident on the part of nutritionists, but

more effort is required for training nurses and physiotherapists. This is not an easy task as there are no national or health professional training programs in this area that are supported by the government.

The Government of India does not recognize osteoporosis as a major health problem. However, the ISBMR and some other societies like Arthritis Foundation of India are involved in conducting public programs for the prevention of osteoporosis. The ISBMR executive has regularly participated in programs on television and radio and has provided write ups in leading magazines and newspapers. Two monographs for the public - one on nutrition and the other on exercise have been recently bought out by the ISBMR, and a Women Leaders' Roundtable has also been organized. An IOF supported countrywide quiz organized for medical students in 2005 was a resounding success.

The Endocrine Society of India has issued guidelines on osteoporosis management. Active corporate partners like: Eli Lilly, GSK, Sanofi-Aventis, Ranbaxy, Eris Lifesciences and several others have played a major role in advertising, organizing public lectures/CMEs and increasing patient awareness.

Priority areas that require attention are as follows

- *Research*: establishing hip fracture incidence; using most recent data to generate India specific BMD standards; completing the study on vertebral fracture prevalence and BMD relationship in Indians; and developing pragmatic, effective strategies to overcome vitamin D insufficiency.
- *Physician education*: greater impetus to the orthopaedic initiative; better use of the web to disseminate information; more structured government supported programs to provide education on a national scale; more information about osteoporosis to be included in undergraduate medical curriculum.
- *Public awareness*: government agencies/ministry of health to take up bone health program as a priority; initiate a media campaign to spread awareness about lifestyle issues across the country; implement strategies to correct vitamin D nutrition, including fortification of milk and food.

Table 2 Diagnostic tools and cost

total DXA machines	DXA machine / 10 000	cost of DXA scan (USD)	cost of US (USD)	income per capita per month (USD)
250	0.002	50-60	20	205

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Projections suggest that the number of people with osteoporosis in India will be more than 36 million by the year 2013.

Indonesia

Overview

Today, Indonesia has a total population of approximately 237 million inhabitants and it is expected that 71 million people will be over 60 by 2050. It is estimated that 28.7% men and 32.3% of women have been diagnosed with osteoporosis, according to DXA. Nevertheless the disease is probably under diagnosed due to the fact that most of the population is distributed over the numerous islands of the country and that half of the 34 DXA machines are located in Jakarta.

In rural areas osteoporosis is not a priority but improvement is expected since the Ministry of Health has recognized osteoporosis as a health priority in 2006.

The Indonesian Healthy Bone Foundation (PERWATUSI) was established in 2004 and is actively involved in promoting awareness about osteoporosis with the help of corporate partners and IOF.

Key findings

The total population of Indonesia, which is widely distributed over its numerous islands is approximately

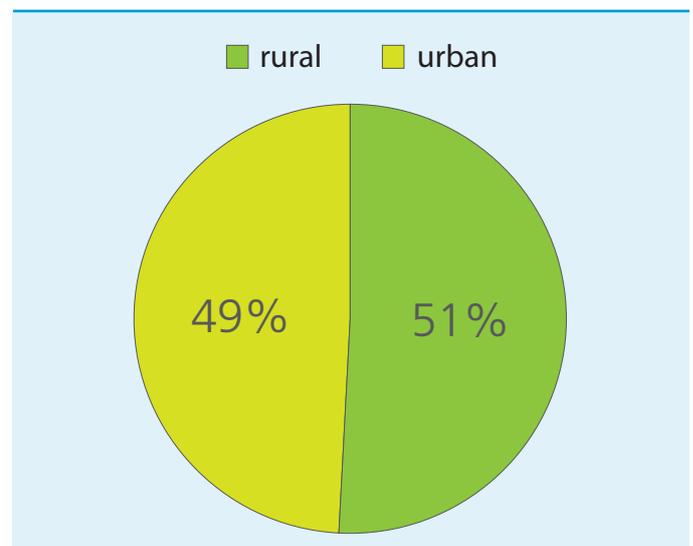
Figure 1 Population projection for Indonesia until 2050



237 million¹. It is expected to increase to 254 million by 2020 and 288 million by 2050 with 11.7% (29 million) and 24.8% (71 million) of the population being above the age of 60 years respectively² (figure 1).

There is no data available on hip or vertebral fractures. Due to limited access to DXA facilities country-wide, a clear estimate of the prevalence of osteopenia and osteoporosis is not available. Data from chapters of the Indonesian Osteoporosis Society (PEROSI) suggests that about 41.8% of men and 90% of women are osteopenic, whereas 28.8% men and 32.3% women have osteoporosis according to WHO criteria.

Figure 2 Repartition of the Indonesian population



Based on limited data from 5 hospitals, it seems that the average hospital stay (nights) for all hip fractures in Indonesia is greater than 10-14 days.

There are a total of 34 DXA machines available in Indonesia (0.001/10 000) with half of them in Jakarta (figure 2). The cost of a test is 50 USD, which is not affordable by most people, and is not covered by any insurance scheme. Therefore access to this facility remains a major issue.

Ultrasound is commonly used but lack of proper standardization makes this approach questionable. A clinical scoring system has been found to be useful

in predicting osteoporosis in a small sample of post-menopausal women in Jakarta, and may be a useful tool if validated in large numbers³.

Table 1 Diagnostic tools and cost

total DXA machines	DXA machine/ 10 000	cost of DXA scan (USD)	income per capita per month (USD)
34	0.001	50	276

Vitamin D insufficiency seems to be common in Indonesia, despite proximity to the equator, and has been reported in both pre- and post-menopausal women⁴. Indonesians are not great milk drinkers, in fact they are among the lowest consumers of milk in the world – under 10 liters per person annually (the average for Malaysia is 25 liters). While milk and food fortified with calcium and vitamin D is available, it is not widely used because of lack of awareness and economic reasons.

Oestrogen, raloxifene, calcitonin, and bisphosphonates are available in some areas. Phytoestrogens are gaining in popularity. Drugs are not usually reimbursable, except by some private insurance companies.

The Ministry of Health has recognized osteoporosis as a major problem since 2006, and efforts are underway, with the help of national societies, to spread the message about prevention among the public.

The Indonesian Healthy Bone Foundation (PERWATUSI) was established in 2004 and is actively involved in promoting awareness about osteoporosis, with the help of corporate partners. These include training tutors in osteoporosis, training exercise instructors in exercises for bone health, distributing materials and books on osteoporosis, organizing a capacity building program with IOF and conducting seminars and symposia.

Level of awareness in health care professionals is variable. In larger cities like Jakarta, doctors are updated regularly by various seminars and lectures, and the level of awareness is good. In rural areas, especially in many local Puskesmas (primary health care centres), osteoporosis has not been a priority. Improvement is expected on this front since the Ministry of Health has included osteoporosis as a health priority.

To tackle the issue of osteoporosis in Indonesia, several approaches have to be carried out simultaneously, at different levels. There is a need for the development of a support system for osteoporosis patients, and a need for much greater awareness among the public about lifestyle measures for prevention and building a better peak bone mass. Studies on identification of risk factors are required to develop better prevention strategies. Health professionals need improved training in diagnosis and treatment. More widespread availability of DXA is essential for such a large and spread out country. It is hoped that many of these issues will be better addressed by the Ministry of Health in the near future.

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In Indonesia, osteoporosis has been named a health priority and it has benefited from high profile political support on National Osteoporosis Day.

Japan

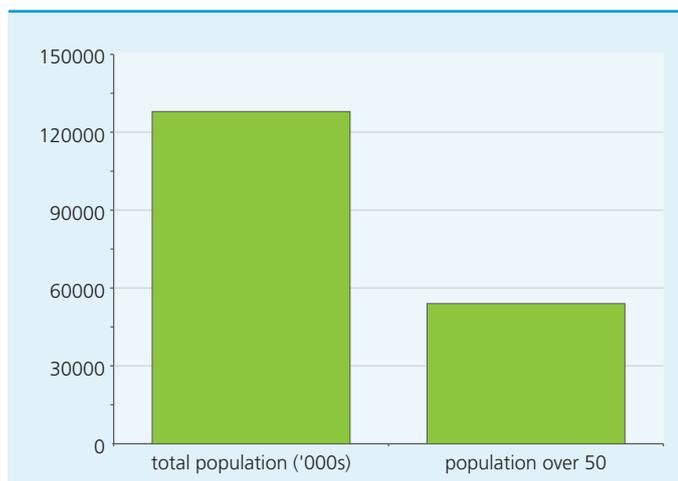
Overview

Today, the population in Japan is approximately 126 million, with 27% aged over 60. Although the total population is expected to decrease to 95 million in 2050, with one of the longest life expectancy rates (83 years) in the world, it is believed that the percentage of the population over 60 will be over 37% in 2050¹. Today, the prevalence of osteoporosis in Japan is around 12 million and the hip fracture incidence rate in the oldest population (over 75) is increasing dramatically in both men and women.

Professor Hajime Orimo, chairman of the Japan Osteoporosis Foundation, wrote: “Japan has become a country of longevity. Women’s average life expectancy has exceeded 80 years of age, placing them in a situation where they are likely to live 30 or more years after menopause. For the women to enjoy enriched lives in these 30 years, with good health, is now a great issue to their families, to Japanese society, as well as to themselves.”

The Japanese Osteoporosis Foundation is actively promoting osteoporosis awareness by providing services to patients, public and health care professionals

Figure 1 Population of Japan in 2007



and by developing medical and scientific activities throughout the year.

Key findings

The total population of Japan was 126 million in 2007. The estimated number of men and women above the age of 50 is about 25 and 29 million respectively (*figure 1*). Current projections estimate that population will decrease to 123 million by 2020 and 95 million by 2050² (*figure 2*).

The total number of Japanese affected by osteoporosis is approximately 11.6 million (women 8.4 million, men 3.2 million)³ and the number of osteoporotic hip fractures was 117 900 in 2002⁵. An average of 90 000 hip fractures are estimated to occur each year in Japan (*figure 3*). Unlike other western countries, the incidence of hip fracture is continuing to rise. The explanation for this is unclear.

The average hospital stay is about 48.4 days (2001). Average hospital costs, including nursing care, was estimated at 6.34-7.58 billion USD per year in 2002^{6,7}.

There are a total of 10 369 DXA machine (0.8/10 000p) in Japan which is high compared to other countries. The number of ultrasound is 5437 (0.4/10 000p)⁸. The cost for a DXA scan is about 33.6 USD and 7.5 USD for an ultrasound (income per capita per month 2737 USD)⁹ (*table 1*).

Figure 2 Total population ('000s)

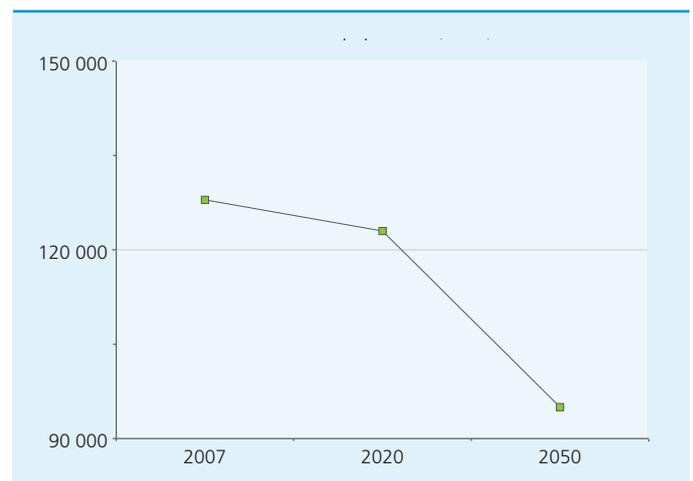
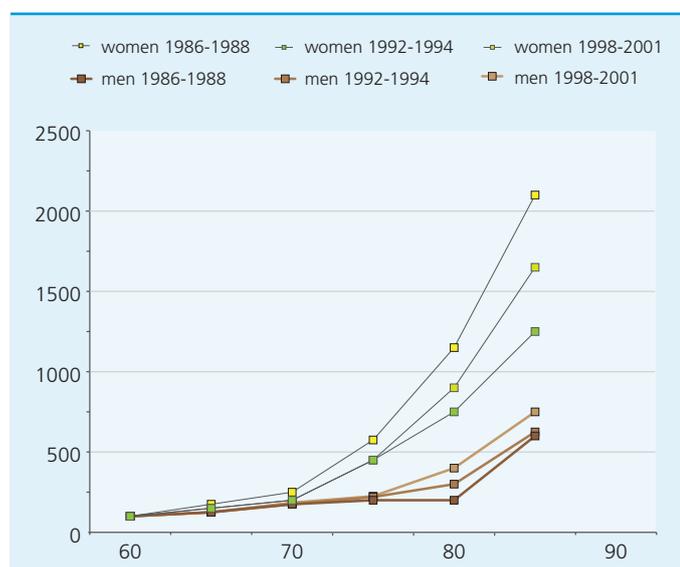


Table 1 Diagnostic tools and cost

total DXA machine	DXA machine/ 10 000	cost of DXA scan (USD)	cost of US (USD)	income per capita per month (USD)
10 369	0.8	33.6	7.5	2737

Figure 3 Age- and gender-specific hip fracture incidence⁷

A retrospective study based on 10 992 hip fractures in patients aged 65 to 111 years and treated from 1999 to 2001 was conducted in 158 core orthopaedic hospitals¹⁰. It reports that the mean duration from fracture to admission was 3.1 days, and the mean duration from admission to surgery was 11.2 days. The mean duration from surgery to discharge over the 3-year period was 48.4 days. Patient function was assessed following criteria established by the Ministry of Health, Labour and Welfare of Japan. The Activity of Daily Living (ADL) independence was assessed pre-operatively

and 1 year after the initial postoperative visit (table 2 and 3). Over the 3-year period, grade 1 and 2 patients accounted for 24.3% and 26.6%, respectively, of the patients pre-operatively. Thus, 50.9% of patients were able to walk without assistance, but at 1 year after the initial visit grade 1 and 2 patients accounted for 12.7% and 14.1%, respectively, for a total of 26.8%. This represented a decrease of 24.1 percentage points. Of the various types of functional disabilities experienced by patients with hip fracture, the degree of disability in stair climbing is marked.

