MEXICO

OVERVIEW

Consistent with trends in other regions of the world, demographic dynamics have changed in Mexico, and its population is ageing. Although this ageing process occurred over two centuries in industrialized and developed countries, it is occurring very rapidly in Mexico. Life expectancy at birth has increased almost 39 years on average over the last seven decades (from 36.2 to 75 years old). The population of those aged 60 years and over, which is currently 10.7 million, will increase to 36.4 million by 2050. By then, the average life expectancy in Mexico will be 82 years of age. Because osteoporosis and fragility fractures are diseases associated with ageing, their incidence is expected to increase accordingly.

KEY FINDINGS

Population growth statistics

The present population in Mexico is estimated to be 113 million. Of this, 18% (20 million) is 50 years of age and over and 4.3% (5 million) is 70 years and over. By 2050, it is estimated that 37% (55 million) of the population will be over 50, and 14% (20 million) will be 70 years and over while the total population will increase to 148 million (Fig 1).

Epidemiology

In Mexico, a polarized model of epidemiological transition — in which diseases with infectious etiology coexist with chronic degenerative illness — has been forming over the last 25 years. Middle and upper income individuals have been experiencing the benefits of this transition whereas lower income individuals have been left behind. The main factors contributing to this transition are increases in life expectancy, decreases in mortality, increases in the ageing population (65 years and over), and the economic impact of these differences.

Some recent figures have been reported in the literature regarding the number of individuals with osteoporosis and osteopenia diagnosed by central DXA in accordance with the WHO classification criteria.

The first study was done in three different geographic areas in Mexico. Delezé et al reported on a comparison of lumbar spine and femoral BMD of 4,460 urban dwelling women, aged 20 to 69 years. The authors found significant variation in BMD across different regions of Mexico. Women in the north had higher BMD at the lumbar spine than women in the centre or the south, but were significantly larger and taller than women in the centre or in the south. The authors concluded that regional differences in BMD were significantly different according to the region where the population was counted.

The second study was based on a random sample used for the LAVOS study in Mexican women and the vertebral fracture prevalence study in men. This random sample of 807 men and women were invited to have a central DXA of the spine and femur. Results at the lumbar spine showed osteoporosis in 9% and 17% of the men and women respectively and osteopenia in 30% and 43% of the men and women respectively. Total femur results revealed osteoporosis in 6% of men and 16% of women and osteopenia in 56% of men and 41% of women.
**Hip fracture**

The incidence rates and lifetime risk probability in Mexican men and women at the age of 50 years were reported in 2005. The hip fracture cases registered in 2000 were collected at all main tertiary-care hospitals in the two major health systems in Mexico City: IMSS and SS. The diagnoses were validated by chart review in all cases. Annually, 169 women and 98 men per 100,000 had hip fractures, and the numbers increase exponentially with age in both sexes. The lifetime risk of having a hip fracture at 50 years of age was 8.5% in Mexican women and 3.8% in Mexican men. In other words, one in 12 women and one in 20 men over the age of 50 years will sustain a hip fracture later in life. According to the classification done by Maggi et al., Mexico has an intermediate rate of hip fractures compared with other countries, with the highest rates occurring in Sweden or in Whites in Olmsted, USA, and the lowest rates occurring in continental China and Turkey. The mean incidence of hip fracture for the years 2000 to 2006 by age and sex is shown in figure 2. A recent published paper shows that age and sex-specific rates of hip fractures increased between 2000 and 2006 both for men and women by 1% per year; the same paper report the projections to the year 2050 where demographic changes estimated for Mexico indicate that the annual number of hip fractures will rise from 29,732 in 2005 to 155,874 expected in 2050. If the age-specific incidence of hip fracture continues to rise, the number of hip fractures would increase by a further 46% (fig 3).

The direct costs related to acute medical treatment of hip fractures paid for by governmental institutions and by patients at private settings in the Mexican health system and estimates of the impact of these entities have been...
published. The information was gathered through direct questionnaires given to 218 patients with hip fractures.

