Differences in hip fractures rates and risk factors across the world

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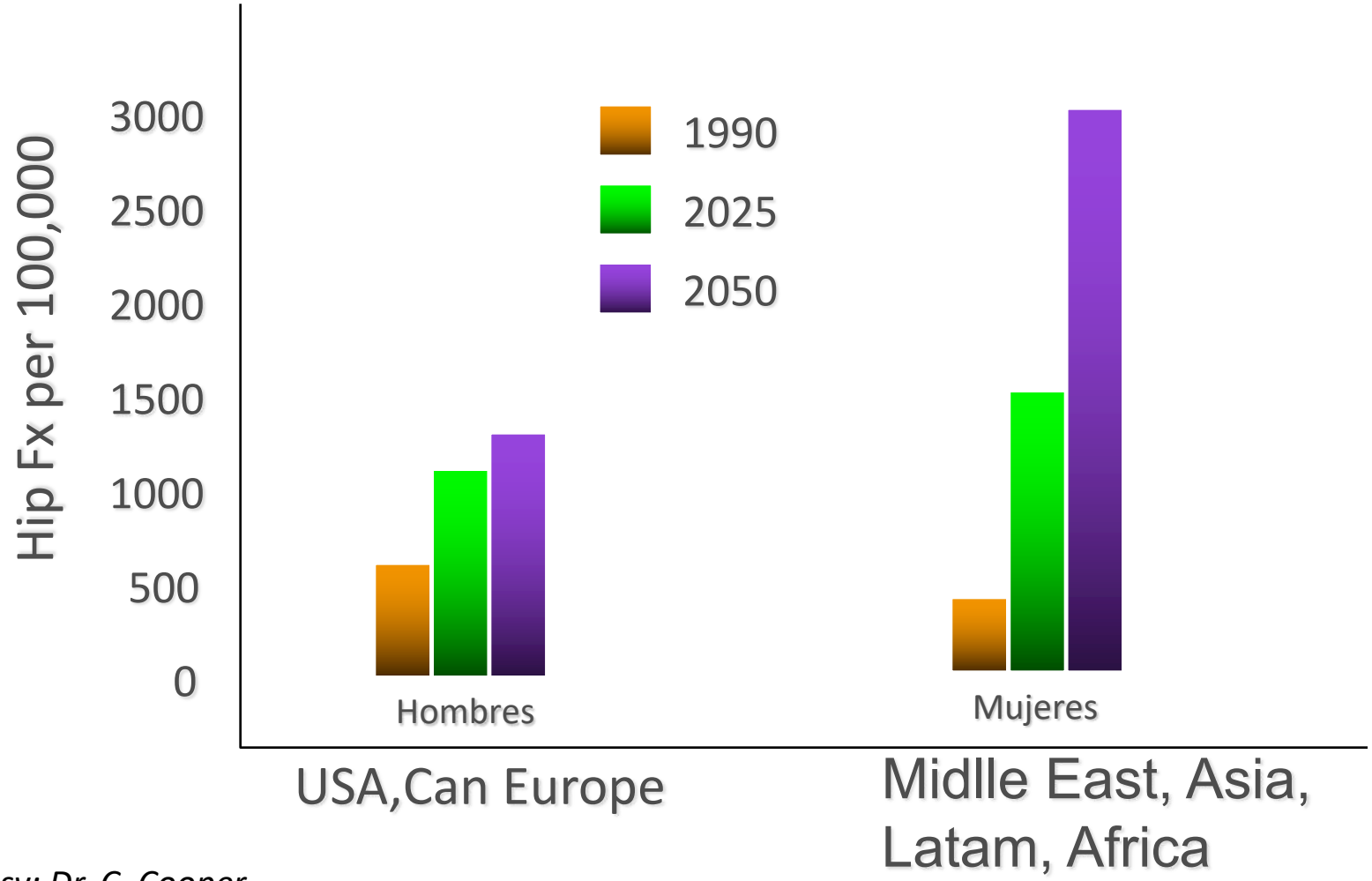
Objectives

- Review of global prevalence/incidence of fractures
- Secular changes of hip fracture
- Different fracture rates within the same country
- How risk factors are associated with these differences?
- Social determinants of health

The Global Burden

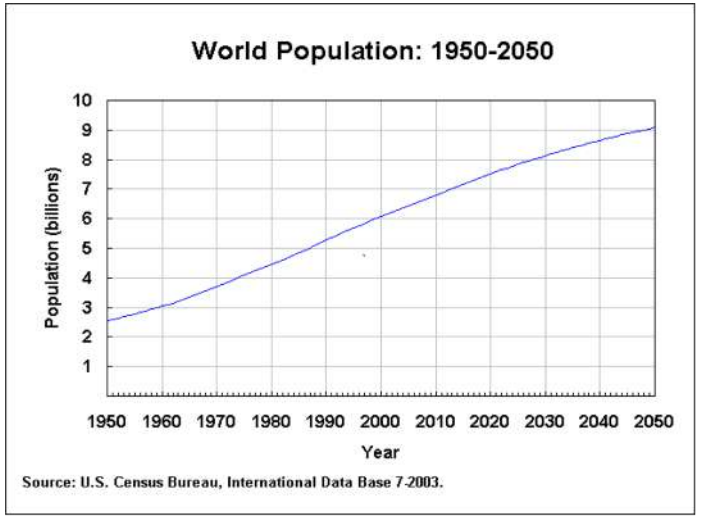
- Hip fracture:
  - 2.5 billion in 2025
  - 4.5 to 6.2 billion fractures 2050
- Population ≥65:
  - ≈506 b (2008),
  - ≈1,300 b (2040)
- Hip fracture costs:
  - $34.8 billion dls (1998)
  - $131.5 billion dls (2050)