There is no program for lifestyle prevention of osteoporosis but calcium and vitamin D supplements are available throughout the country.

The usual drugs for osteoporosis treatment are available: alendronate, risedronate, etidronate (bisphosphonates); estriol, 17 β -estradiol (HRT) • selective oestrogen receptor modulators (SERMs) • calcitonin, active vitamin D₃(alfacalcidol, calcitriol).

Osteoporosis is not yet recognized as a major health problem in Japan. However the Ministry of Health, Labour and Welfare has performed osteoporosis screening since 1995, with the number of examinees in 2006 being 295 434¹¹.

Table 2 Independence before fracture

ADL independence before fracture (scores 1-8)		no.	%
1	able to go out using public transportation	2667	24.3
2	can go out to visit neighbours	2928	26.6
3	can go out with assistance and spend the day out of bed	1997	18.2
4	rarely goes out; spends the day in bed	1971	17.9
5	uses a wheelchair and only leaves bed to eat or use the bathroom	700	6.4
6	can get in and out of a wheelchair with assistance	469	4.3
7	able to turn over in bed independently	67	0.6
8	unable to turn over in bed independently	46	0.4
	unknown and other	29	0.3
no response		118	1.1
total responses		10 992	100

ADL activities of daily living

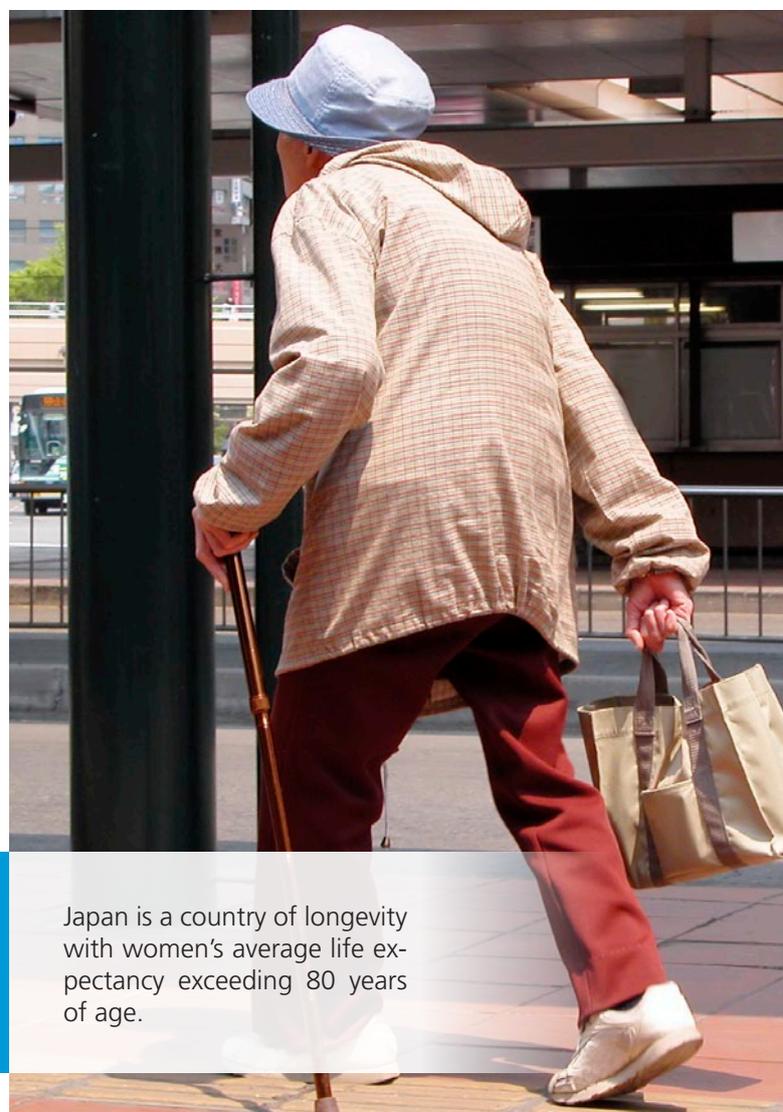
Table 3 Independence 1 year after surgery/initial visit

ADL independence 1 year after surgery/initial visit		no.	%
1	able to go out using public transportation	1399	12.7
2	can go out to visit neighbors	1550	14.1
3	can go out with assistance and spend the day out of bed	1427	13.4
4	rarely goes out; spends the day in bed	1080	9.8
5	uses a wheelchair and only leaves bed to eat or use the bathroom	1000	9.1
6	can get in and out of a wheelchair with assistance	1034	9.4
7	able to turn over in bed independently	167	1.5
8	unable to turn over in bed independently	174	1.6
	unkown and other	341	3.1
no response		2820	25.7
total responses		10 992	100

ADL activities of daily living

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Japan is a country of longevity with women's average life expectancy exceeding 80 years of age.

Republic of Korea

Overview

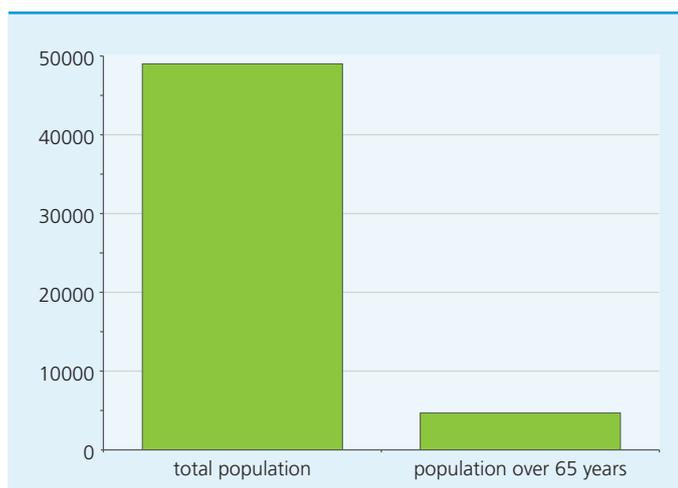
Like some other countries in Asia, the Korean population is expected to stabilize in the next 40 years. However, due to the ageing of the population, the percentage of people over 60 will triple by 2050 (from 13% in 2008 to 40% in 2050). Based on this finding, the number of patients at risk for osteoporosis and hip fracture is expected to increase and logically, the cost of hip fracture will rise substantially. Between 2001 and 2004, it has already been observed that the proportional cost of hip fractures in the total national medical cost increased by 4.5%.

Since 1998, the Korean Society of Osteoporosis has been providing services to groups of patients and education material for public and health care professionals; a symposium for osteoporosis is organized every year.

Key findings

The total population in Korea is approximately 49 million, of this 4.7 million (9.2%) are adults over 65

Figure 1 Total population ('000s) of Korea and population over 65 years in 2009



years of age, and it is expected to reach 15.1% by 2020¹.

Due to the growth of the aged population in Korea, the number of patients with hip fracture is expected to increase as well. A recent study reported that hip fracture incidence in a province of Korea increased fourfold between 1991 and 2001².

As the number of cases of hip fracture increases, the cost of hip fracture is expected to rise accordingly. Direct medical care costs of hip fracture increased from 62 707 697 USD in 2001 to 65 200 035 USD in 2004. The total medical costs in Korea in 2001 were about 29 billion USD³. When this was used as a denominator, the proportional cost of hip fractures in the total national medical cost increased by 4.5% over 4 years (from 0.200% in 2001 to 0.209% in 2004) (figure 2).

In the over 50 years age group, the number of hip fractures in women increased from 250.9/100 000 persons in 2001 to 262.8/100 000 in 2004, a 4.7% increase.

The total number of hip fractures was 26 227 in 2001 and 27 673 in 2004. Of these, the number of hip fractures in subjects over 50 years of age was 20 830 (79.4%) in 2001 and 23 307 (84.2%) in 2004. In the age-specific distribution of hip fractures by year from 2001 to 2004 in women and men over 50 years of

Figure 2 Cost related to hip fracture as a percentage of total medical costs in Korea from 2001 to 2004



Table 1 Incidence (per 100 000 persons) of hip fracture among persons ≥ 50 years of age in the period 2001-2004

year	women				men			
	crude rate	change (%)	standardized rate*	change (%)	crude rate	change (%)	standardized rate*	change (%)
2001	250.9	-	250.9	-	162.8	-	162.8	-
2002	254.2	1.32	253.5	1.04	153.2	-5.90	142.2	-12.65
2003	256.9	2.39	255.1	1.67	151.8	-6.76	137.7	-15.42
2004	262.6	4.66	262.8	4.74	152.4	-6.39	137.5	-15.54

*age adjusted to the 2001 Korean population 50 years of age or older

age, the number of hip fractures was about 1.4 times higher in women than in men. The number of cases of hip fracture in those aged 70 years or more increased steeply for both sexes. The incidences of hip fracture among women and men over 50 years of age from 2001 to 2004 are shown in *table 1*⁴.

The incidence of hip fracture in Korea compared with recent studies in other Asian and Western countries is presented in *table 2*. When comparing the incidence of hip fractures in women determined in similar years, data show that the incidence of hip fracture in Korea was much lower than those in Hong Kong, Singapore, and Finland, similar to Thailand, but higher than those in Malaysia. In men, the 2001 incidence was

similar to that for Hong Kong and Singapore, higher than those in other Asian countries, but much lower than that in Finland.

Compared with previous data from a Korean province⁵, the incidence of hip fracture has increased by more than 6 fold in women and 2.5 fold in men. In terms of sex ratio, the ratio of women with hip fractures to men with hip fractures was lower than those found in recent data from other Asian countries.

Table 2 Incidence (per 100 000 persons) of hip fracture among women and men ≥ 50 years of age in different populations

geographic location	study years	women	men	w:m
Asian studies				
Honam, Korea [19] ^a	1991	41	48	0.9
Beijing, PR China [36] ^a	1990-1992	85	80	101
Shenyang, PR China [37] ^a	1994	87	100	0.9
Kuwait [38] ^a	1992-1995	295	200	1.5
Hong Kong [39] ^b	1997-1998	459	180	2.6
Singapore [39] ^b	1997-1998	442	164	2.7
Malaysia [39] ^b	1997-1998	218	88	2.5
Thailand [39] ^b	1997-1998	269	114	2.4
Tottori Prefecture, Japan [40] ^a	1986-1987	206	74	2.8
Korea (current study) ^c	2001	250.9	162.8	1.5
Korea (current study) ^c	2004	262.8	137.5	1.9
Western studies				
Italy [41] ^a	1990	232	81	2.9
Switzerland [42] ^a	1991	494	170	2.9
Finland [5] ^d	1997	467	233	2.0
Morocco [43] ^a	2002	81	56	1.4