Additionally, a chart review was conducted and information using expert panels was obtained to get accurate protocol scenarios and microcosting; activity-based techniques were used to yield unit costs. The total direct cost for hip fractures estimated for 2006 based on the projected annual incidence of hip fractures in Mexico was a little more than 97 million USD. This estimate was based on the occurrence of about 22,000 hip fracture cases, with an individual cost per event of 4365.50 USD.

The average hospital stay for hip fractures is different for each institution. The IMSS has the highest average, 10.7 days per event; the SS had an average of 9.3; and private institutions had an average of 5.2 days.

In a previous study, the IMSS analyzed the frequency and costs of hospital care due to fractures in a two-year period (2000 - 2001) using hospital discharges and the data of Related Diagnostic Groups (RDG) to estimate the costs of hip, distal forearm, and vertebral fractures. The average cost for each case of the above-mentioned fractures was 5101.63 USD. The same study reported the cost of hip fracture in postmenopausal women to be 36,593,271 USD for a two-year period.

In a review of the literature of the Latin American region, figures similar to the one published by Clark et al. for hip fractures in the region ranged from 4500 to 7550 USD.

These two studies mentioned above used different methodology, therefore comparison is not possible. However, they both showed that the costs for fragility fractures are high in Mexico and prevention efforts have to be implemented as soon as possible to avoid future epidemics of fragility fractures and their economic impact.

There are no studies analysing indirect costs of hip or other fragility fractures in Mexico, but recently a protocol on costs and quality of life has been approved and funded. This study is part of an international study (ICUROS) and results are expected by 2012.

Table 1 (below) shows cost variance in the different institutions as well as the reasons for these differences.

Table 2 (next page) illustrates the costs of other chronic illnesses. The methodology in every case is different and the degree of accuracy is unknown as most of the data were gathered from databases in different institutions. In the hip fracture cases, the methodology included direct

### Table 1: Total cost per patient with hip fracture, adapted with permission

<table>
<thead>
<tr>
<th>RESOURCE UTILIZATION</th>
<th>IMSS</th>
<th>SS</th>
<th>MEDIUM- TO LOW-INCOME PRIVATE</th>
<th>HIGH-INCOME PRIVATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>$1110.60</td>
<td>$439.20</td>
<td>$3374.80</td>
<td>$5191.90</td>
</tr>
<tr>
<td>Medical staff*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prosthesis or fixation**</td>
<td>$660.50</td>
<td>$362.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital stay***</td>
<td>$1893.30</td>
<td>$610.50</td>
<td>$361.20</td>
<td>$1190.90</td>
</tr>
<tr>
<td>Lab and image test</td>
<td>$226.80</td>
<td>$178.20</td>
<td>$415.50</td>
<td>$609.40</td>
</tr>
<tr>
<td>Direct medical costs</td>
<td>$3891.20</td>
<td>$1590.70</td>
<td>$6158.40</td>
<td>$13,681.80</td>
</tr>
<tr>
<td>Transportation</td>
<td>$14.60</td>
<td>$3.90</td>
<td>$21.80</td>
<td>$43.60</td>
</tr>
<tr>
<td>Meals</td>
<td>$15.30</td>
<td>$18.10</td>
<td>$25.10</td>
<td>$52.20</td>
</tr>
<tr>
<td>Non-medical costs</td>
<td>$29.90</td>
<td>$22.00</td>
<td>$47.90</td>
<td>$95.80</td>
</tr>
<tr>
<td>TOTAL COSTS† (USD, 2006)</td>
<td>$3921.10</td>
<td>$1612.70</td>
<td>$6206.30</td>
<td>$13,777.70</td>
</tr>
</tbody>
</table>

*In the private sector, this represents the honoraria of a surgeon, two assistants, an anesthesiologist, and an internist. These costs are included in the surgery item for IMSS and SS.