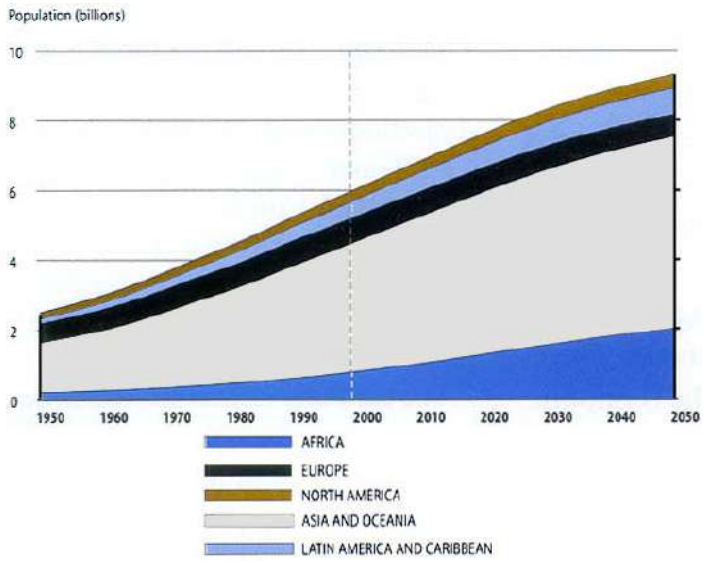
Hip Fractures in Women : 1990 - 2050

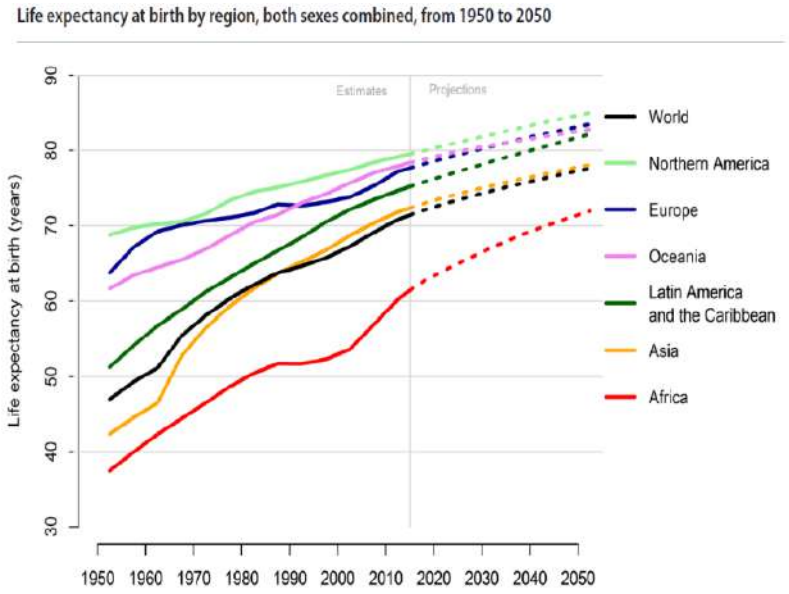


Courtesy: Dr. C. Cooper

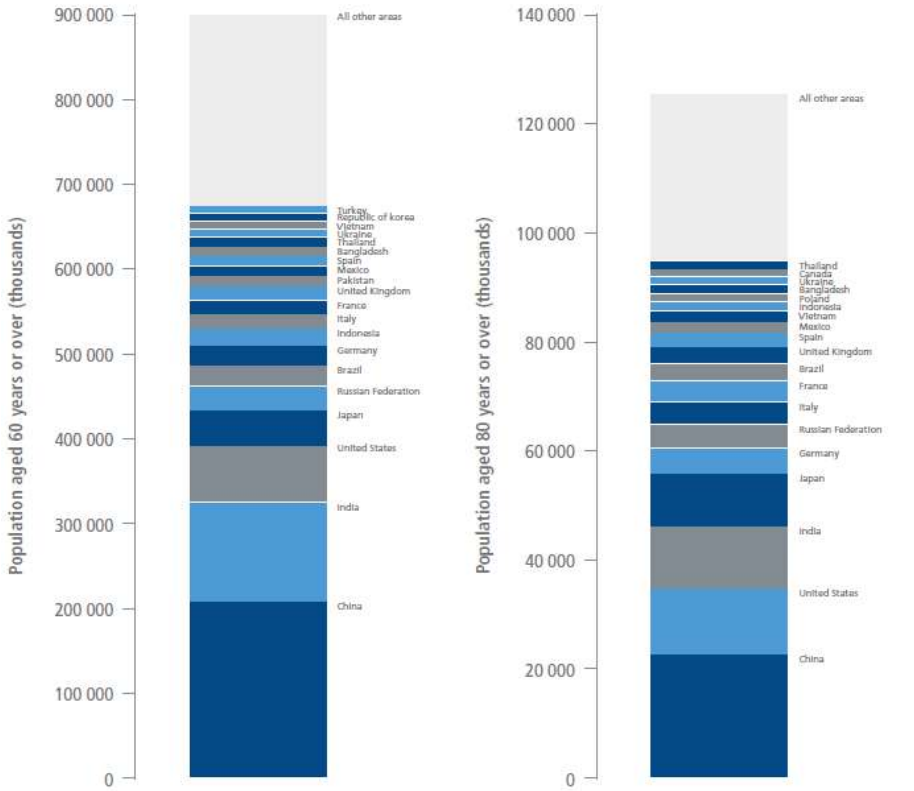
Demographics







Population aged 60 years or over and aged 80 years or over by country, 2015



(Reproduced from *World Population Ageing Report 2015* with kind permission of the United Nations Department of Economic and Social Affairs Population Division)

United Nations Department of Economic and Social Affairs Population Division (2015)
World Population Ageing. United Nations, New York

Differences in the rates of fractures worldwide

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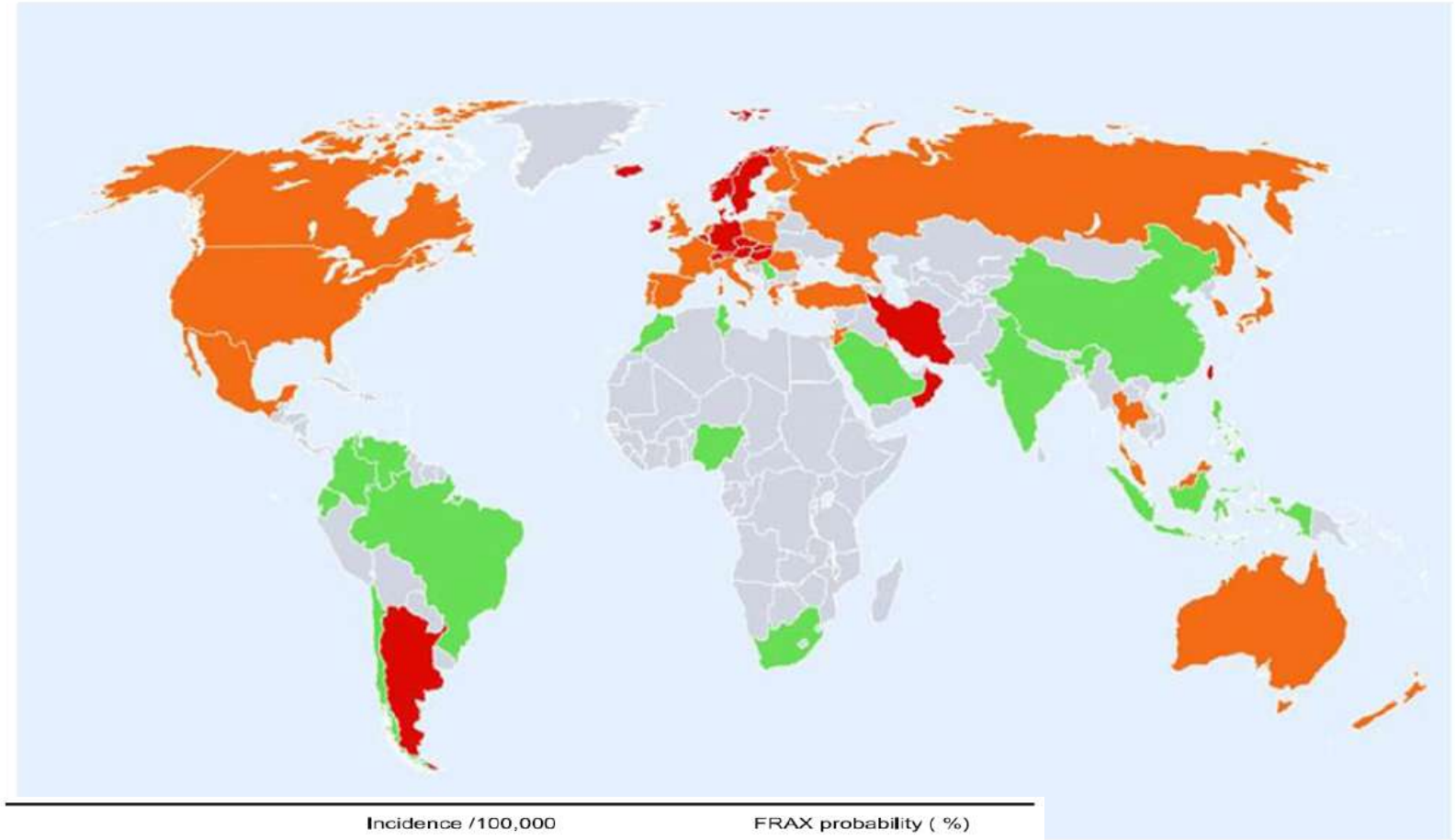
- Marked variations in the incidence rates of hip fractures are found in countries, regions and even within the same country
- The prevalence of vertebral fractures and the 10-year probability of major osteoporotic fractures have been reported for different regions of the world and variations are found.

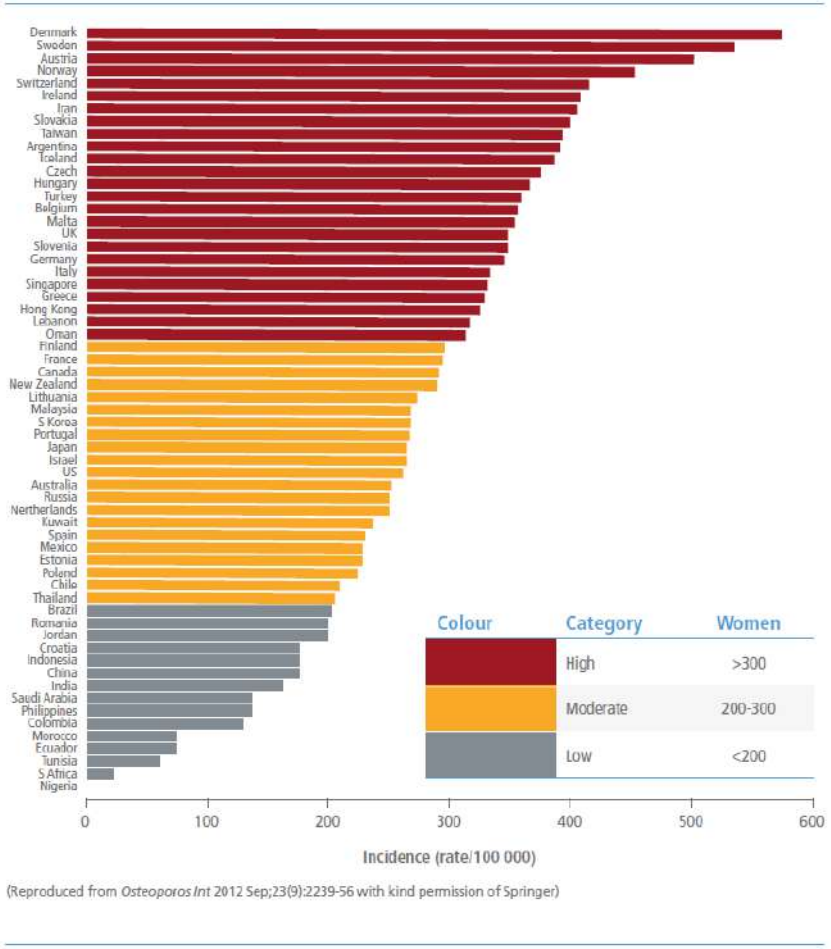
Hip fracture rates for men and women combined in different countries of the world categorized by risk. Where estimates are available, countries are colour coded red (annual incidence >250/100,000), orange (150–250/100,000) or green (<150/100,000)



		Incidence /100,000			FRAX probability (%)	
Colour	Category	Women	Men	Men and women	Men	Women
Red	High	>300	150+	>250	>15	>15
Orange	Moderate	200–300	100–150	150–250	10–15	10–15
Green	Low	<200	<100	<150	<10	<10