^aage adjusted to the 1985 American white civilian population ≥ 50 years of age

^bage adjusted to the 1989 American white population ≥ 50 years of age

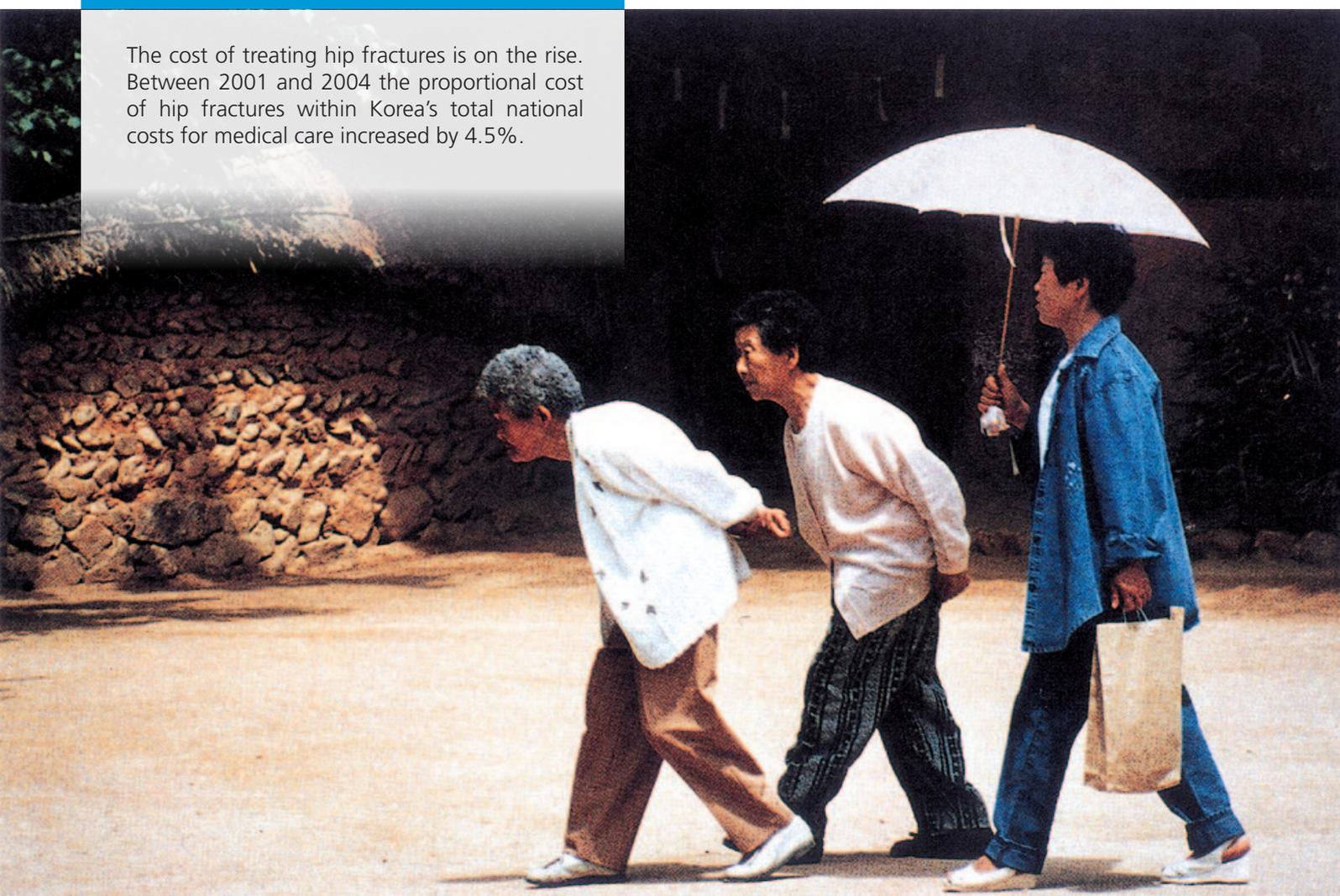
^cage adjusted to the 2001 Korean population ≥ 50 years of age

^dage adjusted to the mean Finnish population ≥ 50 years of age between 1970 and 1997

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The cost of treating hip fractures is on the rise. Between 2001 and 2004 the proportional cost of hip fractures within Korea's total national costs for medical care increased by 4.5%.



Malaysia

Overview

The demographics of Malaysia are represented by the multiple ethnic groups that exist in this country. Malays and other Bumiputera groups make up 65% of the population, Chinese 26%, Indians 8% and other unlisted ethnic groups 1%¹. The Malaysian population continues to grow at a rate of 2.4% per annum¹.

Malaysia's population, as of 31st of July 2009, is estimated to be 28 310 000². About 31.8% of the population is under the age of 15, 63.6% between the age of 15 to 64 years old and 4.6% of population above 65 years of age².

The country's population will reach 29 million in 2010, based on a projection growth of an average of 1.6% per year³. The drop in the population growth rates, compared with the previous years, is believed to be due to more Malaysians delaying marriage to pursue higher education and career advancement³. In 2010, the total fertility rate will decline to an estimated 2.48 per family compared to the total fertility rate of 2.76 per family in 2005. A total of 63.6% of the total population will be aged between 15 and 64 by the end of this period, while those above 65 will increase to 4.7%³.

By 2010, Malaysian men are expected to live up to 71 years of age while women will live up to 77.1 years. The longer life span is attributed to the improvements in accessibility to health and medical services³.

Malaysia is a multiracial country with 3 main ethnic groups comprising Malays, Chinese and Indians. It is well-known that certain illnesses affect certain ethnic group more than others. A factor that reflects cultural, religious, dietary, geographic, and other differences among races, known as ethnicity, is important in the study of disease incidence. Ethnic specific data would be more valuable than a broad, racial sum-

marisation because bone mineral density (BMD) and fracture rate have been shown to vary among Asian ethnic groups.

Key Findings

The incidence of hip fracture in Malaysians above 50 years of age with variation in different ethnic groups was studied. This was a retrospective study performed for the years 1996 and 1997⁴. Data from hospitals treating hip fractures in elderly patients were collected throughout the whole country. The overall incidence of hip fractures was 90 per 100 000 individuals. Overall, 63% of patients presenting with hip fractures were Chinese, 20% were Malays and Indians 13%⁴.

Race-specific incidence data showed that the fracture rates are highest among the Chinese (160 per 100 000) followed by Indians (150 per 100 000) and Malays (30 per 100 000).⁴

Females were twice as commonly affected compared to males. Race and sex-specific incidence data showed that the incidence was highest among Chinese females (220 per 100 000), followed by Indian females (200 per 100 000)⁴. The age-specific incidence was 500 per 100 000 for patients above 75 years, compared to 10 per 100 000 in those between 50 and 54 years⁴. This is the most comprehensive hip fracture study in Malaysia to date.

Table 1 Incidence of hip fracture by age group (per 100 000) in 1996⁴

age group (years)	male	female	overall
50-54	10	10	10
55-59	20	20	20
60-64	40	50	50
65-69	50	100	80
70-74	90	240	180
over 75	300	620	480

Table 2 Incidence of hip fracture by age group (per 100 000) in 1997⁴

age group (years)	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
over 75	320	640	510

A similar hip fracture incidence study for the year 2007 is currently underway. This is meant to compare with the 1997 hip fracture incidence data to see whether there is a difference in the incidence of hip fracture over 10 years. There is no data on the incidence of patients with osteopenia, osteoporosis as well as incidence of osteoporosis related vertebral fractures.

The direct hospitalization cost for hip fractures in 1997 is estimated at 6 million USD. This is a gross underestimate of the total economic burden, as it does not take into account the costs incurred in rehabilitation and long term nursing care. Therefore, in an ageing population this cost will escalate without appropriate intervention.

Vitamin D status among post-menopausal Malaysian women was also studied in detail⁵. Serum levels of 25-hydroxyvitamin D (25(OH)D) were determined in

276 (103 Malays and 173 Chinese) postmenopausal women, aged 50 to 65 years⁵. The level of 25(OH)D was significantly lower in the postmenopausal Malay women (44.4 ± 10.6 nmol/L) compared to the Chinese women (68.8 ± 15.7 nmol/L) ($p < 0.05$). There were 27% Malay women with serum 25(OH)D in the range of 50 – 100 nmol/L (defined as lowered vitamin D status, or hypovitaminosis D) and 71% with levels in the range of 25 – 50 nmol/L (defined as vitamin D insufficiency) compared to 87% and 11% Chinese women respectively. Serum 25(OH)D was found to significantly correlate with BMI, fat mass and PTH level. Multivariate analyses showed that race has a strong association with vitamin D status.

The high prevalence of inadequate levels of serum vitamin D found in this study may have important public health consequences and warrants the development of a strategy to correct this problem in the older adult Malaysian population⁵. The Recommended Nutritional Intake (RNI) values for vitamin D for Malaysia adapted from FAO/WHO (2002) are similar to those adopted by the Working Group for the Harmonisation of Recommended Daily Allowance (RDAs) in South East Asia (2002) as indicated in *table 5*.

There are about 65 DXA machines in Malaysia. They are available in all general hospitals of every state. This service is targeted to those who seek treatment in public hospital. In most general hospitals, the indications for DXA are based on the Malaysian Osteoporosis Society Clinical Practice Guideline. DXA machines are also available in many private hospitals in Malaysia. They are done in private hospitals for

Table 3 Race-specific hip fracture incidence rate 1996⁴

race	total cases 1996 (A)	total population x 1000 (B)	A/B	incidence rate
Malays	424	1309.7	424/1309.7	0.32
Chinese	1353	872.7	1353/872.7	1.55
Indians	294	177.5	294/177.5	1.66
others	95	82.5	95/82.5	1.15

Mantel-Haenszel summary Chi Square = 5.97, $P = 0.01$ between Malay, Chinese and Indians

Table 4 Race-specific hip fracture incidence rate 1997⁴

race	total cases 1997 (A)	total population x 1000 (B)	A/B	incidence rate
Malays	478	1352.6	478/1352.6	0.35
Chinese	1442	906	1442/906	1.59
Indians	280	183.3	280/183.3	1.53
others	94	84.9	94/84.9	1.11

Mantel-Haenszel summary Chi Square = 5.13, $P = 0.02$ between Malay, Chinese and Indians

self paying patients or those covered by health care insurance who seek treatment in private hospitals. The number of calcaneal ultrasound available in Malaysia is unknown. Ultrasounds of calcaneum are widely used as a screening tool during health care awareness campaigns. However, many companies have also used ultrasound scans as marketing tools to promote particular treatments. There is lack of control in using calcaneal ultrasound in the general public for managing osteoporosis. The general public is sometimes being misled to initiate pharmacological treatment based on ultrasound scan result alone.

Various pharmacological agents for managing osteoporosis are available in Malaysia. Basic elements such as calcium and vitamin D are always advised as part of the treatment regime for patients undergoing osteoporosis treatment. Daily agents such as hormone replacement, raloxifene, calcitriol, 1- α -calcidol, strontium ranelate and teriparatide are available. Weekly agents such as alendronate, risedronate,

monthly ibandronate as well as yearly zoledronate are also available. Some of the pharmacological agents are available in public hospitals. These are either free of charge or at a subsidized rate for patients who are treated in public hospitals. Patients seen in private hospitals or general practitioner's clinics will have to pay for the treatment. There is no national health care insurance as such in Malaysia.

In Malaysia, there are currently two societies actively promoting awareness and programs for osteoporosis. The Malaysian Osteoporosis Society (MOS) is the physicians society that was established about sixteen years ago. MOS has published Clinical Practice Guidelines (CPG) in 2001 and 2006. The CPG has been distributed and used widely by general practitioners and specialists from different fields as a guide in managing patients with osteoporosis. Guidelines on epidemiology, hip fracture data, nutrition, diagnosis and treatments for post-menopausal osteoporosis, male osteoporosis as well as glucocorticoid induced

Table 5 Comparison of recommended intake for vitamin D: RDI Malaysia (1975), RNI Malaysia (2005), FAO/WHO (2002) and AI of IOM (1997)⁴

Malaysia (1975)		Malaysia (2005)		FAO/WHO (2002)		IOM (1997)		
	age groups	RDI ($\mu\text{g}/\text{day}$)	age groups	RDI ($\mu\text{g}/\text{day}$)	age groups	RDI ($\mu\text{g}/\text{day}$)	age groups	RDI ($\mu\text{g}/\text{day}$)
infants	< 1 year	10	0 - 5 months	5	0 - 6 months	5	0 - 6 months	5
			6 - 11 months	5	7 - 11 months	5	7 - 12 months	5
children	1 - 3 years	10	1 - 3 years	5	1 - 3 years	5	1 - 3 years	5
	4 - 6 years	10	4 - 6 years	5	4 - 6 years	5	4 - 8 years	5
	7 - 9 years	2.5	7 - 9 years	5	7 - 9 years	5		
boys	10 - 12 years	2.5	10 - 18 years	5	10 - 12 years	5	9 - 13 years	5
	13 - 15 years	2.5					14 - 18 years	5
	16 - 19 years	2.5						
girls	10 - 12 years	2.5	10 - 18 years	5	10 - 12 years	5	9 - 13 years	5
	13 - 15 years	2.5					14 - 18 years	5
	16 - 19 years	2.5						
men	20 - 39 years	2.5	19 - 50 years	5	19 - 65 years	5	19 - 30 years	5
	40 - 49 years	2.5	51 - 65 years	10	51 - 65 years	10	31 - 50 years	5
	50 - 59 years	2.5	> 65 years	15	> 65 years	15	51 - 70 years	10
	\geq 60 years	2.5					> 70 years	15
women	20 - 39 years	2.5	19 - 50 years	5	19 - 65 years	5	19 - 30 years	5
	40 - 49 years	2.5	51 - 65 years	10	51 - 65 years	10	31 - 50 years	5
	50 - 59 years	2.5	> 65 years	15	> 65 years	15	51 - 70 years	10
	\geq 60 years	2.5					> 70 years	15
pregnancy	1 st trimester	10		5		5	14 - 18 years	5
	2 nd trimester	10					19 - 30 years	5
	3 rd trimester	10					31 - 50 years	5
lactation	1 st 6 months	10		5		5	14 - 18 years	5
	2 nd 6 months	2.5					19 - 30 years	5
							31 - 50 years	5

Notes 1 μg = 40 IU

osteoporosis are available and updated regularly in the Clinical Practice Guideline⁷. Biannual scientific meetings, workshops and training courses have been organized regularly to update knowledge and experience in osteoporosis management to all doctors.

