

## The burden of osteoporosis in Latin America

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Received: 14 September 2003 / Accepted: 6 January 2004 / Published online: 20 March 2004  
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**Abstract** Osteoporosis causes considerable morbidity, mortality and resource utilization in industrialized nations. Its burden is relatively well known in United States and Canada, but poorly studied in the rest of America. This study aimed to discover the burden of osteoporosis in Latin America through a review of literature and publicly available information. In this transversal and descriptive study, information from 20 countries in Latin American region was collected from diverse published and electronic sources. Rheumatologists and bone specialists were asked for additional information through a questionnaire created by consensus. In the year 2000, the population of the Latin America and Caribbean region was 524 million from diverse ethnic origins. On average, 5.5% of the population is 65 years and older. However, with life expectancy higher than 70 years in most countries, a significant growth in the elderly population is anticipated. Studies using World Health Organization's criteria for osteoporosis report 12–18% of women 50 years and older with vertebral osteoporosis and 8–22% with proximal femur osteoporosis. Community based studies in Argentina reported between 263 and 331 hip fractures per 100,000 people 50 years and older. Hospital based studies in Colombia, Chile, Brazil, Mexico, Panama, Peru and Venezuela reported between 40 and 362 hip

fractures per 100,000 persons aged 50 and more. Between 17 and 37% of hip fracture sufferers die in the year following fracture. Prevalence of vertebral fractures in community-dwelling women aged 50 and more in Mexico is 19.35%. Data on other fractures are rare. Direct costs of a hip fracture ranged from \$4500 to \$6000. National gross income per capita in the region ranges from \$410 to \$7550. The burden of osteoporosis varies across countries with differences in populations and health resources. Considerable support for research is required, since numerous gaps in knowledge need to be filled to face the anticipated explosive growth in osteoporotic fractures.

**Keywords** Burden of Illness · Epidemiology · Osteoporosis · Osteoporotic fractures

### Introduction

Osteoporosis is a disturbing public health problem [1], which primarily affects postmenopausal women and elderly men. Its relevant clinical consequences are those related with fractures of the spine, forearm and particularly the hip, where fractures are the most catastrophic in nature.

Using the World Health Organization's operational definition for osteoporosis, it has been found that it affects 30% of postmenopausal white women in the United States (9.4 million women); the proportion rises to 70% in women over the age of 80 [2]. Although data on the prevalence of osteoporotic fractures are limited, it is estimated that the number of hip fractures that occurred worldwide in 1990 approached 1.7 million [3]. Hip fractures are responsible for substantial mortality [4].

In addition to morbidity and mortality, osteoporosis and its resulting fractures are associated with significant economic costs related to hospitalizations, surgery, outpatient care, long-term care, disability, and premature death. Health care expenditures attributable to

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This study was performed under the auspices of the World Health Organization Collaborative Center, Liege, Belgium

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osteoporotic fractures in the United States in 1995 were estimated to be \$13.8 billion [5]. Osteoporosis has been shown to result in significant costs in other countries as well [6,7,8,9,10,11,12]. As improvements in life expectancy yield growing fracture-prone, elderly populations, it is certain that the worldwide health and economic burden of osteoporosis will increase in the future [3,13,14].

Currently, our knowledge of the magnitude of the problem in most countries from Latin America remains extremely limited except for a few, mainly industrialized, nations. A World Health Organization study group has stressed the need for considerable research efforts in this area [15]. Therein, we started a burden of illness analysis, as a descriptive tool, with the objective of achieving a better understanding of the impact of this disease in Latin America.

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## Materials and methods

We conducted a review of literature and publicly available information as well as a survey of Specialists oriented to the study of osteoporosis to assess the status of research on estimation of burden of osteoporosis in Latin America, from 1980 to 2003 [16].

Since some information is available only in publications of local or regional importance, not readily available in most international compilations, we requested the cooperation of board-certified rheumatologists, members of the Pan-American League of Associations for Rheumatology and other health professionals interested in the study of osteoporosis and metabolic bone diseases from each country. The bone specialists were identified based on their reputation in the area of osteoporosis and metabolic disease as observed from published articles and presence at scientific conferences. A directory of these bone specialists was created and a 43-question structured questionnaire (created on the basis of consensus of five bone specialists in Mexico), divided into five items (demography, morbidity, mortality, direct costs and information from the contributor) was sent to each of these selected persons. A literature review was conducted by doing a Medline search in order to obtain economic and epidemiological data related to osteoporosis. Further, electronic and locally available printed sources were searched for economic and demographic data on Latin America, centering on demographic characteristics of each country, including age and gender composition; ethnic composition, life expectancy and economic characteristics.