Osteoporos Int (2012) 23:2239–2256

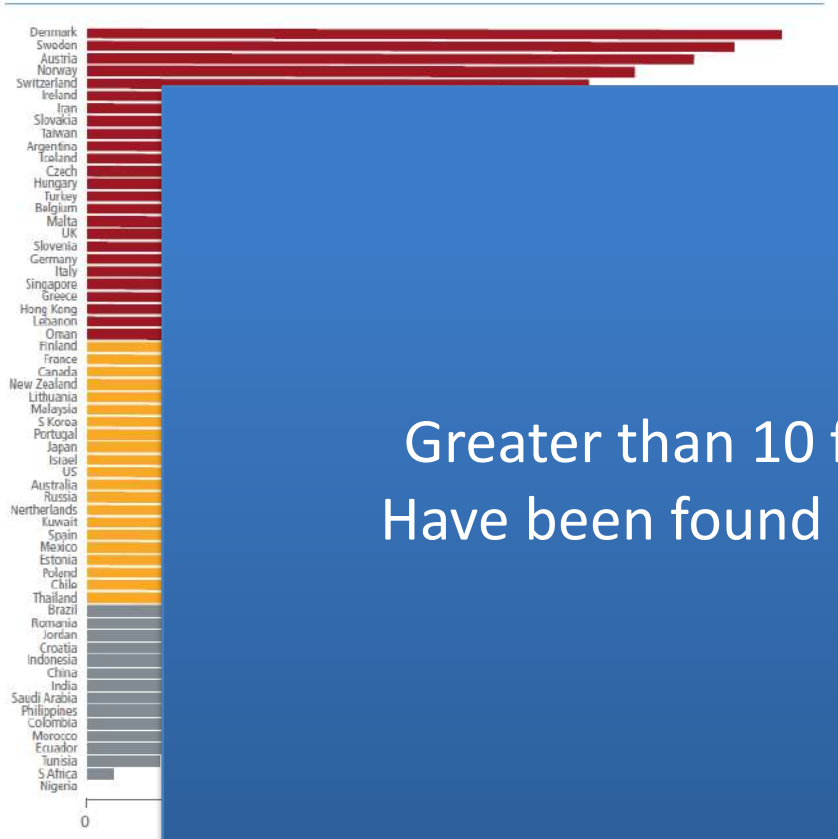
Age-standardised annual incidence of hip fractures in women (/100,000) according to country together with the colour codes



(Reproduced from *Osteoporos Int* 2012 Sep;23(9):2239-56 with kind permission of Springer)

- Denmark 574/100 000
- Norway 563/100 000
- Sweden 539/100 000
- Austria 501/100 000
- Nigeria 2/100 000
- South Africa 20/100 000
- Tunicia 58/100 000
- Ecuador 73/100 000

Age-standardised annual incidence of hip fractures in women (/100,000) according to country together with the colour codes



Greater than 10 fold differences
Have been found across countries

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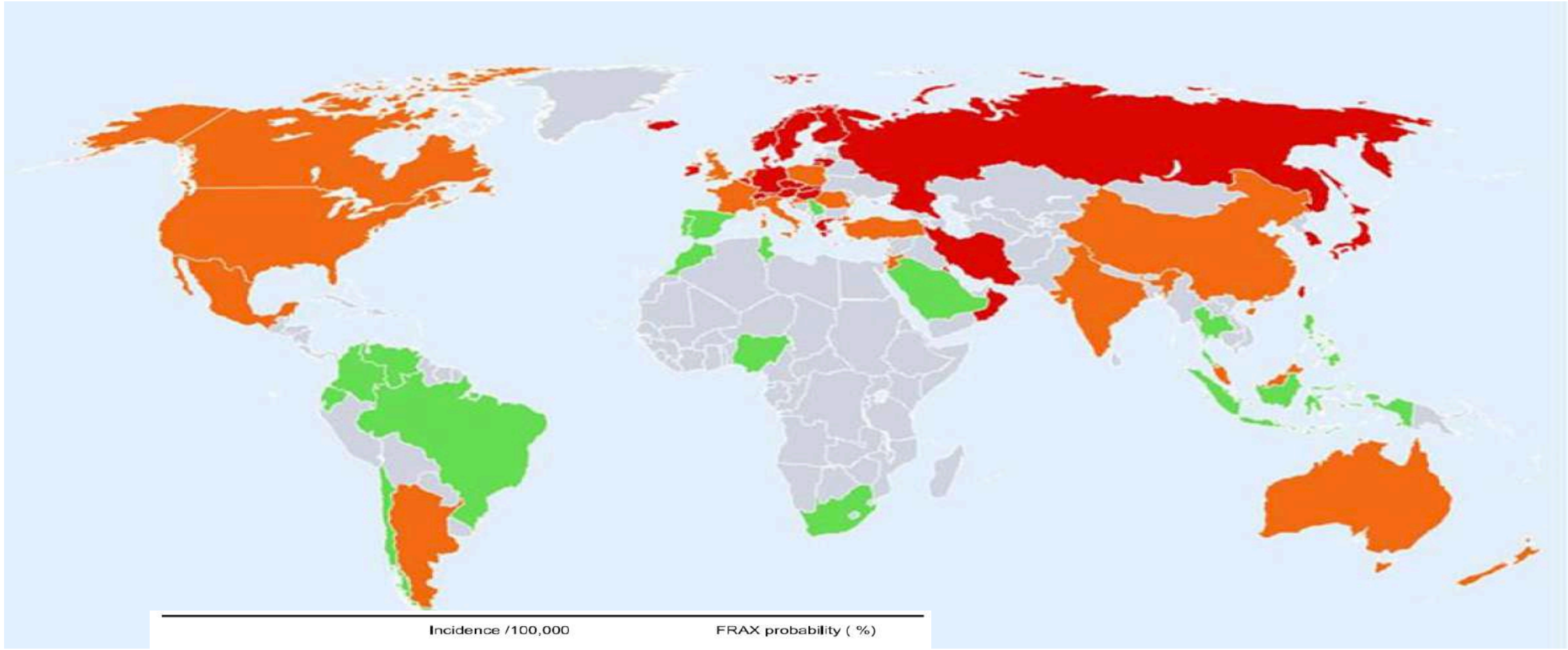
(Reproduced from *Osteoporos Int* 2012 Sep;23(9):2239-56 with kind permission of Springer)

Hip Fx rates for men in different countries of the world *categorised by risk*. Where estimates are available, countries are colour coded red (annual incidence >250/100,000), orange (150–250/100,000) or green (<150/100,000)



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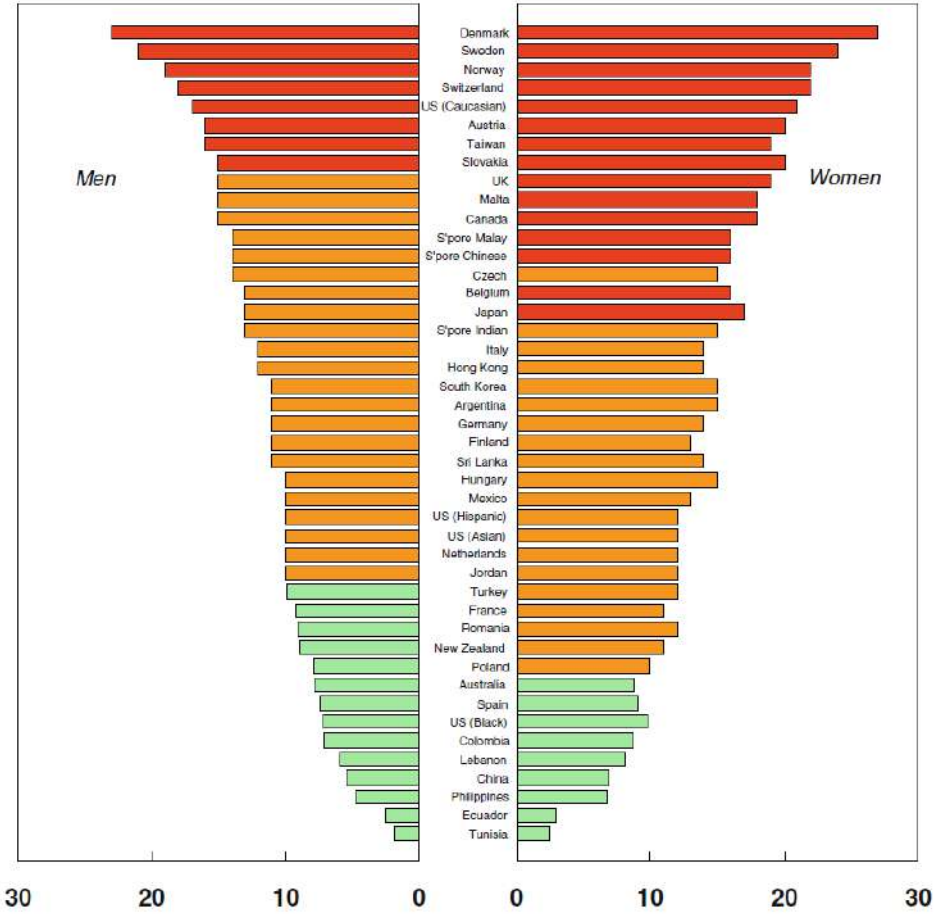
Ten-year probability of a major fracture (in percent) in men and women aged 65 years with a prior fragility fracture (and no other clinical risk factors) at the threshold of osteoporosis as judged by BMD at the femoral neck (i.e. a t-score of −2.5 SD). The body mass index was set at 24 kg/m2



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Osteoporos Int (2012) 23:2239–2256

Disparities of fracture rates across the world

- Age-standardised rates varied approximately 10-fold for both men and women.