** In private patients, these costs are included in a surgery pack.

*** General ward and Intensive Care Unit. For private patients only in excess of 4 days in a general ward is taken into consideration

† Adjusted by the Purchasing Power Parity (PPP) Index
Because there is little information on costs of musculoskeletal diseases (and there is only a little information about rheumatoid arthritis), it is difficult to prove their burden and impact on the health system. There is a need for these studies to be done so that they can be compared with other groups of diseases and prioritized in the context of the health system.

**Vertebral fracture, other fragility fractures**

The LA VOS study reported the radiographic prevalence of vertebral fractures in women 50 years and older from five Latin American countries using the standard methodology previously reported at SOF in the United States and the EPOS study in Europe (see table 3). The overall prevalence in Mexican women was 19.2%, the highest among the five countries included in the study (Argentina, Brazil, Colombia, Mexico, and Puerto Rico).

Another study revealed the prevalence of vertebral radiographic fractures by digital morphometry in a random sample of Mexican men 50 years and over. Results showed the prevalence in men is half the prevalence of women (9.8%). In both sexes, the fractures increased with age, as shown in figure 4.

A major concern is that vertebral fractures are greatly underestimated. The databases consulted included emergency rooms and specialty consultations in all care facilities in the country at IMSS. There were no reliable reports of vertebral fractures in any of these facilities. A possible explanation for this bias is that vertebral fractures are not diagnosed at any level of medical attention and will probably be reported as osteoarthritis of the spine or lumbago. Special attention should be given to this matter. Timely diagnoses of vertebral fractures allows for diagnosis and treatment of underlying disease and subsequent prevention of future fractures.

Databases at the Division of Informatics at IMSS were accessed to analyze the frequency of other major osteoporotic fractures in men and women over 50 years. Illustrated in Figure 5 (next page), and in agreement with the literature, wrist fractures are by far the most frequent fractures reported followed by hip, humerus and pelvis.

---

**TABLE 2** Average cost per year in selected chronic conditions in Mexico*, adapted with permission

<table>
<thead>
<tr>
<th>DISEASES</th>
<th>AVERAGE COST/YEAR (2009, USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast cancer</td>
<td>$10 050.35</td>
</tr>
<tr>
<td>Localized cervical cancer treatment*</td>
<td>$6091.63</td>
</tr>
<tr>
<td><strong>Heart Disease</strong></td>
<td></td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>$16 856.25</td>
</tr>
<tr>
<td>Stroke</td>
<td>$15 371.24</td>
</tr>
<tr>
<td><strong>Pulmonary Disease</strong></td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td>$9424.37</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>$14 073.54</td>
</tr>
<tr>
<td><strong>Inflammatory Diseases</strong></td>
<td></td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>$2251.35</td>
</tr>
</tbody>
</table>

* Cumulative cost of diagnosis and treatment

---

**TABLE 3** Age-specific prevalence (%) of vertebral fracture in Mexican women aged 50 and older, adapted with permission

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>PREVALENCE % (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 - 59</td>
<td>8.3 (2.7 - 13.8)</td>
</tr>
<tr>
<td>60 - 69</td>
<td>12.6 (6.1 - 19.1)</td>
</tr>
<tr>
<td>70 - 79</td>
<td>18.6 (10.7 - 26.4)</td>
</tr>
<tr>
<td>&gt; 80</td>
<td>37.9 (28.3 - 47.4)</td>
</tr>
</tbody>
</table>
Diagnosis/training course

There are 409 reported DXA scanners in Mexico\textsuperscript{13}. Eighty-five per cent of the machines can be found in the private sector. The Mexican Society of Bone and Mineral Metabolism (AMMOM), which offers the certification course on bone densitometry yearly, reports that not more than 300 BMD machines are in use in DXA centres, and only some technicians had attained certification by the International Society of Clinical Densitometry or other exams\textsuperscript{2}.

The cost of a DXA scan in Mexico ranges from 18 to 131 USD depending on the service (private vs. government).