The Osteoporosis Awareness Society of Kuala Lumpur (OASKL) is a newly formed society in 2008. This is a non-governmental organization formed with the main objective of promoting bone health to the public. OASKL is introducing the program “Healthy Bone for Life” to the general public as well as to the health care provider. The program emphasizes the importance of promoting healthy bone in all stages of life, from pregnant women, children, adolescents, adults and the elderly. Patient support groups for patients, family members and care givers are also part of the public program under this ‘Healthy Bone for Life’ program. Healthy bones should be part of the healthy lifestyle for all age groups. OASKL hopes to introduce the ‘Healthy Bone for Life’ program to the Ministry of Health and subsequently incorporate the idea as part of the health care program for all Malaysians.

There is still a lack of awareness among health care providers. The public health program does not include osteoporosis as one of the high priority conditions. The concept of skeletal health for all age groups has been neglected as in most of the other countries. There is also lack of driving force and support to promote bone health. With the collaboration of OASKL and MOS, we hope bone health, in particular osteoporosis, will be included in the National Health Policy in Malaysia.

Efforts should be made to raise awareness about osteoporosis as a serious and debilitating disease, increase the priority of osteoporosis at national health policy planning, consider osteoporosis on the list of chronic, disabling diseases, define essential care levels at a national level, define future strategies, projects and plan to fight osteoporosis, to reduce the incidence of osteoporosis related fractures and to promote safe home environment for the elderly.

Programs on prevention, identification of high-risk individuals, early diagnosis, and treatment intervention, prevention of falls, rehabilitation program for patients with fracture should be designed for Malaysians as well as tackling vitamin D insufficiency. Efforts to create a national osteoporosis and osteoporosis related fracture database should be a top priority.

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In Malaysia, as in many other countries around the world, the promotion of bone health must include strategies to correct the problem of low vitamin D levels at all stages of life.



Pakistan

Overview

Pakistan has a rapidly growing population, with the percentage of elderly steadily increasing. Osteoporosis is therefore, increasingly being recognized by the medical fraternity as a significant health problem.

While there is no clear data on the number of (osteoporotic) hip fractures per year, estimates based on a large ultrasound study conducted throughout the country suggested that there are 9.91 million people (7.19 million women, 2.71 million men) with osteoporosis. These numbers are estimated to rise to 11.3 million (2020) and 12.91 million (2050). There is lack of information on epidemiology and demographics of fractures. Considering the low per capita income, the hospital cost of treating a hip fracture is very high. Also, there is a loss of earning capacity because of an average hospital stay of 7 nights after hip fracture, followed by extended limited mobility, which is most of the time not compensated.

Despite the enormity of this disease, diagnostic tools might not always be utilized or available. Reimbursement is inconsistent and limited at best. Equipment is usually available in urban centres only. Although calcium and vitamin D supplements are available, foods are rarely fortified with calcium or vitamin D.

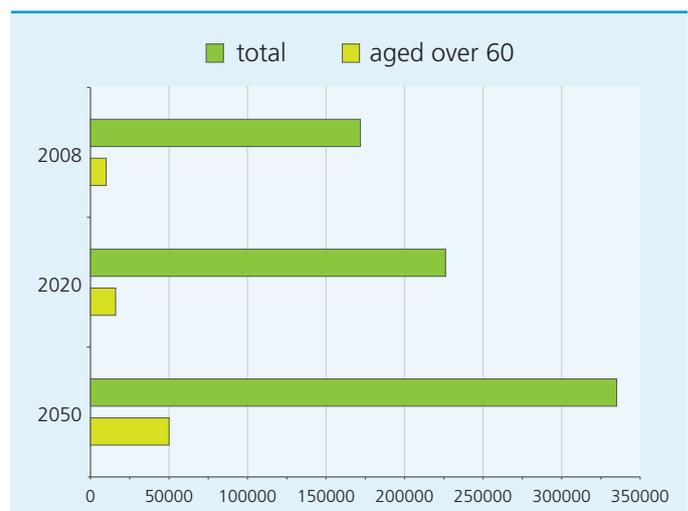
Unfortunately osteoporosis is still not recognized as a major health problem. There have been individual and society efforts, but no government policy.

In summary, issues such as limited epidemiological data, lack of awareness at primary care physician level, and limited awareness about osteoporosis among the public, are major challenges in Pakistan. It is time to initiate multicentre studies and use governmental authority to regulate medications especially regarding efficacy of generics. Involvement of the government, medical societies and media, could go a long way in improving the current situation in Pakistan

Key findings

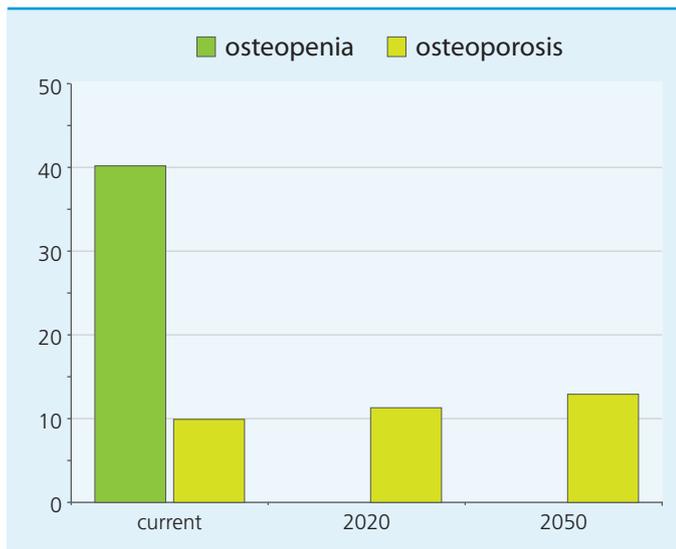
The present population of Pakistan is estimated to be 172 million¹ and expected to increase to 185 million by 2010, of this, 6.2% (11 million) will be above the age of 60 years. It is projected that the population will reach 226 million and 335 million by 2020 and 2050 respectively, of this, 7.1% (16 million) by 2020 and 14.9% (50 million) by 2050 will be the population aged over 60 years² (figure 1).

Figure 1 Population projection for Pakistan until 2050



Accurate data on fracture incidence is lacking. Analysis of hip fracture cases from a single centre over 5 years showed that female: male ratio was 2, and that the average age at fracture was 61 years³, which is lower than that in Europe and North America, but comparable to that reported from India⁴.

An estimate based on an ultrasound study of 171 788 subjects across Pakistan, puts the number of people with osteopenia at 40 million (almost equal numbers of men and women), with almost 10 million having osteoporosis. In another, smaller study, again using ultrasound on women aged 45-70 years the prevalence of osteoporosis and osteopenia was found to be 16 and 34% respectively⁵. In the North West Frontier Province, a similar study showed a prevalence of 29 and 42% respectively⁶. A clinical

Figure 2 Osteoporosis actual and projection

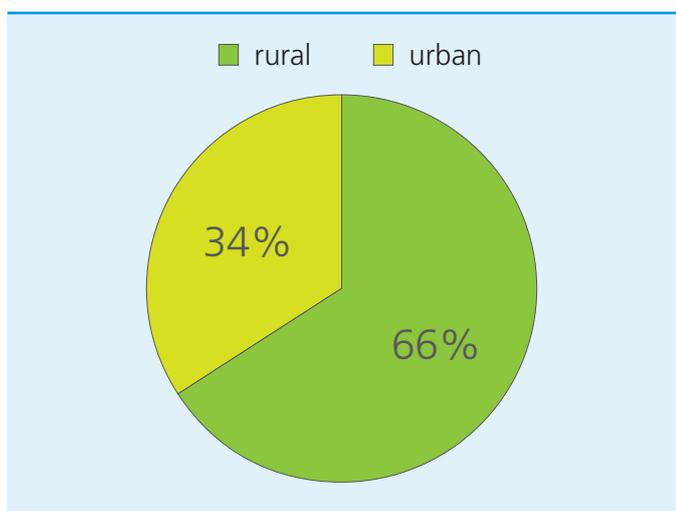
risk score administered to postmenopausal women in Peshawar suggested that as many as 75% were at risk for osteoporosis⁷.

The direct cost of treatment of hip fracture varies from 4000 to 10 000 USD per case depending on the hospital. Most fractures are treated surgically, and the average hospital stay is 7-10 days.

Table 1 Hip fracture treatment

% surgically treated	direct hospital cost (USD)	average hospital stay (days)
95	4000 to 10 000 /case	7-10

Diagnostic facilities for osteoporosis are localized to large towns and cities. Sixteen DXA machines and about 150 ultrasound machines are available. Ultrasound usage is largely limited to promotional campaigns by pharmaceutical companies.

Figure 3 Repartition of the population in Pakistan

The cost for DXA varies from 12 to 50 USD (government vs private). The scan is usually performed on the

same day. There are no reimbursements under government health plans but some private health insurances do reimburse on doctor prescription.

Table 2 Diagnostic tools and costs

total DXA machines	DXA machine/ 10 000p	cost of DXA scan (USD)	income per capita per month (USD)
16	0.001	12-50	201

Available evidence suggests that, like the rest of South Asia, vitamin D deficiency is a major issue in Pakistan too. Almost 8% of hip fracture patients in Karachi showed some evidence of osteomalacia on histology³. In another study from Hazara district, multiparous women were found to be particularly vulnerable to osteomalacia⁸. Low levels of 25(OH)D are the norm, rather than the exception, and more than 90% of ambulatory clinic patients could be affected⁹. Even infants have been found to be deficient¹⁰. Calcium intakes, especially among women are generally low in Pakistan. One study from a region of Pakistan showed daily calcium intakes of postmenopausal women to be in the 300-500 mg range⁶. Calcium and vitamin D supplements are readily available, but there is no program for fortification of food with either of them. There are no formal programs for the lifestyle prevention of osteoporosis.

Most drugs used in the treatment of osteoporosis are available with or without prescription, both in generic and branded forms. This includes bisphosphonates, oestrogen, raloxifene, calcitonin and parathyroid hormone.

Osteoporosis is not recognized by the government as a health problem and there are no policies or programs for prevention of osteoporosis and associated fractures. There are no government approved guidelines or physician guidelines nor any training programs for health professionals. The awareness of health professionals varies depending upon their specialty, with endocrinologists, rheumatologists and orthopaedists having a higher level of knowledge about the condition. The level of awareness among allied health professionals as well as the general population is limited¹¹. More recently, societies like the Osteoporosis Society, Menopause Society, and Pakistan Endocrine Society have made major efforts towards spreading awareness among health professionals, through national seminars as well as for the public through seminars and World Osteoporosis Day activities. Information material, including IOF material is available in the local language (Urdu) but dissemination is limited.

Overall, osteoporosis seems to be a significant problem in Pakistan. There are major nutritional (calcium and vitamin D) issues. Diagnostic facilities are very

limited, but even those are not fully utilized. Most drugs used for treatment are available, but are not widely prescribed except by specialists. The major hindrances to proper and standardized diagnosis and management in Pakistan are the lack of solid epidemiological data on fractures, gaps in knowledge among primary health care professionals, and limited awareness among public. There is urgent need for large multicentric epidemiological studies, which will ideally have to be supported by governmental agencies. This lack of data leads to difficulty in convincing the government to take up action. Other challenges include the unsubstantiated use of indigenous herbal remedies, and lack of adequate stringency in controlling and standardizing generic formulations. To provide the population access to diagnostic services, there is an urgent need to install DXA machines in major government hospitals.

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One of the major limitations in Pakistan and other Asian countries is the lack of solid epidemiological data on fracture prevalence and the gaps in knowledge among health care professionals. Annual seminars on osteoporosis are organized by the national osteoporosis society to help further education among the medical community.

Philippines

Overview

Awareness of osteoporosis in the Philippines was one of the lowest when compared to other Asian countries in the mid 1990s. Ten years later, awareness of the disease has moved one level higher. Many recognize the consequences of growing old and osteoporosis is one of the greatest fears of the elderly population.

Osteoporosis is just one among the major health issues in the country due to a rapid increase in the ageing population. While the government has recognized osteoporosis as a major problem and has initiated measures to improve awareness about the disease, more sustained effort and structured programs are essential for substantive progress to be made. The elderly in the Philippines are usually cared for by their families. There is an urgent need to have more preventive programs which are government aided and also an increase in the diagnostic facilities especially in rural areas.

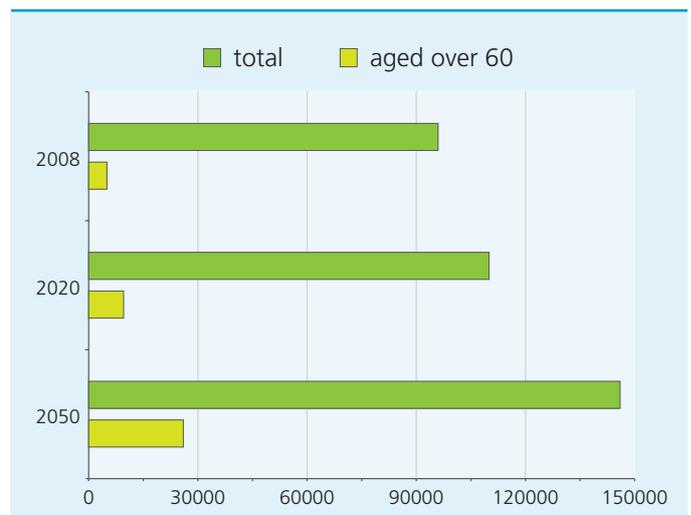
Currently the number of people over 60 years, in a population of 96 million, is 6-7%. The Philippines Osteoporosis Society has posed a Call to Action to the Philippines Government to try and address the shortfall in services for the many people suffering from osteoporosis and fractures (see recommendations).