We analyzed morbidity, including the prevalence of osteoporosis (using the World Health Organization operational definition [15] based in bone mineral density measurements) and the incidence of fractures of hip, spine and wrist attributable to osteoporosis, according to published criteria [17,18]. We also analyzed mortality (including age and gender specific hip fracture incidence and mortality rate); resource utilization (including prevention of osteoporosis, screening and diagnosis, pharmacotherapy, outpatient care and treatment of osteoporotic fractures, including hospitalization, surgery, nursing home and related facilities, outpatient care, home health care, etc.); an analysis of cost per unit of identified resources and an analysis of collected information, by using descriptive statistics.

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## Results

Questionnaires were sent to 32 health professionals from 18 countries. A total of 15 of these bone specialists, from 11 countries, responded. Information from the rest of

the countries was obtained from alternative sources like published literature.

## Demography

Latin America and the Caribbean had 524 million of inhabitants in year 2000. Table 1 presents demographic and other characteristics from 20 selected countries in Latin America. In year 2000, they had 507,932,043 inhabitants, of whom 5.57% were 65 years and older. In Argentina and Uruguay, people 65 years and over constitute over 10% of the national population. Cuba (9.6%) and Chile (7.2%) are in the middle, and the rest of the countries have below 6% elderly population. Although hip and vertebral fractures are most prevalent in population over 65 years of age, persons aged 50 years and older can sustain some (particularly wrist, vertebral and other) fractures. In addition, menopause and several medical conditions make people over 50 candidates for early detection of osteoporosis and prevention of fractures, with considerable resource utilization. Persons aged 50 years and older constitute 14.62% of the population in the region, with figures ranging from 9 to 26.9% among different countries [19,20]. Different (even neighboring) countries show a very diverse ethnic composition. Argentina and Uruguay have a predominantly white Caucasian population. Native American populations constitute high proportions of the total population in Bolivia, Guatemala, Ecuador and Peru. Black Africans form the majority in Haiti and a significant proportion of the total in several countries. The Mestizo population (comprising a variable mixture of native American, white Caucasian and black African descents) predominates in most Latin-American countries [20]. Information regarding differences in the risk of osteoporosis and fractures in the different ethnic groups is quite rare except for a few studies conducted in minorities in the United States. Life expectancy at birth reached 70 years in the region. Only Haiti's remains below 55, but even in countries with a high infant mortality, elderly population is on the rise [20]. Gross national income expressed in US dollars per capita provides a glimpse of available economic resources. Mean Gross National Income in this region is \$2776 (ranging from \$410 to \$7550) and some of the poorest countries (Haiti and Nicaragua) of the world are part of this region [21]. Access to medical care also varies among countries. Although Social Security and diverse forms of medical insurance are present in most countries, a high proportion of the population depends of a fee-for-service model, where reimbursement policies are limited or non-existent in the case of detection and treatment of osteoporosis [22].

Other demographic realities of Latin America include the "urbanization" of the population and a high illiteracy rate and incomplete elementary education in many countries. Most people in Latin America live in cities now. Their knowledge and attitudes towards health care

**Table 1** Population and characteristics of the PANLAR region, year 2000 [19,20,21,22]. %POP Percentage of the population of a given age group. Ethnic composition: *w* white, Caucasian; *na* native American; *m* Mestizo (diverse proportions of Caucasian, native American and African origins); *b* Black African origins; *o* other