- In terms of the regional disparity of the 10-year probability of major osteoporotic fractures, the majority (55%) of individuals deemed to be at or above the high fracture probability in 2010

Secular Changes

Estimates have reported

Increase

Plato

Decrease

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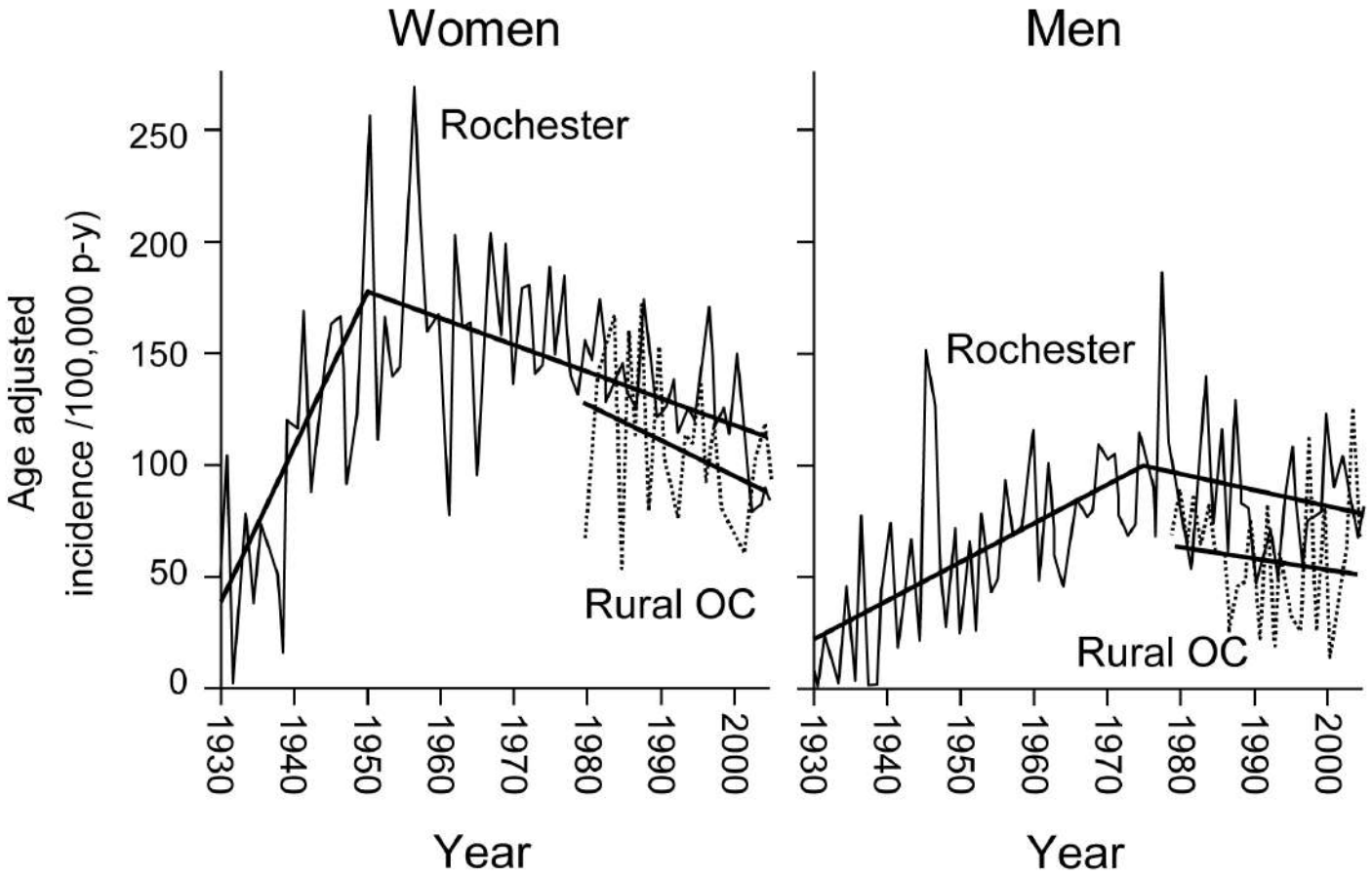
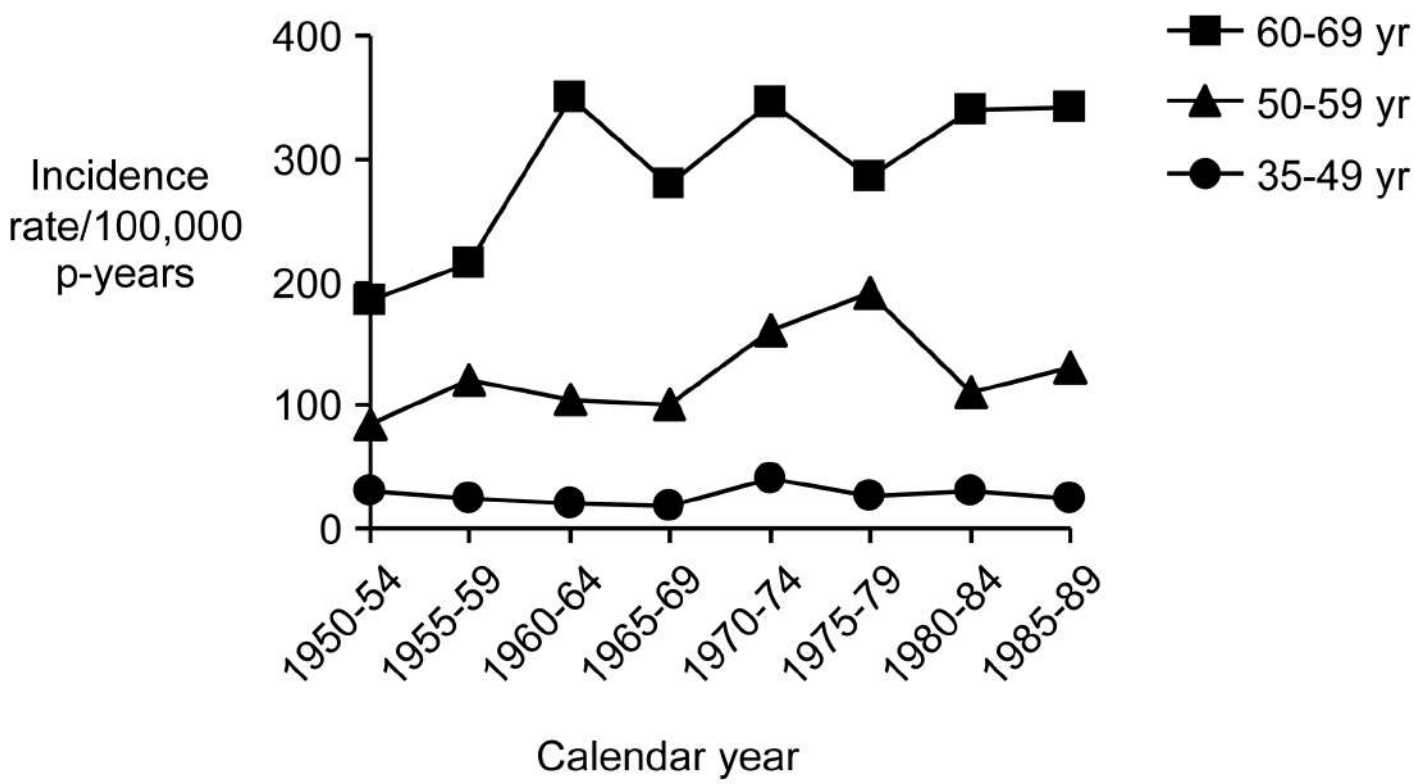
Age-adjusted incidence rates for hip fracture in Rochester, Minnesota, USA: 1928-2006. (Reproduced from Melton LJ et al, Osteoporos Int 2009; 20:687-694



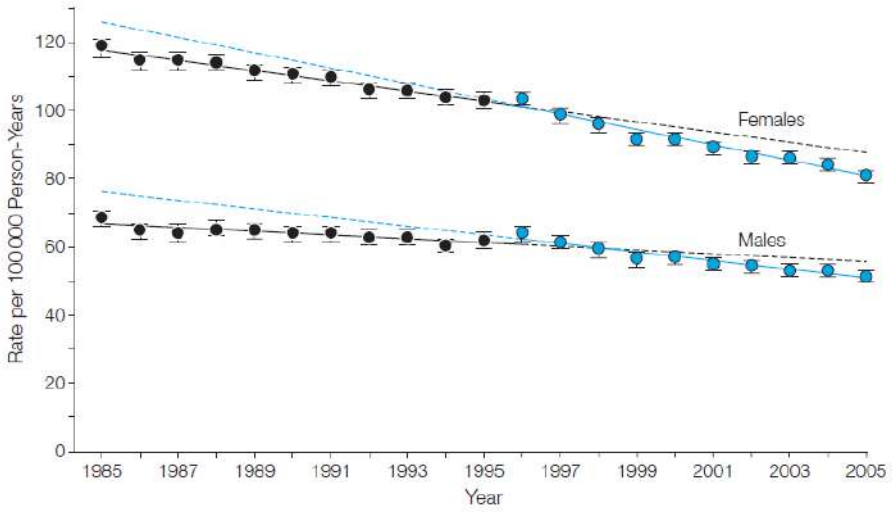
Osteoporos Int. 2011 May ; 22(5): 1277–1288

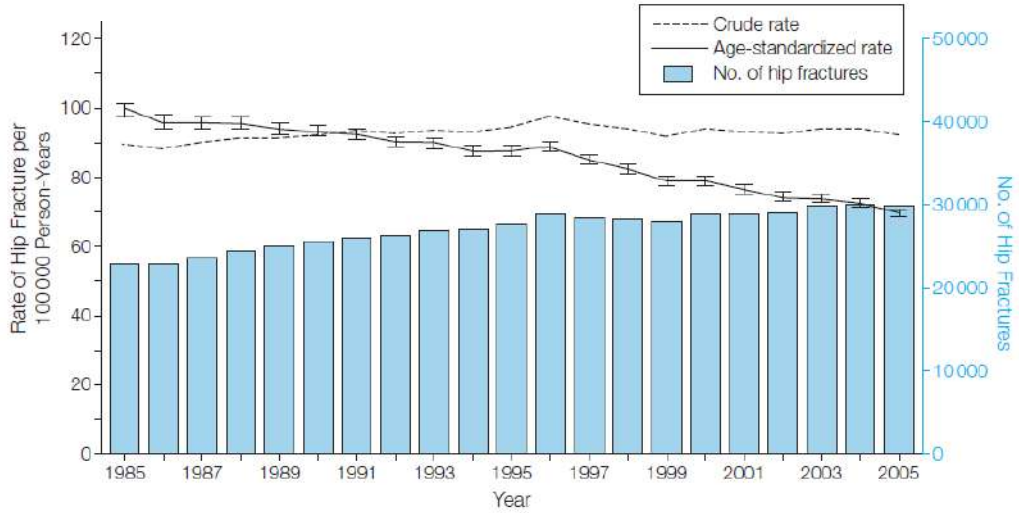
Secular change in the incidence of vertebral fracture in Rochester, Minnesota
(Reproduced from Cooper C et al. Calcif Tissue Int 1992; 51:100-104).