Key findings

The current population of the Philippines is 96 million¹. Presently the number of people over 60 years of age is between 6.0 to 6.7% (6 million) of the total population. It is expected to increase to 110 million by 2020 and 146 million by 2050 and of this, 8.8% (9 million) and 17.9% (26 million) will be more than the age of 60 years¹ (figure 1).

The prevalence of hip fractures in individuals over 70 years and above was estimated to be 160 per 10 000². Based on this prevalence rate, it is estimated that there

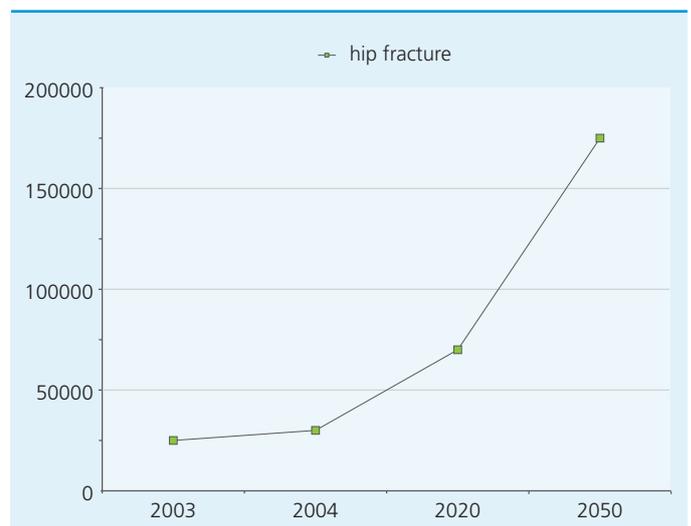
Figure 1 Population projection for Philippines until 2050



were about 28 000 hip fractures in 2003 and 34 000 in 2005. The numbers are expected to reach 65 000 by the year 2020 and almost 175 000 by the year 2050.

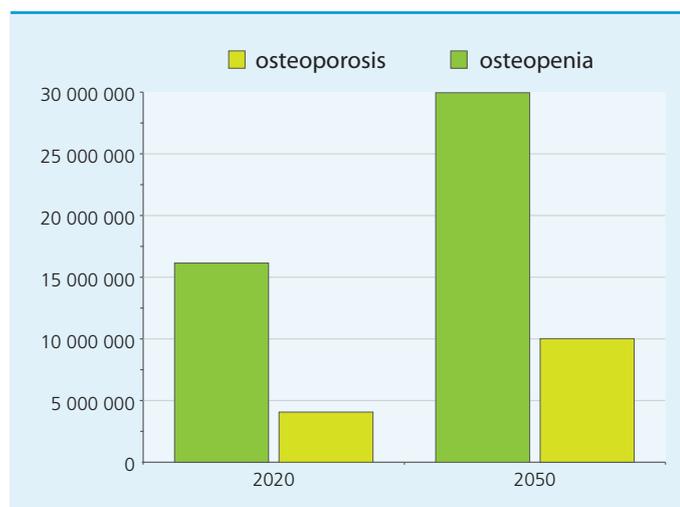
A recent survey of urban postmenopausal women using ultrasound showed a 19.8% prevalence of osteoporosis, with age and lower body weight being major risk factors³. A 2003 survey based on Osteoporosis Self Assessment Tool for Asians (OSTA) suggested that 11.23% women and 8.97% men over 50 are at high risk for osteoporosis; the risk in-

Figure 2 Hip fracture projection (population > 70 years)



creased markedly with advancing age. It is predicted that about 4 million people will be at high risk by 2020, and this number may surpass 10 million by 2050⁴ (figure 3).

Figure 3 Projection of osteopenia and osteoporosis



Philippine Health Insurance Program claims from 2001 – 2005 revealed that 66.46% of hip fractures were surgically treated. The total number of claims doubled between 2002 and 2005; the number of claims for vertebral fractures increased fourfold in this period.

On an average the direct cost for the treatment of a hip fracture in the elderly varies from 2000 USD per case at a government hospital to 6500 USD per case at a private hospital⁵. The hospital stay for a patient is a minimum of 7 nights for an uncomplicated case. Even though hip fracture is the fourth or fifth most common cause for claim, it has the highest number of admission days at the hospital and higher cost claims. The annual economic burden of fractures, as estimated from insurance claims, is higher than carcinoma of the colon, prostate and ovary but less than that of breast cancer, and chronic disorders like diabetes and hypertension. The projection is that the claims will rise from 64 million in 2020 to 170 million USD in 2050. The indirect costs of hip fracture are much higher. This includes cost for rehabilitation therapy, transportation and meal allowance for the caregiver. The projections for 2020 are 10.48 million to 43.32 million USD and 2050 27.42 million to 117.28 million USD. Other than this there is loss of productivity for at least one of the family members during hospitalization, loss of salary, reduced productivity for the employer and other costs.

Table 1 Hip fracture treatment

% surgically treated	minimum hospital stay (nights)
66.46	7

Table 2 Direct hospital cost

per case (USD) actual	total 2020	total 2050
2500 (public hospital)	64 million	170 million
6500 (private hospital)		

There are 21 DXA machines which are all confined to the urban centres. There is only one DXA machine for every 500 000 adults 50 years old and above, and the waiting time for a test does not exceed 2 days. Senior citizens can claim 20% rebate. Ultrasound is done free; however the cost for DXA varies from 20 to 130 USD.

Table 3 Diagnostic tools and cost

total population ('000s)	96 000
total DXA machines	21
DXA machine / 10 000	0.002
cost of DXA scan (USD)	20-130
income per capita per month (USD)	286

Calcium intakes in the Philippines are generally inadequate, averaging about 440 mg/day (2003 Food and Nutrition Research Institute of the Philippines Survey), and data on vitamin D status of the population is not available.

Virtually all drugs used in treatment of osteoporosis are available including oestrogen/progesterone preparations/ tibolone, calcitonin, all the bisphosphonates, strontium ranelate and parathyroid hormone. Brand-ed formulations are commonly used, while alendronate is available in generic form. Both government and private health plans offer partial reimbursement and senior citizens get 20% discounts on drug costs. Calcium and vitamin D are available without prescription. Although the government does not recognize osteoporosis among the top 10 health priorities, the Republic Act No. 19 implemented in 1990 declares every 2nd week of October as National Osteoporosis Awareness Week. There are National Guidelines 2004 for the Diagnosis, Prevention, and Treatment of Osteoporosis. The Osteoporosis Society of the Philippines Foundation (OSFFI) is actively promoting both health professional and public awareness programs. There are no government approved guidelines or training programs for the health professionals, but the OSPFI has joined with the Philippine Academy of Family Physicians in 2007 to conduct regular modular courses for general physicians.

A survey conducted in 1996 for public awareness which revealed that 3 out of 10 Filipino women were aware of osteoporosis⁶. Public programs and free peripheral densitometry with corporate support are available. The efforts of OSPFI with the Philippines

Bone and Joint Decade council has begun to improve the level of awareness among multiple specialties in the medical field.

The Osteoporosis Society of the Philippines Foundation Inc. (OSPFI) started its fight against osteoporosis in 1998. Presidential Proclamation No. 19 directs all local and national agencies along with the private sector to be supportive of activities of OSPFI in the annual celebration of NOAW. The OSPFI also joins the International Osteoporosis Foundation (IOF) in celebrating the World Osteoporosis Day annually on the 20th day of October where the global concern for the disease is highlighted.

OSPFI offers the following call to action in regard to improved osteoporosis prevention and treatment:

- Inclusion of osteoporosis as one of the official causes of significant morbidity and mortality of elderly persons 65 years and above
- Health care awareness programs, which should be closely coordinated with national osteoporosis organizations or societies
- National research studies to establish baseline risk for fracture in elderly Filipino persons
- Drawing up strategies for the early detection of high risk individuals through the inclusion of the use of Osteoporosis Screening Tool for Asians (OSTA), and case finding strategies of measuring bone density in health care packages of adult women and men

- Evaluation on impact of osteoporosis related fragility fractures, most especially vertebral fractures by including baseline thoraco-lumbar radiographs and central BMD measurement where available in health care packages of all postmenopausal women and elderly men age 65 years and above
- Revise privileges for the senior citizens set forth in the provisions of Republic Act 9257 with an increase of all grants accorded to senior citizens to at least 25% discount (from 20%).
- In view of such low calcium intake in the population there should be a call for increased fortification of food.

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The Philippines currently has a young population with slightly more than 6% above 60 years of age. However by 2050 almost 18% of the population will be over 60.



Singapore

Overview

In Singapore, as in the rest of Asia, osteoporosis will become an increasingly important public health problem. The age-adjusted hip fractures rates among women over the age of 50 years are about 450/100 000 females. Fracture of the lower limb ranked fourth in terms of the number of hospital inpatient discharges and direct hospital cost per year in Singapore.

The Osteoporosis Society Singapore (OSS) conducts public and professional talks on falls prevention, exercise and nutrition. The Singapore Health Promotion Board (HPB) disseminates information on calcium nutrition and physical activity to schools and the public. Collaborations exist between OSS and HPB in bringing education services to the community centers. However, among postmenopausal women, about half had not heard of osteoporosis. The problem is particularly acute in females above 65 years old, as many of them are illiterate and speak in dialects.

Clinical Practice Guidelines from the OSS in collaboration with the Ministry of Health (MOH), and Continuous Medical Education programs, have helped to improve the knowledge of osteoporosis among health care professionals in Singapore.

There are more than 14 DXA machines serving a population of 3.6 million. There are chronic disease management programs for osteoporosis in Singapore. Patients who have previous fragility fractures are given diet, exercise and subsidized osteoporosis treatment to prevent recurrent fractures. These programs aim to improve acceptance and adherence of interventions to prevent recurrent fractures.

Key findings

The present population for Singapore is 4.6 million¹ and is expected to increase to 4.8 million by 2010 of which 16% (0.7 million) will be aged over 60 years².

It is estimated that the total population will increase to 5.2 million by 2020. The population over the age of 60 years will increase from 26.5% (1.3 million) in 2020 to 39.6% (2.1 million) in 2050² (figure 1).

Figure 1 Population projections for Singapore until 2050

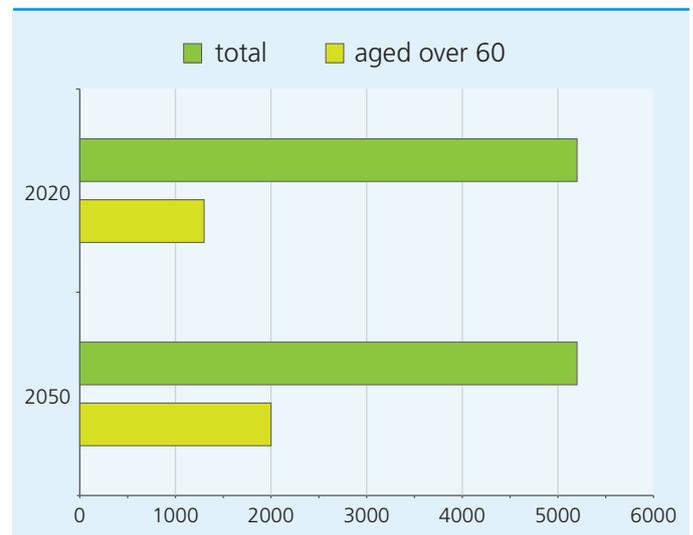
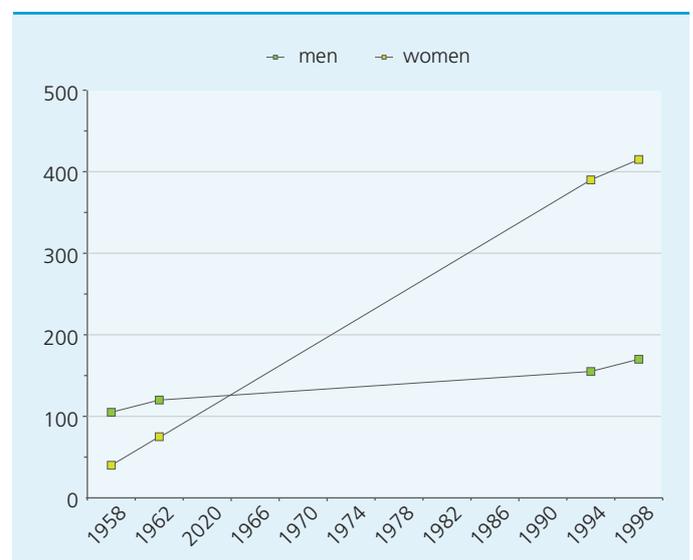


Figure 2 Progression of hip fracture rates between 1958 and 1998



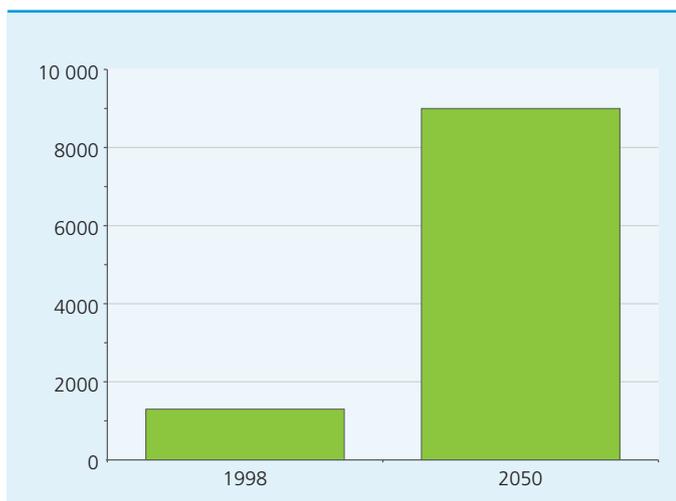
In the year 2006, a hip BMD measurement study estimated that there were about 55 000 female Singaporeans above the age of 50 who are suffering from osteoporosis. The statistics indicate osteoporosis is likely to increase as the population of Singapore is aging rapidly³.