The quantity of DXA machines in Mexico is clearly insufficient. If there were 16 724 525 people older than 50 years of age in Mexico in 2008, then only about 1.8 to 2.3 pieces of equipment were available per million people. The imbalance in this resource is noteworthy because the majority of the Mexican population use the governmental facilities where only a minority (15\%) of the DXA machines in the country can be found\textsuperscript{2}.

Reimbursement policy

The Mexican health care system is a mixture of governmental and private institutions, with varying quality of services offered at different costs. The costs and impact of osteoporosis and fragility fractures differ in these systems.

The government maintains multiple parallel health systems for different populations groups. There are two main governmental systems. One is the Mexican Institute of Social Security (IMSS), which provides several benefits besides health care (pensions, life insurance, disability, etc.) and covers almost 50 million beneficiaries (employees and their families). It is financed by employees’ payroll taxes plus legally mandated government contributions. The second-largest governmental health care system is offered through the Ministry of Health (SS) and covers the health needs of around 48\% of indigenous people who have no access to other health care facilities\textsuperscript{13}. During the last decade, the Ministry of Health began a health reform project that was expanded to offer health insurance for this population; it covers basic health needs and is called Seguro Popular\textsuperscript{15}. Finally, a heterogeneous, private system covers about 2 million people. It is noteworthy that 54\% of the total health care expenditures in Mexico are out-of-pocket payments. These figures were published in 2002\textsuperscript{14}.

Calcium and vitamin D

In Mexico the status of vitamin D and calcium is only partially known and no official recommendations are given for supplementation at any age. Few studies have reported on calcium ingested by Mexicans over 50 years through questionnaires in epidemiologic studies\textsuperscript{4,16}. Mexicans on average ingest far less calcium than the international recommendations for this nutrient. Regarding vitamin D, there are two recent studies in the paediatric population in Mexico and several studies in adults: Elizondo et al. reported in 2010 that 62\% of a paediatric sample had deficiency and 20.2\% insufficiency using radioimmunoassay\textsuperscript{17}. The second study measured vitamin D concentrations using ELISA in 1025 children from two to 12 years old from the 2006 ENSANUT Survey. The authors found insufficient levels in 23\% of the sample and deficiency in 16\%\textsuperscript{18}. A third study of 585 adults 14 years and older using tandem mass spectrophotometry found that 46.8\% of the sample was deficient and 43.6\% was insufficient\textsuperscript{19}. All three studies use the cut-off points published by Hollick et al.

Lips et al. examined vitamin D levels in osteoporotic women in Mexico, Chile and Brazil. In the Mexican population studied, 67\% had vitamin D level of < 30 ng/mL\textsuperscript{20}. Two other studies in Mexican postmenopausal women also demonstrated low levels.
of vitamin D. One study revealed that 96.8% had levels below 30 ng/ml while the other study (which included women on vitamin D supplements) reported that 50.6% of the women studied had levels below 30 ng/mL\(^{21-22}\).

There are many calcium supplements that can be easily acquired over the counter in any pharmacy, supermarket, or health and nutrition store. Several doses and types can be found. Some of them have vitamin D together with calcium.

Milk and dietary products are fortified with vitamin D. Recently new types of calcium enriched milk have been specially marketed for men and women over 40 years. Juices and cereals of different brand names are also fortified with calcium and vitamin D.

**PREVENTION, EDUCATION, LEVEL OF AWARENESS**

There are no official programmes for prevention of osteoporosis or fragility fractures in Mexico at this time. The dairy industry now has a marketing programme to increase the consumption of milk and dairy products. In Mexico, the ingestion of milk has been displaced by ingestion of carbonated soft drinks, making it the second-highest country in consumption per capita of soft drinks (160 litres per person) and the highest in consumption of cola soft drinks\(^2\).