Osteoporos Int. 2011 May ; 22(5): 1277–1288

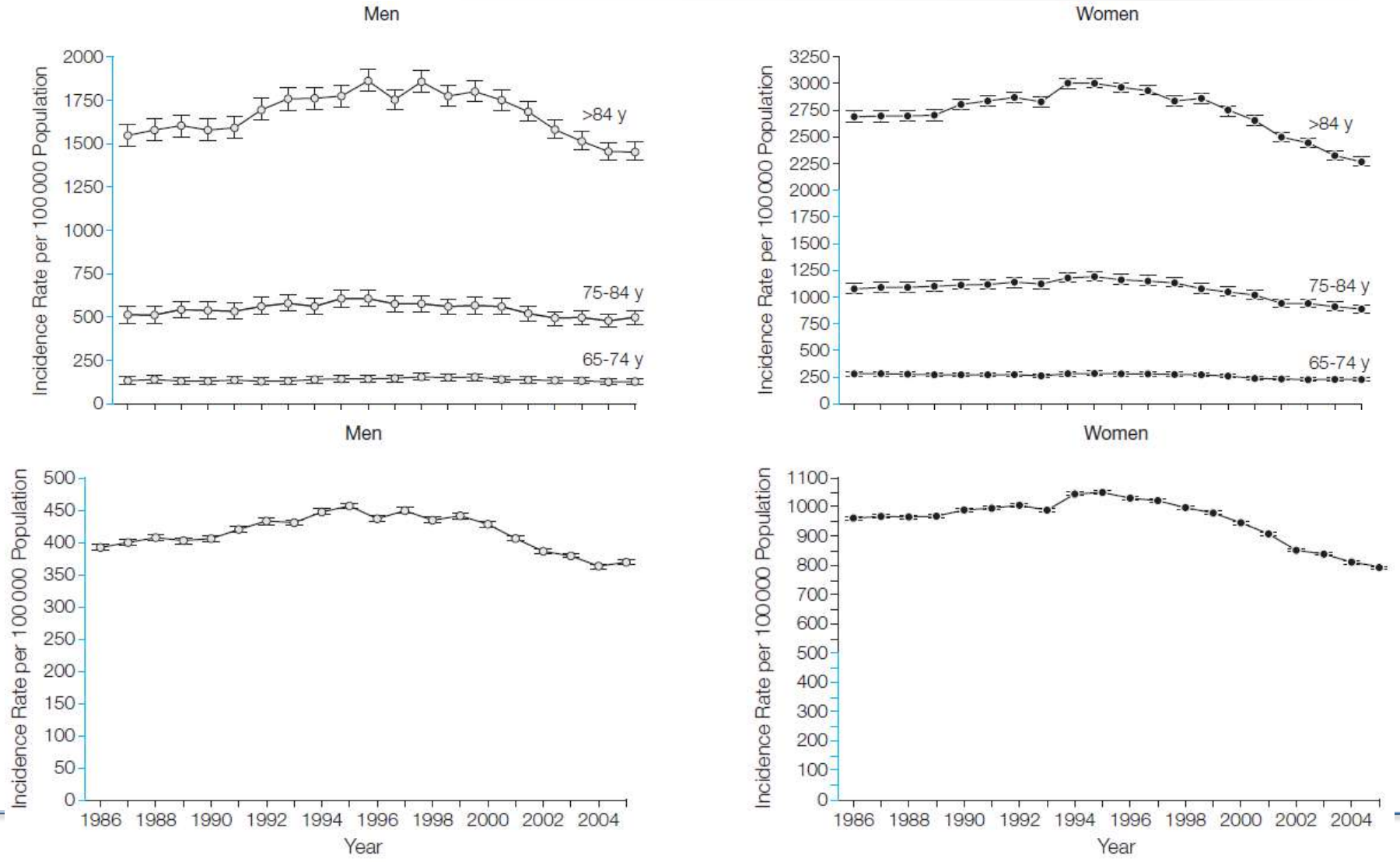
Hip Fx rates in Canada 1985-2005





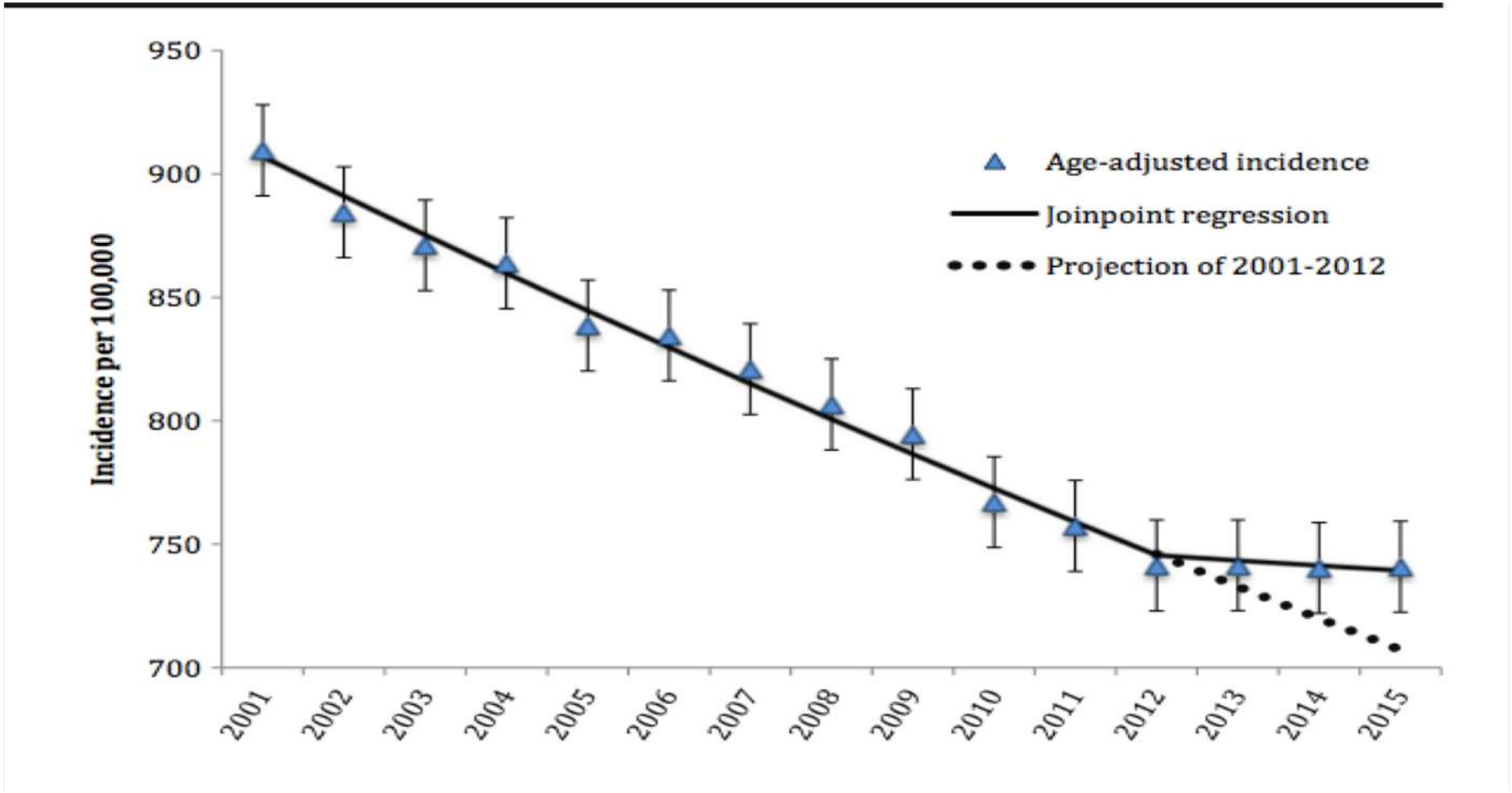
Leslie WR. JAMA 2009;302:883-889.

US – Hip Fx rates in men and women 1996-2004



Brauer CA. JAMA 2009;302:1573-9.