Country	Population	> 50 years	% POP	> 65 years	% POP	Ethnic composition	LEB	GNI	% UP	% AI
Argentina	37,031,802	8,285,230	22.4	3,883,408	10.5	w97, na1, m1, o1	73	7550	89	3
Bolivia	8,328,699	1,000,526	12.0	334,676	4.0	w24, na45, m31	62	990	62	14
Brazil	170,693,424	26,022,389	15.2	8,841,286	5.2	w53, na1, m39, b6, o1	70	4350	76	10
Colombia	42,321,386	5,681,311	13.4	1,994,957	4.7	w20, na1, m61, b18	70	2170	73	9
Costa Rica	4,023,466	571,705	14.2	205,357	5.1	w33, na1, m60, b3, o3	76	3570	47	5
Cuba	11,200,692	2,713,389	24.2	1,072,807	9.6	w37, m51, b11, o1	78	NA	77	4
Chile	15,211,308	2,858,225	18.8	1,090,387	7.2	w2, m92, na6	75	4630	85	4
Dominican Republic	8,495,360	1,122,756	13.2	381,763	4.5	w15, m75, b10	70	1920	64	17
Ecuador	12,646,095	1,648,094	13.0	757,734	6.0	w4, na52, m40, b4	70	1360	64	9
El Salvador	6,276,037	827,072	13.2	312,448	5.0	w1, na5, m94	69	1920	46	22
Guatemala	11,385,336	1,133,400	9.9	403,744	3.5	w8, na45, m45, b1, o1	64	1680	39	32
Haiti	8,356,765	928,516	11.1	302,306	3.6	w5, b95	54	460	35	39
Honduras	6,485,475	634,515	9.8	223,336	3.4	w1, na7, m90, b2	69	760	51	26
Mexico	98,881,308	13,066,375	13.2	4,670,869	4.7	w10, na10, m80	72	4440	74	9
Nicaragua	5,074,243	458,369	9.0	158,267	3.1	w17, na9, m69, b5	68	410	55	32
Panama	2,855,701	440,226	15.4	158,113	5.5	w10, na8, m66, b10, o6	74	3080	56	8
Paraguay	5,496,450	569,862	10.4	190,946	3.5	w3, na2, m95	69	1560	55	7
Peru	25,661,690	3,521,444	13.7	1,238,022	4.8	w13, na45, m37, b2, o3	69	2130	75	16
Uruguay	3,337,062	896,953	26.9	430,191	12.9	w90, m10	73	6220	91	2
Venezuela	24,169,744	3,238,313	13.4	1,075,386	4.5	w20, na1, m61, b18	73	3680	86	8
Total	507,932,043	75,618,670	—	27,726,003	—	—	—	—	—	—
	—	—	Mean: 14.62	—	Mean: 5.57%	—	Mean: 69.9	Mean: 2,776	Mean: 65%	Mean: 13.7%

origins. Figures express percent of total population. *LEB* Life expectancy at birth. *GNI* Gross National Income in US dollars per inhabitant. *%UP* Percentage of the population living in urban zones. *%AI* Percentage of adult population who are illiterate [20,21]

(including bone health care) may be inadequate in large portions of the population.

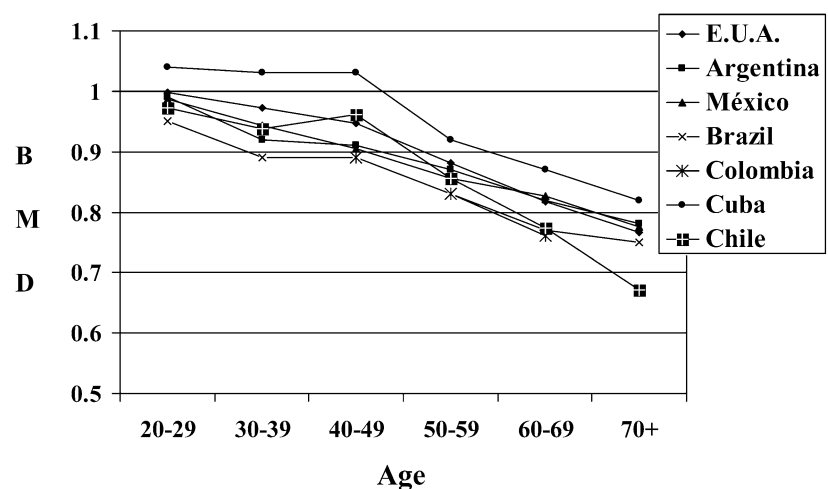
#### Prevalence of osteoporosis

There are several publications regarding the distribution of bone mineral density values in Latin America, using dual-energy X-ray absorptiometry. Figures 1 and 2 present the distribution of bone mineral density in spine and hip, respectively; of women in several countries [20,21,22,23,24,25,26,27] using Lunar values (or adjusting to them, as in the case of Chile, for comparison

purposes, according to published [28,29] formulae). Peak bone mass is attained at a similar age and declines after menopause with age at similar rates across all the studies.