It is also observed in Singapore men and women above the age of 50 years, that hip fracture incidence rates have risen 1.5-fold and 5-fold respectively since the 1960s. The age-adjusted rates among women over the age of 50 years are currently among the highest in Asia, and approaching those of the West⁴.

The numbers of hip fractures per year in Singapore are projected to increase from 1300 in 1998 to 9000 in 2050 because of the aging of the population (figure 3).

In women, vertebral fracture continues to increase. As the definition of a vertebral fracture differs between studies the true incidence of vertebral fractures is difficult to assess.

Figure 3 Prediction of hip fractures.

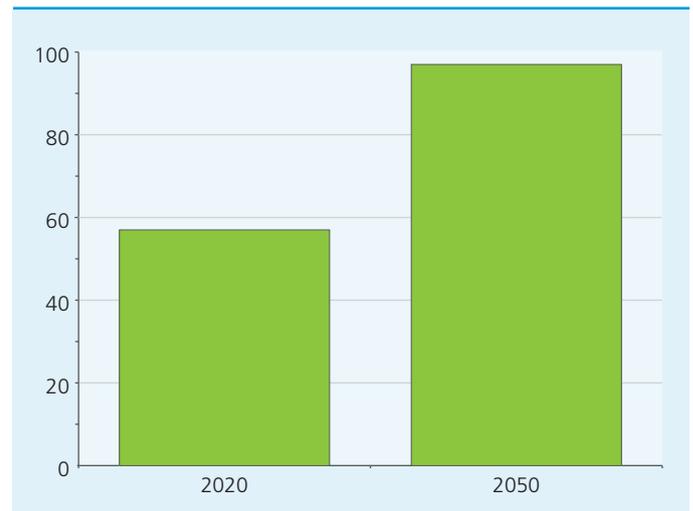


The direct costs of fractures are high: about 7920 USD for the immediate hospital care and 5940 USD in total costs for the first year (calculated at non subsidized rates in a restructured hospital). As the population ages, the total immediate hospital cost of these fractures was 10 million USD in 1998 and is estimated to rise to 83 million USD by 2050. If indirect cost is included, the total cost of managing hip fracture within the first year after fracture in Singapore is 17 million USD in 1998, and will reach 145 million USD in 2050.

Table 1 Hip fracture treatment and cost

%hip fracture	average hospital stay (nights)	direct hospital cost (USD)	total cost for the first year (USD)
100	18.7	7920	5940

Figure 4 Total cost projection (million USD) for 2020 and 2050



The average number of days of stay in hospital for hip fracture is 18.7 days⁶.

Other than the large financial burden of osteoporotic fractures, the social dependence is also high. An analysis of patients who sustained osteoporotic hip fractures in Singapore demonstrated a mortality of 20% at two years. Of the survivors, 20% became semi- or fully dependent, and 42% became less or non-ambulant. Only 8% were cared for by chronic health care facilities suggesting that the main social and economic burden was borne by the families of those affected.

There are a total of 14 DXA machines available. With the total population aged 50 years and above being 918 600 there is availability of 1 scanner per 65 614 (0.15 per 10 000). The use of ultrasound machines is generally not encouraged. There are no charges for ultrasound machine but a DXA costs 52.8-79.2 USD.

Table 2 Diagnostic tools and costs

total DXA machine	14
DXA machine/10 000 over 50	0.15
cost of DXA scan (USD)	53-79
average income per capita per month (USD)	3608

Reimbursement under a government health plan occurs when a patient is referred to hospital (50% subsidy) for DXA. These patients generally have to wait for 2 to 3 months. The full paying patients need to wait 1 to 2 weeks and at the private hospitals DXA is done in 1 to 2 days.

DXA facility is widely available in Singapore and no one is more than 30 minutes away from a centre providing this facility.

Public vitamin D and calcium supplements are readily available plus fortified foods. The Osteoporosis Society for Singapore (OSS) also provides talks on Falls Pre-

vention, Exercise and Nutrition. The Singapore Health Promotion Board (HPB) disseminates information on calcium nutrition and physical activity to schools and the public. Collaborations exist between OSS and HPB in bringing education services to community centres.

All the US Food and Drug Administration (FDA) approved drugs for osteoporosis treatment are available in Singapore. There is no reimbursement available by government health plan but are available under private health plans depending on the insurance company. These drugs are licensed as branded drugs and are available only on physician prescription.

Osteoporosis is recognized as a major health problem. The major recent achievement has been the Health Service Development Project (HSDP) osteoporosis program. This is a chronic disease management program for osteoporosis. Here patients who have previous fragility fractures are given diet, exercise and subsidized osteoporosis treatment to prevent recurrent fractures. Activities by Osteoporosis Society (Singapore), Health Promotion Board, hospital and numerous community based programs are conducted. Clinical Practice Guidelines (CPG 1998⁸, 2002⁹ and 2009) from the Osteoporosis Society(Singapore) in collaboration with the Ministry of Health is available as physician guidelines. Government supports this by giving scholarships to clinicians to do further training in osteoporosis and also Health Manpower Development Programs for further training in metabolic bone disease and osteoporosis.

Since the Osteoporosis Society (Singapore) was founded in 1996, it has been actively involved in education and dissemination of updated and accurate information on osteoporosis to health care professionals and the public, including patients and caregivers. The society also conducts various activities which are for health care professionals, patient societies, the needy osteoporotic individuals and community awareness.

The specific awareness campaigns that have been conducted include the OSS Awareness-and-Action Program and OSS Community Outreach Program. The public has availability of services such as telephone and web based help lines, patient support groups, information on the Internet and through public lectures.

In spite of all the educational activities that have occurred in Singapore, in a population-based survey among 1376 Chinese women aged 45 years and above (mean age 57 years) in 2001, 42% had not heard of osteoporosis⁷. This study indicates that awareness is still suboptimal. However awareness of osteoporosis is generally high among health professionals although some gaps remain in various professional groups. The endocrinologist, geriatric specialist and rheumatologist are well aware compared to the general practitioner and orthopaedic surgeons. The level of awareness is above average among the allied health professionals. The important setbacks are that osteo-

porosis is under-diagnosed and under-treated and the high cost of treatment. An effective prevention strategy will have to advocate building up sufficient bone reserves during youth years and making lifestyle adjustments to minimize bone loss.

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The need for public awareness campaigns in Singapore was underlined by a 2001 survey which showed that 42% of women over the age of 45 had not heard of osteoporosis.

One in three women over 50 years old suffers from osteoporosis.



Sri Lanka

Overview

Despite the predictions of high fracture incidence in the future, the efforts to face the health and socio-economic burden associated with increased number of fractures are unapparent in Sri Lanka. The current burden of communicable diseases caused by new and reemerging infections, some of which reach epidemic proportions, probably has diverted the attention of all concerned.

There are two major areas of concern regarding osteoporosis in Sri Lanka. Patchy data on the prevalence of osteoporosis and the incidence of fragility fractures is restrictive us when planning and implementing preventive strategies in high risk populations. The restricted availability of central-type DXA; only four machines for the entire country, is a major limitation. Although it was hoped that the recently introduced FRAX[®] model would partly fill this void, the applicability of FRAX[®] in clinical practice is still limited.

Lack of a coordinated program to meet the demands of osteoporotic patients has paved the way for many unacceptable practices in the country. Indiscriminate screening not based on clinical risk profile and using therapies which are expensive and not evidence-based are the end results.

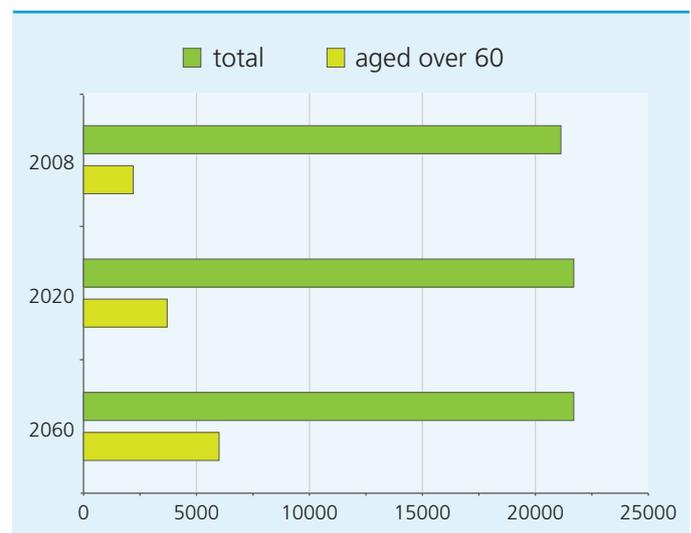
The medical community in Sri Lanka has a huge responsibility to generate reliable data to depict the correct picture of osteoporosis in the country and practice evidence-based guidelines in screening and managing those who are affected with the disease. The White Paper on Osteoporosis could be a stepping stone in this direction.

Key findings

The present population of Sri Lanka is approximately 21 million¹. It has been estimated that the total population will increase to 21.7 million by 2020 but in

spite of some increase thereafter it is expected that by 2050 the total population will again be about 21.7 million. However, the population of more than 60 years will increase from 17.1% (3.7 million) in 2010 to 27.8% (6 million) by 2050² (figure 1).

Figure 1 Population prediction for Sri Lanka until 2050

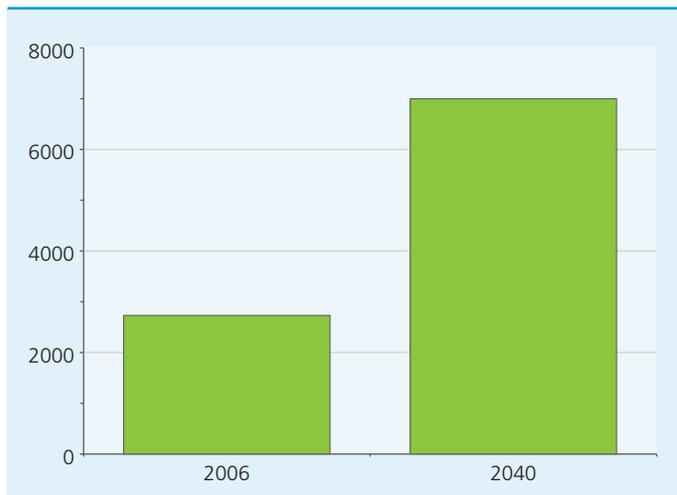


There is lack of nationwide surveys or a central database for hip fractures. However a fair estimate based on a 2007 survey in the southern province suggests that there are 73 fragility hip fractures per 100 000 people aged over 50³. This incidence is very low when compared with European and Scandinavian countries but comparable with low figures reported from some Asian countries. The estimated total number of hip fractures per year in Sri Lanka in 2006 was 2730. This number is expected to rise substantially, to about 7000 by 2040, as the population over 50 increases (figure 2).

Furthermore, a sample of postmenopausal women from a single province showed a 10% prevalence of vertebral fractures and this again is low when compared with prevalence figures from other countries⁴.