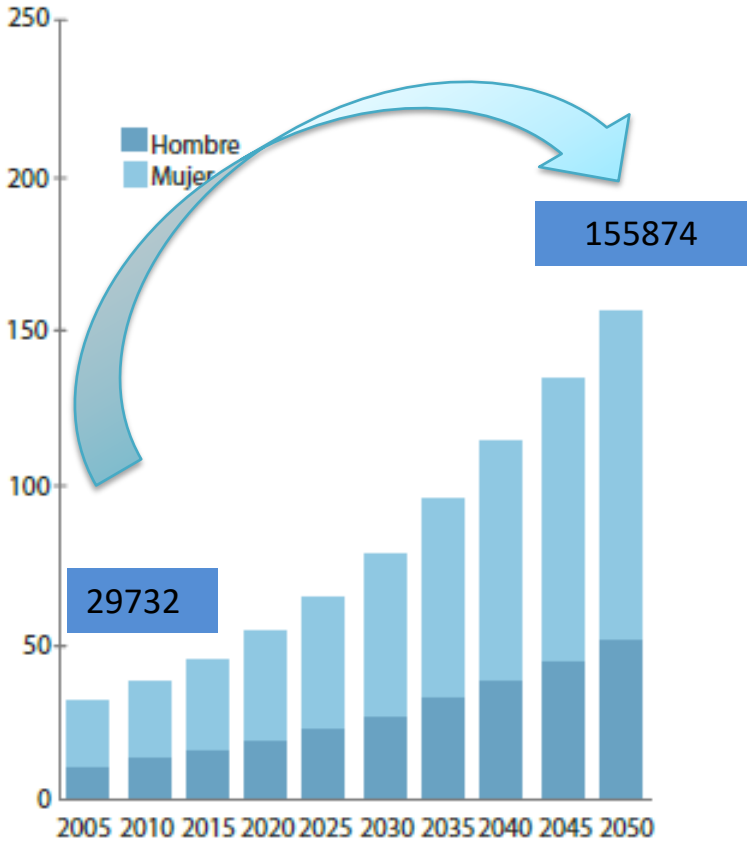
Annual incidence of hip fractures in US female Medicare recipients age 65 yrs



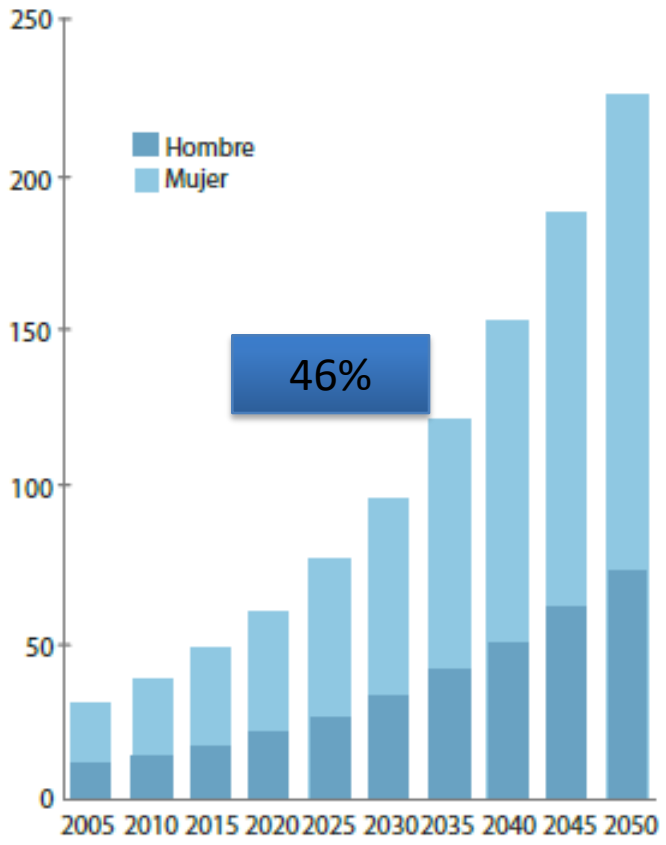
Posibles causes for the shift of Fx rates in US

- ↓ Density tests (not only with DXA)
- ↓ In Medicare reimbursements
- ↓Drugs for OP and treatment rates
- Safety concerns for side effects
- Concerns about optimal duration of Tx
- Treatment holiday
- Non compliant patients
- Shift in demographics in older population in US

Hip Fx Mexican men and women 2005 y 2050



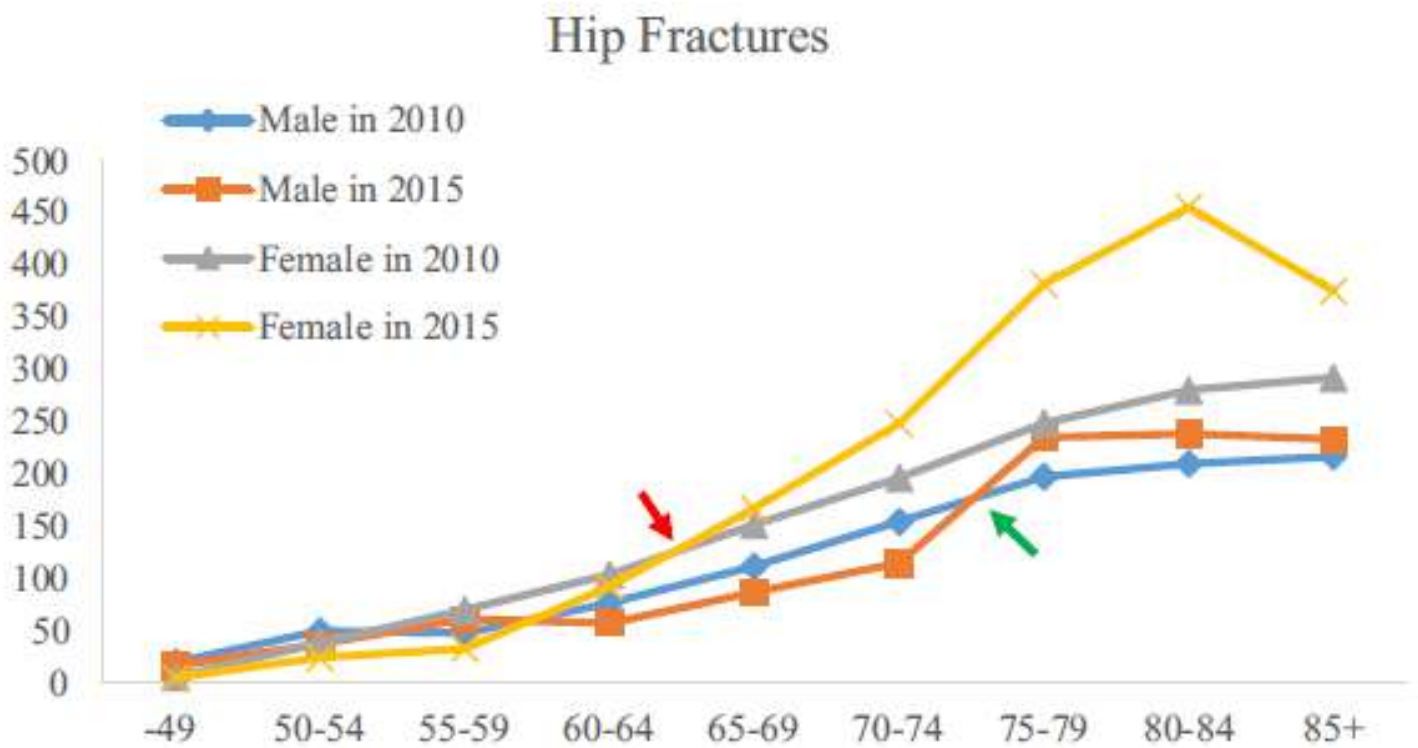
asumimos no cambio



asumiendo cambio 2000-2006

Johansson H, Clark P., Carlos F. Increasing age and sex specific rates of hip fractures in Mexico. Osteoporosis international. DOI: 10.1007/s00198-010-1475-z On line 21 Diciembre 2010

Age- and gender-specific incidence of hip fractures in Tangshan in 2015 and 2010. The incidences in females aged over 65 (red arrow) and males aged over 75 (green arrow) are higher than in 2010