Prevalence of osteopenia and osteoporosis is less well known. Table 2 shows the findings in several studies [30,31,32,33,34] using the World Health Organization criteria. The prevalence of vertebral osteopenia in women 50 years and older ranges from 45.5 to 49.7% and vertebral osteoporosis range from 12.1 to 17.6%, while the prevalence of femoral neck osteopenia ranged from 46 to 57.2% and osteoporosis ranged from 7.9 to 22%. Differences could be due to the variation in selection of

**Fig. 1** Comparison of mean vertebral BMD ( $\text{g}/\text{cm}^2$ ) values of women in diverse populations of America, by age decade



populations across studies, but could also be related to body composition, ethnic, nutritional and other factors. Table 2 also includes data from the largest community based study (NHANES) performed in the United States [31] on prevalence of osteoporosis as a reference for comparison. It included only hip bone mineral density values and found 50% of women aged 50 years and older with osteopenia and 20% with femoral neck osteoporosis. This study included an estimation of prevalence of osteoporosis of Mexican American women, which was lower than that among United States general and white population, and similar to that found in Mexico.

Prevalence and incidence of osteoporotic fractures

Table 3 presents the incidences of hip fracture in different regions. Community-based studies have been reported only in Argentina [36,37,38]. The incidence of hip fracture from a study in Rochester, USA, has been included as a reference for comparison. The incidence found in those studies ranges from 263 to 304 per 100,000 persons aged 50 years and older, with three women affected for each man. Estimates of incidences of hip fractures from hospital based studies varied widely [33,39,40,41,42,43,44,45,62,63]. Hip fracture incidence ranges from 40 to 362 per 100,000 persons aged 50 years and older, with a ratio ranging from two to three women per each affected man. The studies from Chile and from

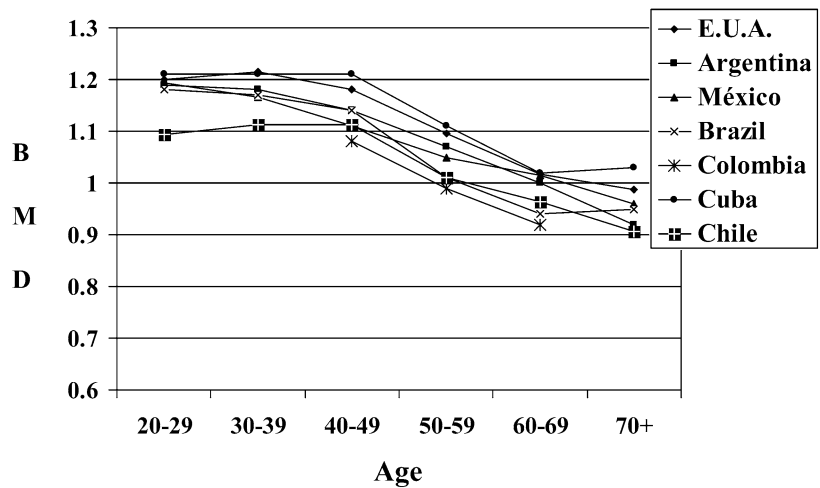
Marilia, Brazil, used a different age limit in their definitions, and therefore cannot be compared directly. Most studies show lower incidences of hip fracture in Latin American populations as compared to that found in the population of the USA, Canada or Europe. However, this may be due to the selection of the population studied, differences in definition of cases, and other methodological factors. Studies conducted in North America also showed a trend of lower incidence of hip fracture among Mexican American women as compared to Caucasian American women [46,47,48].

There is a scarcity of information on prevalence of vertebral fractures in the Latin American region. Several studies have been conducted on prevalence of vertebral fractures in the USA and Canada [49,50,51]. In these studies Mexican American women were shown to have a lower prevalence of vertebral fractures as compared to Caucasian American women [52]. A recently completed community-based study, including 400 women in Puebla, Mexico, showed a prevalence of vertebral fractures of 19.35% in women 50 years and older. The prevalence ranged from 8.3% at the age strata from 50 to 59 years, to 37.9% in those above the age of 80 [64]. The frequency of other osteoporosis-related fractures has been less studied.