In 2008, the Ministry of Health through the National Commission of the Institutes of Health and high-level specialty hospitals in Mexico convened a group of experts to study osteoporosis. The group was...
composed of clinical researchers, epidemiologists, health economists, social scientists, and policymakers from different institutions in Mexico. The objective of the team was to develop a national programme for prevention, treatment, and education to bring awareness to health professionals and the general public regarding osteoporosis and fragility fractures.

The group now meets on a regular basis and is currently gathering national and international data to develop national guidelines and protocols of treatment for osteoporosis. The agenda also includes setting priorities for research that will eventually evolve into nationwide prevention programmes at the population level. Education programmes for laypeople and physicians will be part of these programmes. This governmental initiative is a positive step as osteoporosis and bone health are on the government’s agenda for the first time.

Part of the group was involved with the WHO Collaborative group in modelling the FRAX® Mexican version that was added to the site in 2011.

Many structured activities are organized through AMMOM, the Mexican Committee for study of Osteoporosis Prevention (COMMOP), and local societies or groups within different provinces of Mexico for the World Osteoporosis Day in October; however, little occurs outside of these efforts. There have been three initiatives to form patient societies; unfortunately, none of them have been successful.

Several courses are offered for continuing education for different health care professionals, mostly clinicians. The courses are fully sponsored by the pharmaceutical industry; nevertheless, they are taught by leading specialists and the programmes are comprehensive and of high quality.

The Seguro Popular offers courses to qualified general physicians in several areas, and osteoporosis and fragility fractures are included in this programme.

AMMOM holds a yearly meeting in the first semester of the year, and attendees are mostly physicians with varying specialties. Posters and oral presentations are included in the programme every year. A prize is awarded for the best poster or oral work presented at the meeting.

A group of academics in the field of nutrition from the Department of Health at the Universidad IBERO works actively with COMMOP as well as with the Department of Sports Medicine at the National University (UNAM) and at the Autonomous University in the State of Mexico.


RECOMMENDATIONS

- Improved epidemiological data collection is required for: the number of fractures, common sites, direct and indirect costs related to fragility fractures, quality of life, disability and death rates in affected individuals.
- Estimate disability adjusted life years (DALY) lost due to osteoporosis and its fractures, and develop sound economic modelling studies to estimate the burden of this disease in Mexicans in order to help the government to prioritize this health condition and be able to allocate the resources needed to treat and prevent osteoporosis.
- Develop absolute risk of fractures in Mexicans, using the Mexican version of the WHO FRAX, and conduct a cost effectiveness analysis study and a case finding strategy to help the Mexican authorities set up reasonable treatment thresholds for the Mexican population.
- Implement special programmes to assist clinicians in detection of vertebral fractures, because timely diagnosis and treatment will prevent other fragility fractures in the elderly.
- Study individuals who present with wrist fracture at the age of 50 years and over and follow them as high-risk group.
- Increase the number of DXA machines in order to meet the needs of the elderly and distribute them wisely within the governmental institutions.
- Facilitate better diagnosis, treatment opportunities, and education programmes for primary physicians.
- Encourage research on vitamin D and calcium status in Mexicans. Determine to what extent
these nutritional supplements are needed in older Mexicans and develop national recommendations for supplementation accordingly.

- Increase awareness and education programmes for consumers and health professionals using as many avenues as possible and to as many people of influence as possible (medical centers, periodical journals, newspapers, government departments, business community groups, and media campaigns).

- Make resources available to fund large-scale research projects that are evidence based and provide tools for early identification, recognition, post-fracture treatment and management of osteoporosis both in the health care profession and in the community.

REFERENCES

1. U.S. Census Bureau, International Database 2011
5. Patricia Clark, MD, MSc, CNM Siglo XXI-IMSS. The prevalence of low bone mineral density in a random sample of Mexican women and men 50 years and older: A population study. ISCD 12th Annual Meeting Feb 1-4, San Diego Cal. Poster Number: 132
18. Flores M et al, Resultados de la ENSANUT 2006
19. Clark P et al. Poster to be presented at 1st IOF Latin American regional Meeting