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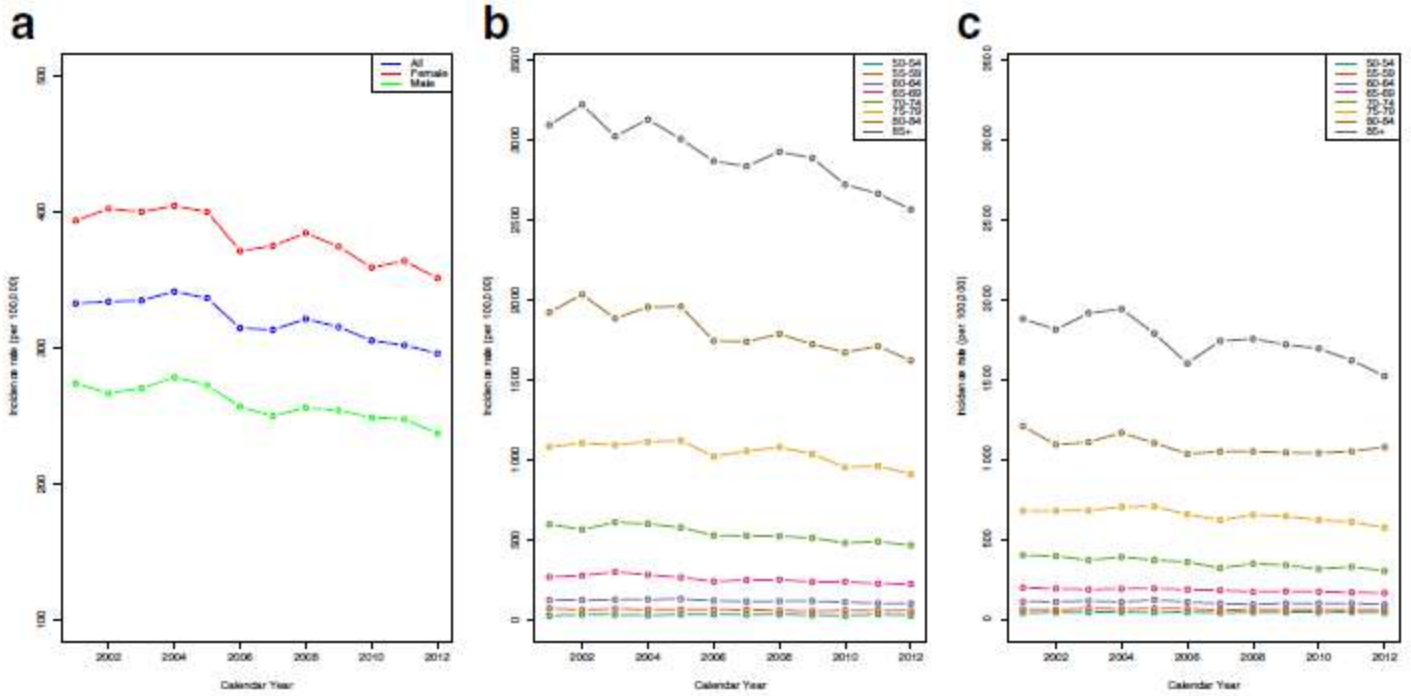
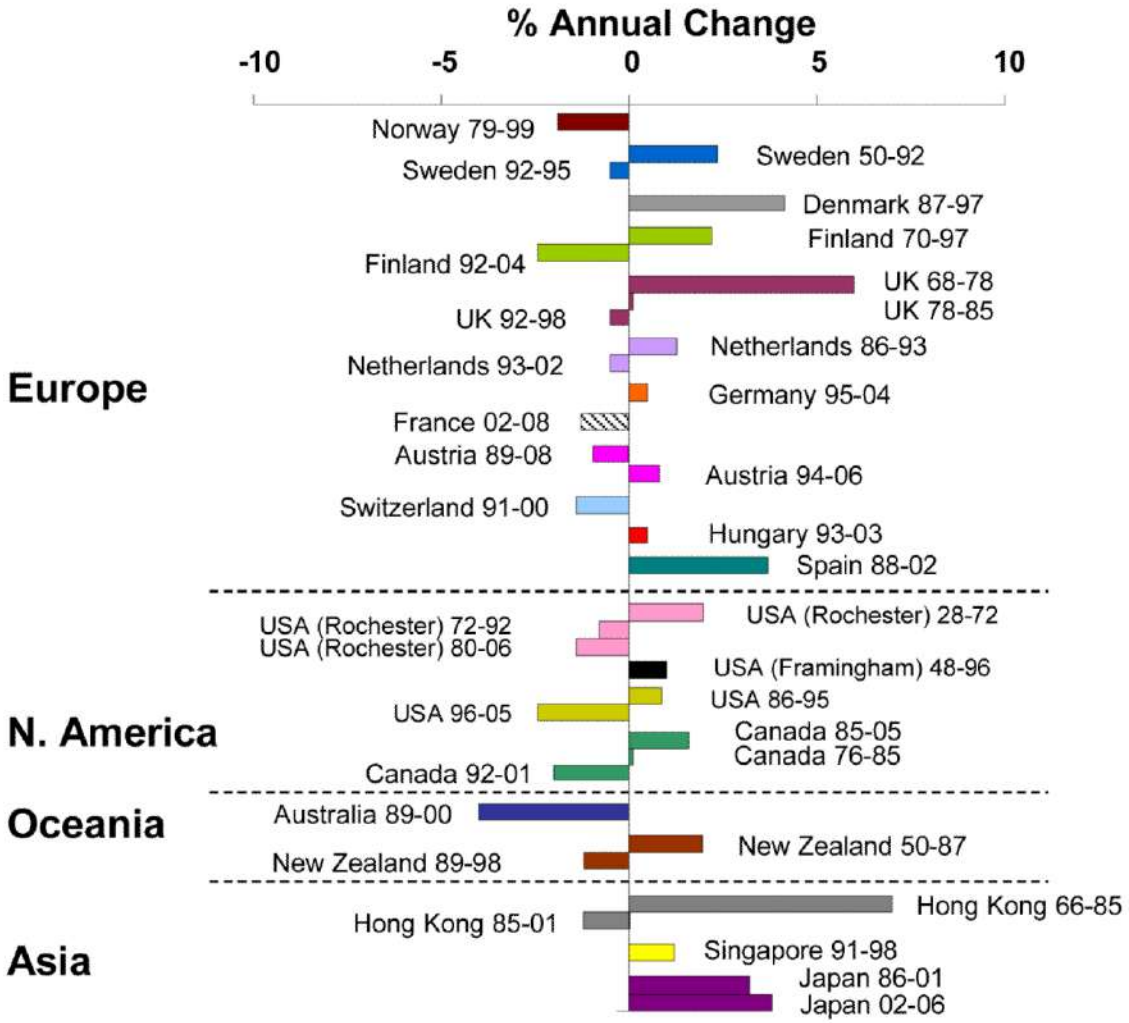
Secular trend of incidence abc rate of hip fractures (per 100,000 person-years) in a the overall population Taiwan, b women, and c men, stratified by age from 2001 to 2012



Osteoporos Int (2017) 28:811–818

Secular trends in hip fracture worldwide: annual change in age- and sex-adjusted hip fracture incidence



Osteoporos Int. 2011 May ; 22(5): 1277–1288

Different rates within countries

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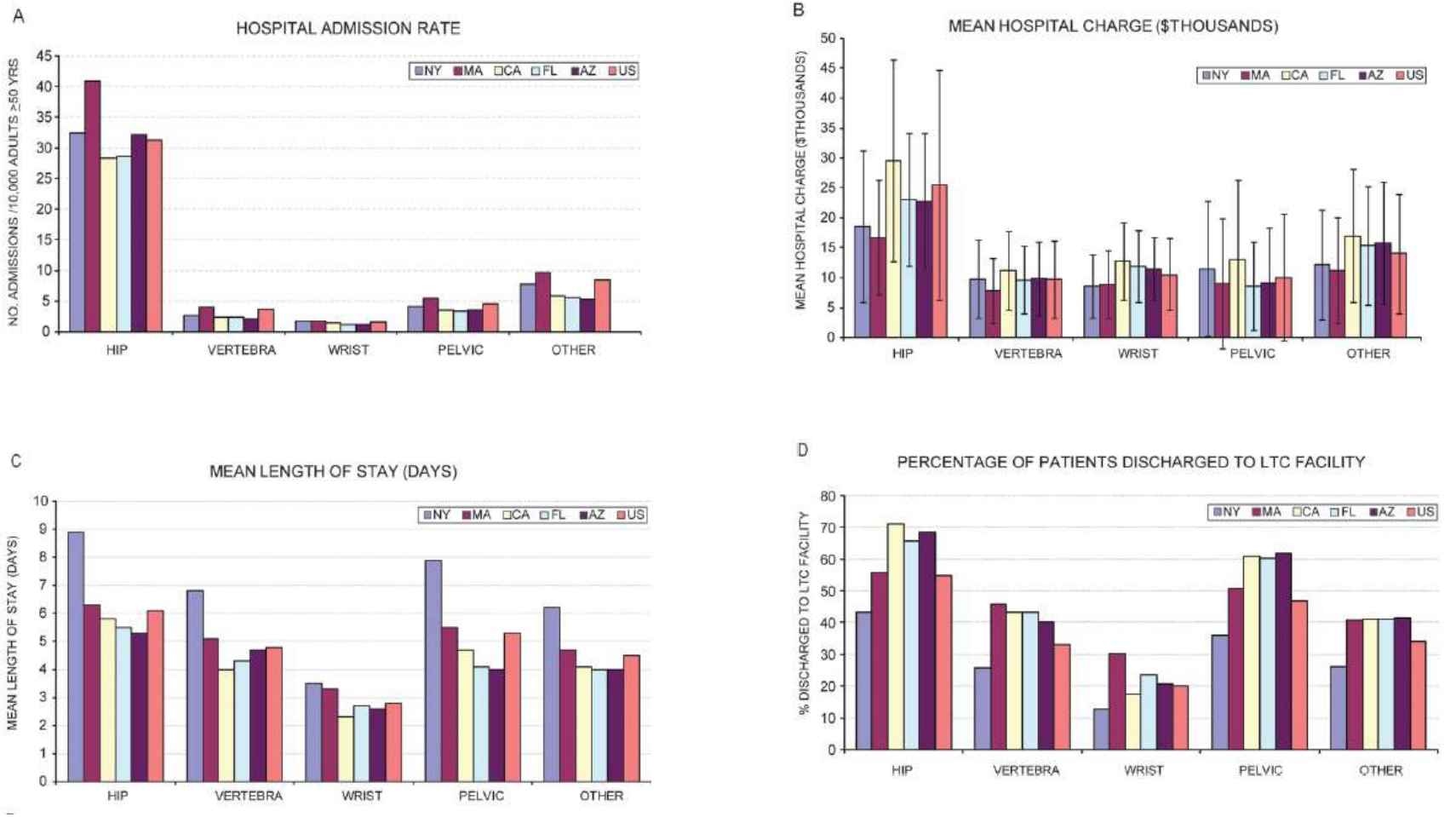
JOURNAL OF BONE AND MINERAL RESEARCH
Volume 24, Number 4, 2009
Published online on December 8, 2008; doi: 10.1359/JBMR.081226