Mortality

Table 4 presents results from existing studies on mortality related to hip fractures. It includes mortality rate

**Fig. 2** Comparison of mean femoral neck BMD (g/cm<sup>2</sup>) values of women in diverse populations of America, by age decade



**Table 2** Prevalence of low BMD in women aged 50 years and more

Place	Vertebral osteopenia	Vertebral osteoporosis	Proximal femur osteopenia	Proximal femur osteoporosis
Mexico City [32]	47	17.6	57.2	13.3
Mexico [30]	45.5	12.2	57	14.2
USA(NHANES) [31]	ND	ND	50	20
Mexican-Americans [31]	ND	ND	49	13
African-American [31]	ND	ND	35	7
Bogotá [33]	49.7	15.7	47.5	11.4
Chile [34]	ND	ND	46	22

**Table 3** Incidence of hip fractures. Community and hospital based studies. Rates per 100,000 persons aged 50 and more years

Hip fracture incidence	Total incidence	Women	Men
<i>Community based studies</i>			
Rochester (USA) [36]	331.4	487.4	175.5
La Plata (Argentina) [37]	263.6	379.4	101.0
Luján (Argentina) [38]	304.5	442.9	135.3
<i>Hospital based studies</i>			
Colombia [33]	175.7	234.9	116.5
Venezuela [39]	69	94	44
Chile [43] 1988	40	53	27
Chile [42]1991 <sup>a</sup>	155.9	192.5	119.3
Mexico [45]	148	188	103
Mexico [62]	104.15	130.3	78
Peru [63]	362	444	264
Sao Paulo, Brazil [40]	153.3	202	104.7
Marilia, Brazil [41] <sup>b</sup>	343.8	500.3	187.3
Panama [44]	ND	191.7	ND
Mar del Plata (Argentina) [55]	175.5	259	92

<sup>a</sup>Chile: age 55 and older

<sup>b</sup>Marilia: age 60 and older, 1995

from a study in Baltimore, USA as a reference. Rate of deaths during hospital stay range from 1.02 to 10% in different countries [37,38,45,53,54,55]. The mortality rates in the year following the fracture vary from 23 to 30%. Mortality rate was higher among males than females. Variation in study population, length of hospital stay and other factors may account for the wide variation seen in mortality rates.

**Risk factors for fractures**

A few studies have addressed the importance of risk factors among certain populations in Latin America.

**Table 4** Mortality associated with hip fractures

Study	In-hospital mortality	One-year mortality
Baltimore [53]	4.3%	17.4%
La Plata [37]	1.02%	ND
Luján [38]	10%	30.5%
Lima [55]	ND	23.2%
León [45]	1.86%	ND
Mexico City[54]	6.8%*	ND

<sup>a</sup>Mortality within the first month of the fracture

**Table 5** Estimated costs (in US dollars) associated with hip fractures and diagnosis and therapy of osteoporosis in some countries. Therapy costs are considered in a monthly basis. National gross Income per capita, year 2000, in US dollars

Country	Hip Fracture (direct costs of acute episode)	Axial BMD testing	Calcium	Alendronate	Calcitonin	National gross income per capita
Argentina	5500	90	10	64	140	7550
Brazil	5500	40	7	60	80	4350
Chile	5500	90	10	40	70	4610
Mexico	5500	80	8	50	75	4440
Panama	6000	100	10	68	110	3080
Uruguay	4500	80	10	40	200	6220
Venezuela	4500	40	5	60	60	3680
USA	8500	120	10	70	120	29,340

Most consistently found factors include: older age; neurological disorders (particularly stroke); previous fractures; use of psychotherapeutic drugs; alcohol consumption; cardiovascular disease; poor intake of dairy products; lower body mass index; less physical activity; higher number of pregnancies and lactation; living alone and having limitations for activities of daily living [56,57,58,59,60,61].

**Costs**

To the best of our knowledge, no study has so far been conducted on overall resource utilization for osteoporosis and fractures in Latin America. Since hip fracture usually requires in-hospital care and hospitalization is less common in the case of vertebral, wrist or other osteoporotic fractures, information on costs of care for hip fracture is more accessible than information on costs of other osteoporosis related fractures.

Table 5 presents direct costs of an episode of hip fracture in different countries, and average costs of some diagnostic and therapeutic interventions. The cost of diagnostic interventions (such as BMD testing) and discrete therapeutic agents vary across countries, but the variation is more pronounced in the indicators of a country's wealth, like national gross Income per capita (Table 1 and Table 5). Health resources of each country usually reflect this economic reality.

In Mexico, there are not any community based studies to know the actual incidence of hip fractures, but projections from the information obtained from public hospitals have produced a figure of 19,369 hip fractures among people aged 50 years and over in 1995 [45]. Those fractures would have a direct cost of US\$ 106,529,500 in year 2000. That figure represents 6.7% of the yearly national health expenditure of Mexico.