A community based survey in 7 out of 9 provinces in Sri Lanka using peripheral DXA of the phalanges, suggested that 876 thousand women may be suffering from osteoporosis by densitometric criteria. The

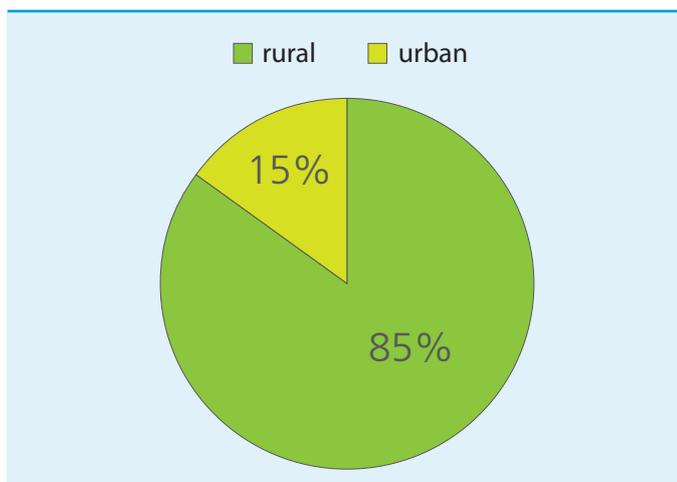
Figure 2 Comparison of the number of hip fracture cases in 2006 and 2040



use of phalgeal DXA and its validity in diagnosing osteoporosis and predicting fractures is not optimal. DXA remains the good standard for diagnosis⁵. This number would be expected to double or triple by 2020 and 2040 respectively.

Diagnostic facilities are limited to urban areas. However majority of Sri Lankans live in rural areas (*figure 3*).

Figure 3 Urban rural proportion in Sri Lanka



There are only four DXA machines (three central and one peripheral) and one ultrasound machine available for the whole of the country. Since the ordering of these tests is still infrequent, despite such limited number of machines, the waiting period is very short-1-3 days for DXA and the same day for ultrasound. The cost for DXA scan varies from 30-40 USD and for ultrasound to about 10 USD, and is reimbursable by the government and in the private sector.

Although large surveys are not available, one study done in suburban men showed an average calcium intake of about 200 mg/day, which is considerably below the recommended levels⁶. Despite favorable latitude and plenty of sunshine, the limited data available suggest that vitamin D deficiency is common in wom-

en⁷. Calcium and vitamin D supplements are widely available. Furthermore, vitamin D enriched milk and dairy products are sold all over the country. Lifestyle modification programs for osteoporosis prevention have been initiated in some areas.

Table 1 Diagnostic tools and costs

total DXA machines	4
DXA machine/10 000 population	0.002
cost of DXA scan (USD)	30-40
cost of ultrasound (USD)	10
income per capita per month (USD)	311

Vitamin D and derivatives, raloxifene, bisphosphonates (alendronate, zoledronate, and ibandronate) as well as teriparatide are available in both branded and generic forms. Apart from calcium and vitamin D, other drugs are not available in government hospitals. Reimbursements are available from the government and private health insurances with no restrictions. However, a very small proportion of the population is covered by insurance schemes.

The Sri Lankan government has not recognized osteoporosis as a major health problem. As a result there are no government approved guidelines on screening or management. Awareness of osteoporosis among health care professionals has improved considerably but there is still a gap between knowledge and implementation of treatment. Patients suspected of having osteoporosis do not receive adequate care most of the time. This could be related to lack of facilities, or hesitation on the part of the treating physician. Most of these patients are treated by rheumatologists, endocrinologists, physicians and nephrologists. Although there is no regular renewal of management guidelines, regular educational activities are being conducted with the help of national societies to inform the medical community regarding the new developments in the field of osteoporosis. Awareness of paramedical staff about osteoporosis is limited at present. Training programs for medical officers and paramedical staff are organized by Osteoporosis Sri Lanka. Guidelines by the Sri Lankan Medical Association and Osteoporosis Sri Lanka are available, and a South Asian Society for Bone and Mineral Research has been formed. The primary objective is to promote local and collaborative research within the region. With osteoporosis being addressed to a greater extent in medical curricula, the newer generation of doctors would be better prepared for the challenges that this disease poses.

Corporate partnerships have enabled wider dissemination of information materials and regular public lectures. Thus there is increasing awareness among the public in urban areas, but a lot needs to be done in the rural areas.

In summary, there is a need for countrywide fracture data to convince health authorities of the seriousness of the issue. More data about vitamin D status of the population will help to formulate strategies regarding nutrition. Awareness programs for medical professionals need to be more structured, frequent and widespread to educate and empower physicians and surgeons. A sustained public awareness campaign through the media is urgently required. More education and awareness should automatically translate into better diagnostic facilities. Reimbursement policies are in place in Sri Lanka but the availability of drugs is a concern especially for low income groups who depend on medical facilities provided by government hospitals.

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In Sri Lanka, like in many other countries, there is a great urban / rural divide. The rural population has limited access to diagnostic technology and osteoporosis treatment.

Thailand

Overview

As in the rest of the region, the population in Thailand over 60 years of age is increasing rapidly. In studies, the prevalence of osteoporosis measured by DXA is 13.6% and 19.8% at the hip and spine respectively. This translates into a total number of 909 000 women with a BMD diagnosis of osteoporosis at the hip and 1.3 million at the spine.

In other studies, about 17% (7140 cases) of those who sustained a hip fracture died in the first year after treatment. These numbers are as high as 1 in 6 women with hip fracture and carry greater mortality than the rate found in breast cancer patients after one year (1 in 9 cases). Following these women who sustained a hip fracture to 5 years, it was found that mortality increased to 1 in 3, which makes it the sixth leading cause of death in Thai women. Similar mortality rates have been reported for Thai men.

A recent study from Chiang Mai in 2005 clearly showed the rising incidence of hip fracture in both women and men. Of all women and men who sustained hip fracture and survived, 22.1% were non-ambulatory, 10% had to use gait-aids, and the remaining (67.9%) were impaired in their quality of life, even if they could walk independently. Costs of treatment are high and the annual cost is almost double of the annual per capita income.

In conclusion, osteoporosis has significant mortality and morbidity which can significantly impact resources. Osteoporosis is not among the top ten health priorities of the government, even though the number of deaths caused by it is comparable to lung cancer. Improvement in awareness and education of the Thai population especially with regard to prevention is the best public health strategy. At the same time, there is an urgent need to lobby policy makers and to convince them about the need for placing greater importance to osteoporosis in the national health priorities.

Key findings

The total population of Thailand is approximately 66 million¹. The population will increase to 68 million by 2010; 11.5% (8 million) will be above the age of 60 years. It is estimated that the total population will increase to 71 million by 2020 and 73 million by 2050. Of this 16.4% (12 million) and 26.4% (19 million) will be above the age of 60 years respectively² (figure 1).

Figure 1 Population projection for Thailand until 2050

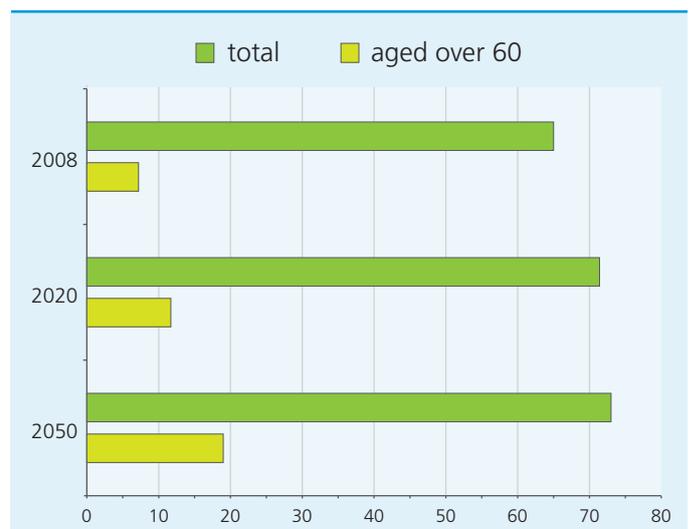
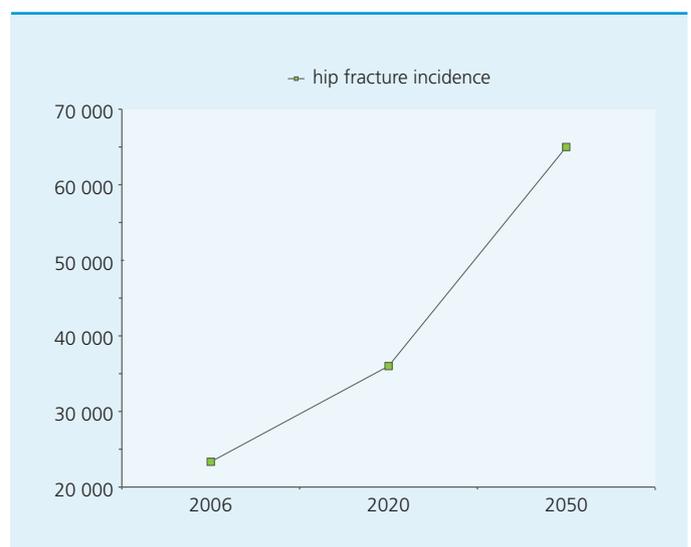


Figure 2 Prediction of hip fracture incidence until 2050



Age-specific (>50) hip fracture incidence rates for men and women were estimated to be 114 and 289 per 100 000 respectively in a 1997 Asian study³. The total number of hip fractures every year is projected to reach more than 36000 in 2020 and 65 000 in 2050 (figure 2). The majority (90 to 95%) of hip fractures are surgically treated (table 1).

The prevalence of osteoporosis (by DXA) was 33% by femoral neck or lumbar spine BMD in Thai women aged 60+/-10 years⁴. In addition to menopause, low dietary calcium and sedentary lifestyle were thought to be the main contributors to a low BMD in this population⁵. Another study using DXA showed a prevalence of over 50% in women over 70⁶. Application of the Osteoporosis Self Assessment Tool for Asians has shown mixed results in the Thai population^{4,7}.

A recent study showed a higher incidence of vertebral fractures in men than in women, and attributed it to more strenuous physical activity amongst men. In this study incidence of vertebral fracture in women and men over 50 was 32.1/1000 and 54.5/1000 person-year, respectively, and increased with advancing age⁸.

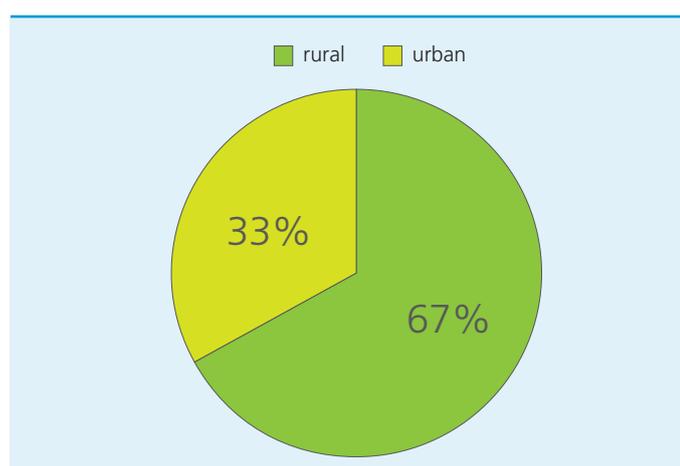
A cohort study conducted from 2002 to 2004 revealed that the median total cost of hip fracture treatment in 1 year was 3384 USD⁹ as compared to heart disease (520 USD) and pulmonary disease (225 USD); the average direct cost was 1756 USD⁹.

In Thailand, the average length of hospital stay for hip fracture is 17-22.7 days. The modified SF-12 health survey reveals that all patients suffered some degree of deficits in health perception, mental health, emotional, physical, social function and pain.

Table 1 Hip fracture treatment

% surgically treated	90-95
average hospital stay (days)	17-22.7
median direct cost (USD)	1756
total annual cost (USD)	3384
total cost heart disease (USD)	520
total cost pulmonary disease (USD)	225

Figure 3 Repartition of the Thai population



There are a total of 50 DXA machines (0.008 machine per 10 000). Most of these are available in large urban medical centers and medical school hospitals. Figure 3 shows repartition of the Thai population between urban and rural area. Ultrasound machines are more widely available. The wait for DXA is not more than 1-2 weeks; for ultrasound there is no wait if the machine is available. The cost for DXA (hip and spine) is about 60 USD. The ultrasound cost is about 10 USD per test under government and private health plans both DXA and ultrasound are reimbursed if ordered by a doctor.

Table 2 Diagnostic tools and costs

total DXA machines	50
DXA machine / 10 000	0.008
cost of DXA scan (USD)	60
cost of US (USD)	10
income per capita per month (USD)	620

Under government and private health plans both DXA and ultrasound are reimbursed if ordered by a doctor.

Calcium intakes are low in Thailand (<400 mg/day), especially in the rural population, where nondairy sources like fish may predominate¹⁰. Low calcium intakes (<138mg/day) were found to correlate with low BMD⁴. There is limited data on vitamin D status. In one study vitamin D insufficiency (25OHD <75nmol/L) was found in 47% of ambulatory postmenopausal Thai women¹¹. Calcium supplements, vitamin D supplements and foods fortified with calcium or vitamin D e.g. fortified milks, spreads, juices, cereals are available. There are no structured lifestyle prevention programs for osteoporosis.

Calcium preparations are available without prescription. Prescription drugs approved by the Thai FDA include bisphosphonates like alendronate, risedronate, ibandronate, SERMs like raloxifene, calcitonin, strontium ranelate, PTH, vitamin D analogues and vitamin K₂.