**Discussion**

Latin America and the Caribbean is a region with a great diversity in geographic characteristics, including climate and sunshine. The ethnic composition of the Latin American region is heterogeneous with a great variation of inter-racial mixing of the original Indian population with Caucasians from Europe, mainly

Portuguese in Brazil and Spanish in the rest of Latin-America as well as blacks from Africa and Orientals mainly from eastern Asia. The proportion of white, Indian, black and Oriental origin population varies enormously in the different countries, for example, Argentina and Uruguay are populated mainly by Caucasians, Peru has a high proportion of Orientals, as Bolivia, Guatemala, and Ecuador have a high proportion of Indians. Brazil, Colombia and the Caribbean countries have a considerable proportion of black population. In other Latin American countries, the "Mestizo" population predominates. Countries with older populations (Uruguay, Argentina, Cuba), but also countries with higher populations (Brazil, Mexico, Colombia) will require more resources to detect, prevent and treat osteoporosis.

Currently, our knowledge of the extent to which osteoporosis affects populations and impacts health care budgets in many countries in this region remains very limited. Therefore, there is a tremendous need for studies estimating the socio-economic burden of osteoporosis.

The countries with higher proportions of elderly population are currently facing a heavy burden of osteoporotic fractures and their consequences. Considering the Latin American and the Caribbean population is expected to grow 16% by 2010 but the population aged 50 years and older, that is, the susceptible population, will grow by 28% [20], it is reasonable to assume that osteoporosis will pose a significant burden on this region. However, knowledge of the epidemiology of osteoporosis and fractures in the elderly remains fragmentary in Latin America. Too little information from most countries, coupled with differences in ethnic origins, dietary habits, gender distribution, proportions of elderly population, etc. across countries, make it difficult to draw a definite conclusion about the burden of osteoporosis in the region. Nonetheless, findings from this study may help in defining areas where data are lacking and to identify country specific target population for screening when necessary. National and regional estimates of osteoporosis related health care resources usage and detailed cost components involved along with morbidity and mortality rates will give a clear insight into the magnitude of osteoporosis and its consequences. This information will increase awareness and will provide a much better understanding of (a) the particular contribution of the disease to the overall health care budget as well as (b) the contribution of each individual health care resource devoted to the total budget of osteoporosis management.

Further, economic and epidemiological results derived from burden of illness studies will be very useful for predicting future trends when combined with demographic projections. Considering the anticipated growth in population over 50 years of age, ageing populations alone could be responsible for a dramatic increase in fracture incidence [3]. Even under conservative assumptions regarding the evolution of medical technology, projecting the impact of demographic changes

on the burden of osteoporosis can certainly help in planning for the future.

A burden of illness estimation can represent an appropriate balance between what should be done ideally and what could be practically performed within a relatively short time frame in order to depict the problem. Although this article discusses only direct costs (medical and non-medical costs related to the treatment of disease), it is highly recommended that indirect costs (the value of present and future production losses resulting from morbidity, premature death or disability caused by the disease) should be considered when possible. An incidence-based approach to cost estimates should be preferred when possible, but prevalence-based cost estimates are quite useful and could be determined by reasonably accessible data.

In this study, it was observed that there is a significant lack of information on epidemiology of osteoporosis and related resource utilization. Epidemiological and health economic research in the osteoporosis disease area needs to be carried to address this knowledge gap. The serious nature of the socio-economic burden of this condition and limited economic resources available in this region call for a vigilant yet efficient approach for diagnosing osteoporosis patients and effectively treating them with proven therapies, to avoid the catastrophic economic and clinical consequences of this disease.

**Acknowledgements** The authors wish to thank the following persons for their contributions of information for this paper: O.D. Messina (Argentina); S. Ragi (Brazil); A. Iglesias and J. Rueda (Colombia); C. Santos-Hernández (Cuba); M. Arriagada and R. Arinoviche (Chile); A. Garcia-Kutzbach (Guatemala); F. Cons and M. Delezé (Mexico); G. Guerra (Panama); J. Angulo-Solimano and Risto Perich (Peru); J. Hernández (Uruguay) and G. Riera (Venezuela). The authors also thank Professor J.Y. Reginster and Professor Shuvayu S. Sen, for reviewing this manuscript. This study was funded partly through an unrestricted educational grant from Merck Sharp & Dohme

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