Reimbursement from government insurance is variable and available only in government hospitals. Anti-osteoporosis drugs are not usually reimbursed under the social security program and reimbursement from private health insurance varies according to policy.

The government does not recognize osteoporosis as a major health problem and neither are there any public or health professional awareness programs, covering prevention, diagnosis and management conducted by the government.

Treatment Guidelines for Postmenopausal Osteoporosis (PMOP) have been formulated by the Thai Osteoporosis Foundation (TOPF) and the Department of Medical, Ministry of Public Health.

The Thai Osteoporosis Foundation (TOPF) conducts awareness programs and provides information on osteoporosis on its website.

The level of public awareness about osteoporosis, is at best, moderate, and is better in urban than in rural areas.

There is fair level of awareness among orthopaedic surgeons, rheumatologists, gynaecologists and endocrinologists. Awareness is poor among other doctors and also in the allied health services.

Lack of government recognition regarding importance and burden of osteoporosis is a drawback. Prediction of risk by use of age, weight and ultrasound has been shown to be useful and could be included by the government in its health plan strategies¹².

There is need for greater action to educate the public and health professionals, especially by the government.

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In Thailand, as elsewhere, there is need for greater action to educate the public and health professionals.

Viet Nam

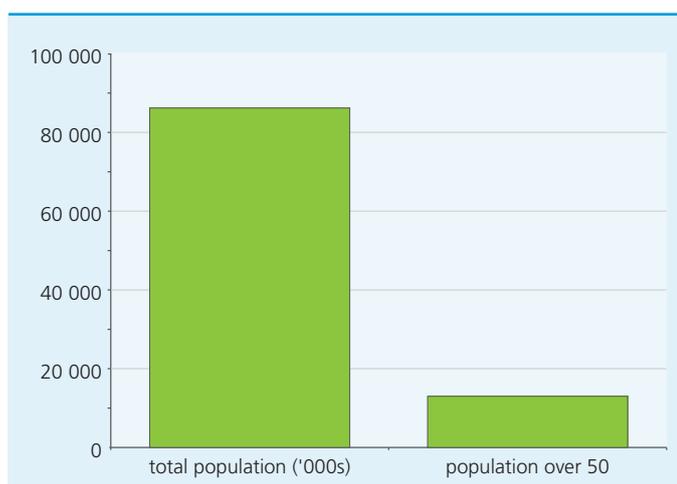
Overview

With a population of 86 million, Viet Nam is a rapidly growing and developing country. The population is expected to increase by more than 30% in the next 40 years to reach more than 111 million. Today, osteoporosis is estimated to concern 2.8 million people in Viet Nam and hip fracture due to this disease is projected to reach 47 652 cases in 2050.

These estimations are probably below reality due to the fact that most of the diagnostic tools like DXA and osteoporosis concerned health care professionals are located in the urban area whereas 73% of the Vietnamese population is rural.

Osteoporosis has been recognized as a major health problem in Viet Nam. Different measures have already been taken like prevention programs, but guidelines, health care professional training and a national strategy regarding health insurance and reimbursement policy need to be implemented.

Figure 1 Population distribution in Viet Nam



Key findings

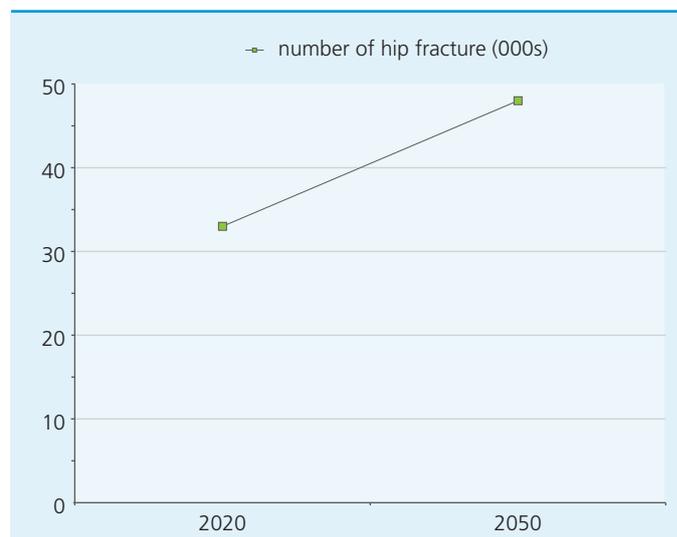
The population of Viet Nam in 2009 is approximately 86 million, of this 6.3 % (5.45 million) are women over 50 and 8.5% (7.34 million) are men over 50 (figure 1). Population is expected to increase to 98 million by 2020 and 111.7 million by 2050.

Currently, osteoporosis is estimated to affect 2.8 million people in Viet Nam (about 3.3% of the popula-

Figure 2 Population projection (in millions) in Viet Nam until 2050



Figure 3 Predictions of hip fracture



tion) and hip fracture due to osteoporosis is projected to reach 32 818 cases in 2020 and 47 652 in 2050. Regarding vertebral fracture, a recent study suggested that the prevalence of radiographic vertebral fracture was 23% in women aged over 50¹.

All of hip fractures are treated surgically and direct hospital cost is 2200 USD for a hip replacement with an average stay at hospital of 7 nights.

Table 1 Hip fracture treatment

% surgically treated	average hospital stay (nights)	direct hospital cost (USD)
100	7	2200

In total, 25 DXA machines are available for the whole population (0.003 per 10 000). They are located mostly in urban centers and large hospitals in major cities such as Ho Chi Minh City, Hanoi, Can Tho, Da Nang, and some provinces. Ultrasound machines are widely available in Viet Nam. The cost for a DXA is 12 USD (average income per capita per month is 193 USD) and for an ultrasound scan is 3 USD. Both tests are partially reimbursed by government if patients have health insurance (45% of the population have health plan).

Figure 4 Repartition of the population in Viet Nam

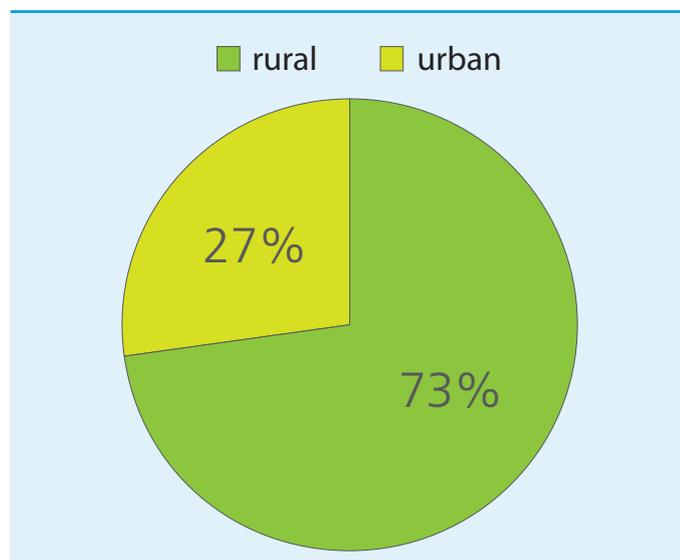


Table 2 Diagnostic tools and cost

total DXA machines	25
DXA machine / 10 000	0.003
total US machine	40
cost of DXA scan (USD)	12
cost of US (USD)	3
income per capita per month (USD)	193

Bisphosphonates, hormone replacement therapy (HRT) and selective oestrogen receptor modulators (SERMs) are available drugs as well as calcium, vita-

min D supplements and fortified food; some medications are reimbursed for inpatients.

Osteoporosis is recognized as a major health problem in Viet Nam, major achievements have been the marked increase in awareness of osteoporosis and prevention measures, awareness of impact of tobacco and alcohol on bone, benefits of regular physical exercises and appropriate nutrition. Numerous problems need to be recognized such as:

- Increase of elderly population (longevity = 71 years) but limited resources (funds, equipments)
- Lack of appropriate training for health care professionals.
- Lack of awareness among many health care professionals and in the general public
- Cost of medication for prevention and treatment is too high for a vast majority of patients, esp. those without health plan and poor.

Recommendations for prevention of osteoporotic fractures:

- *Individuals*: adequate osteoporosis information, actively participate in osteoporosis programs, seek early and regular care from health professionals, follow prevention guidelines (healthy and safe lifestyles)
- *Health care professionals*: appropriate training, raise awareness of osteoporosis in the public and patients, and pay attention to those with high risks
- *The government*: priorities should include development of guidelines, national strategy development, appropriate changes in health insurance and reimbursement policy, raising of funds from various resources

Reference

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Conclusions

Osteoporosis is a major health problem throughout the Asian region and the resulting burden is set to increase dramatically as the population in most of the region expands, with a rising proportion of elderly people.

The incidence of hip fracture has already risen 2- to 3-fold in most Asian countries during the past 30 years. And worse is to come: the fracture projections show that by 2050 more than 50% of all osteoporotic fractures will occur in Asia.

This impending fracture epidemic has enormous personal and socio-economic implications for millions of people. The burden of fragility fractures to government and societies across the region will increase, translating into higher health care costs, stretching already scarce resources, and resulting in higher mortality and disability rates - In Asia and around the world, approximately 20% of people die following an osteoporotic hip fracture.

International studies have also shown that loss of function and independence among survivors of hip fracture is profound. Forty percent are unable to walk independently, and 60% still require assistance a year later. Because of these losses, 33% are totally dependent on care in the year following a hip fracture. These statistics may underestimate the level of disability due to fractures in under developed or rural regions of Asia. In these areas many hip fracture sufferers do not receive surgical treatment due to lack of access to hospitals or lack of reimbursement for hospital stays. In a region where the elderly are largely cared for by their families, the impact of disability in terms of lost productivity is enormous; multiplied million-fold in communities throughout this vast region.

Overall, this report paints a current picture of osteoporosis in Asia – that of a greatly under-recognized and under-treated disease that represents an ever increasing socio-economic burden. The report shows that there is great diversity in osteoporosis manage-

ment and care within the region and, within many of the countries, great rural/urban disparities in awareness of osteoporosis and access to diagnosis and treatment. Widespread vitamin D deficiency and low calcium intake, which have a detrimental impact on bone health, is also shown to be an important issue that needs to be addressed.

Finally, it is apparent that there is a general lack of solid epidemiological data on fractures in the majority of countries. More research is required to help us better understand and ascertain the true picture and burden of osteoporosis and fractures in individual countries and across the region as a whole. Such data is crucial in helping to persuade policy makers that action needs to be taken to institute effective prevention and treatment programs.

Recommendations

- Policy makers must recognize that osteoporosis poses a serious health and economic burden throughout Asia – consequently, osteoporosis should be recognized as a National Health Priority in all these countries.
- Promotion of large scale epidemiological studies on prevalence and incidence, also addressing the ethnic differences in fracture rates throughout the region.
- Improved monitoring of fractures and hospitalization in order to acquire solid epidemiological data on fractures.
- Gaps in knowledge among primary health care professionals must be addressed, with osteoporosis prevention and treatment becoming a part of the official medical curriculum.
- Government guidelines for osteoporosis management and treatment should be published and widely disseminated among primary health care professionals.
- The widespread problem of Vitamin D deficiency needs to be addressed and supplementation strategies considered.
- Very low calcium intake needs to be addressed through nutritional guidelines and information campaigns in an effort to raise calcium intake among all age groups, and especially among youth.
- Promotion and instigation of affordable lifestyle and treatment strategies (including falls prevention) through government health care policies.
- Disparities in rural versus urban healthcare must be addressed.
- Government support for osteoporosis societies should be expanded.

By slowing the rising tide of osteoporotic fractures, we can help ensure that millions of people throughout Asia remain healthy and independent as they age.





Prof Cyrus Cooper

"This is an immensely important report as it is the first time that fracture data and costs have been collected in one document to highlight the enormity of the problem of fragility fractures in each of the 14 countries involved, as well as collectively across Asia. Fracture projections indicate that by 2050 more than 50% of all osteoporotic fractures will occur in Asia. This is an astounding statistic and as a consequence, IOF realized the urgent need to produce a report highlighting the actual burden and costs of fragility fractures across Asia.

I urge all national patient and scientific societies throughout Asia with an interest in bone health and fracture prevention to make use of this landmark report – both individually and collectively. Use it to generate media, to knock on the doors of key politicians and policy makers, to speak to other like minded organizations. Only by working together can we hope to change the fracture predictions in Asia in the next 20 years from an enormous increase in fractures to a steady decrease."

Professor Cyrus Cooper, Chair of the Committee of Scientific Advisors
International Osteoporosis Foundation



**International
Osteoporosis
Foundation**

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 and improve prevention, early diagnosis and treatment of osteoporosis.

Although osteoporosis affects millions of people all over the world, awareness of the disease is still low, doctors often fail to diagnose it, diagnostic equipment is often scarce, or not used to its full potential, and treatment is not always accessible to those who need it to prevent the first fracture. IOF's growing membership has more than doubled since 1999, reflecting the increasing international concern about this serious health problem. There are 194 member societies in 92 locations worldwide (September 2009). IOF member societies represent 5.33 billion people, which is equivalent to 82% of the world's population.

For more information about IOF and to contact an IOF member society in your country please visit: <http://www.iofbonehealth.org>

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