Interstate Variation in the Burden of Fragility Fractures

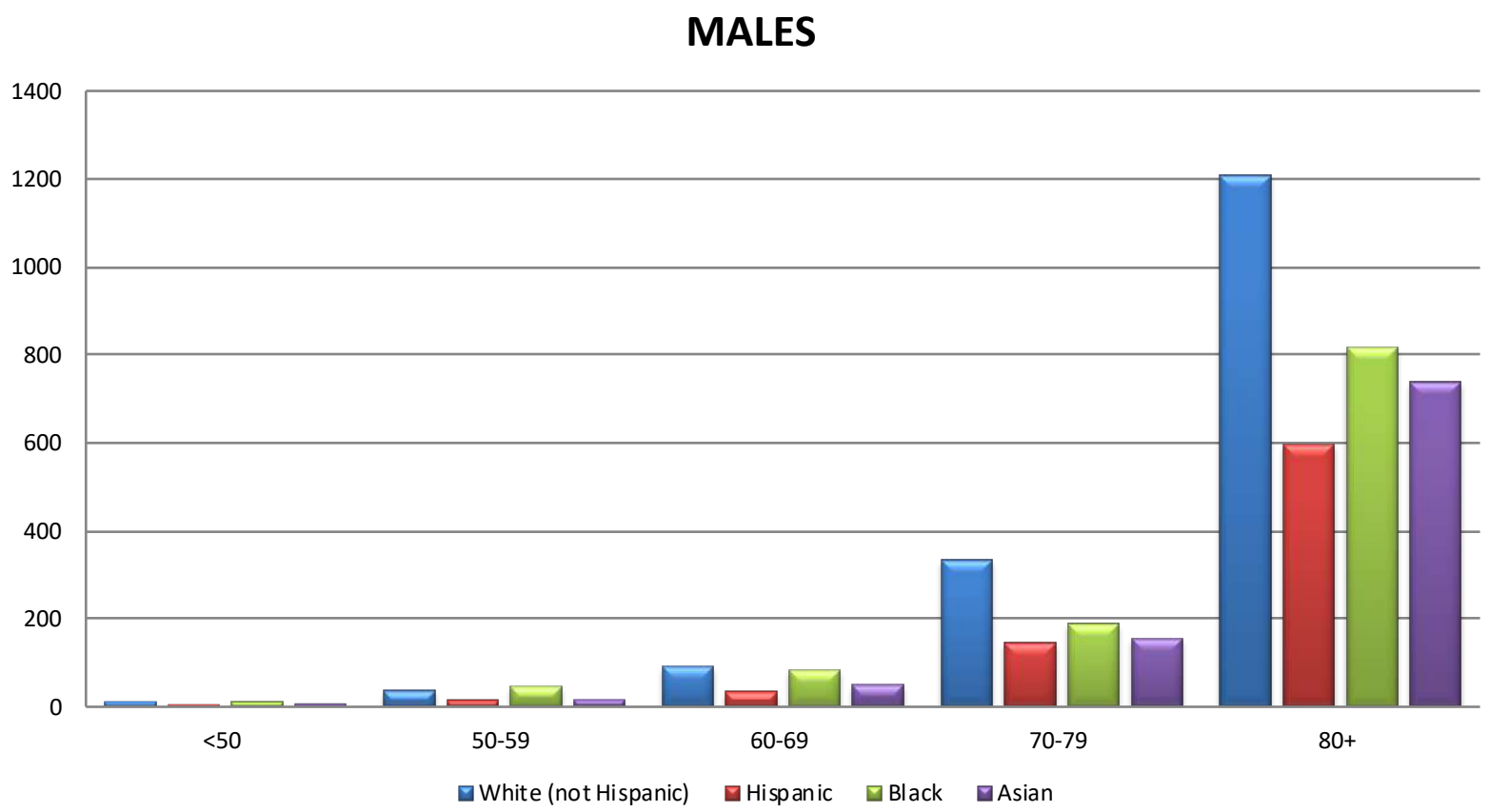
Alison B King,[1] Anna NA Tosteson,[2] John B Wong,[3] Daniel H Solomon,[4] Russel T Burge,[5,6] and Bess Dawson-Hughes[7]

(A) Number of hospital admissions per 10,000 men and women 50 yr of age. (B) Mean hospital charge (bars represent SDs). (C) Mean length of hospital stay. (D) Percentage of patients discharged to long-term care (LTC) facilities for men and women 50 yr of age admitted to hospitals for fragility fracture in 2000. (U.S data are for hospital admissions in 2001.)



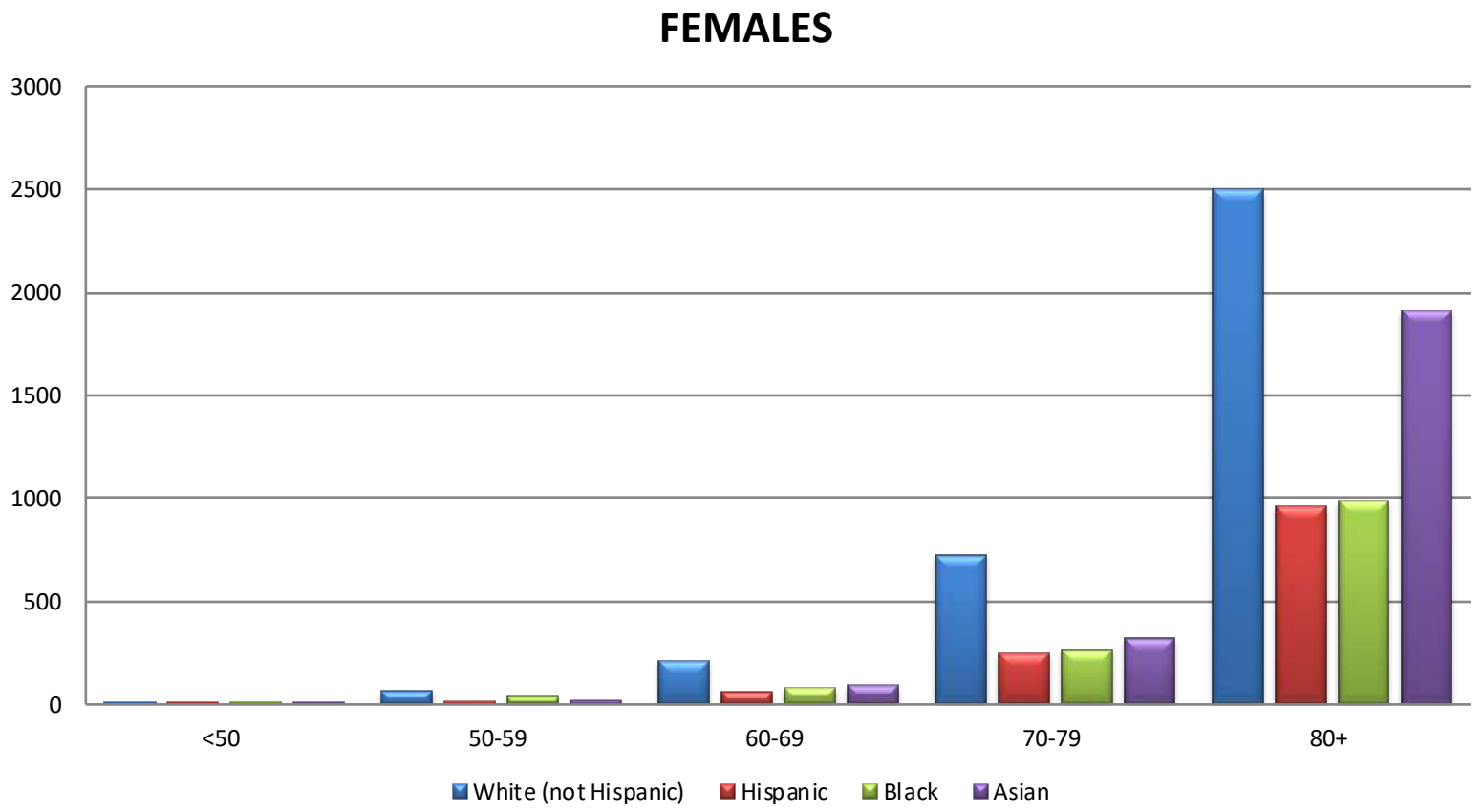
J Bone Miner Res 2009;24:681–692

Hip Fracture Incidence Rates (hospital discharges/100,000 person years) among Males by Ethnic Group and Age (1983 and 1984 averaged)



AJPH November 1988, Vol. 78, No. 11

Hip Fracture Incidence Rates (hospital discharges/100,000 person years) among Females by Ethnic Group and Age (1983 and 1984 averaged)



AJPH November 1988, Vol. 78, No. 11

Possible factors that contribute for geographical variability and different rates of fractures globally

Cohort effect:

- Sweden women born 1926-1936 had higher fracture rates (nutrition and physical activity)
  - Failure to reach peak skeletal mass
  - Reproductive factors
- USA Framingham
  - Women born 1911-1921 had 40%incidence of hip Fx than women born 1887-1900
  - Men born 1911-1921 had two fold higher risk of hip Fx than men born 1887-1900

Possible factors that contribute for geographical variability and different rates of fractures globally

- Use of biphosfonates
  - ↓ 9% 1995-2005 (40% OF 23% reduction)
  - Denmark: 11.3% men and 3.7% women
- The epidemic of obesity
  - Not clear when BMD adjustment are made or other concomitant diseases are present

Possible factors that contribute for geographical variability and different rates of fractures globally

- Secular increases of BMD
  - NHANES: 6%⇧ BMD FN 1988-1994 to 2005-2008
  - CANADA: ⇧0.52% CF y 0.32% lumbar 1996-2006
  - CHINA: ⇧9.6 DMO CF y 4.17 lumbar 1995-2000 y 2000-2005

Possible factors that contribute for geographical variability and different rates of fractures globally

- The epidemic of T2DM
  - This disease is a mayor risk factor for fractures
- Lifestyle factors
  - Decline in smoking
  - Increase in physical activity
  - Use of Calcium and Vit D suplements
- Improvement in fall prevention
  - Programs oriented for prevention
- Increased comorbidities
  - Increasing age, increasing comorbidities

Risk factors

Non modifiable

- Age
- Sex
- Genetics
  - Quantity and quality of bone
  - Arq. PM collagen, Vit D
- Family history of fractures
- Previous fracture after 45 y
- Ethnicity
- Menopause

Modifiable RF

- Weight
- Nutrition
- Smoking
- Alcoholism
- Sedentary/physical inactivity
- Drugs
- Propensity to falls
- BMD

LAVOS Study 5 countries

Characteristics of participants

Variable	Argentina	Brazil	Colombia[a]	México	Puerto Rico	Total
Sample size	N= 420	N=415	n=281	N=406	n= 400	n=1922
Age (mean± sd)	68.98 ± 10.58	69.36 ± 11.22	65.47 ± 9.44	69.55 ± 11.87	67.50 ± 10.73	68.36 ±10.96
Height (mean± sd)	154.43 ± 6.68	152.78 ± 6.17	154.46 ± 6.29	147.69 ± 6.71	153.81 ± 8.23	152.44 ± 7.37
Weight (mean± sd)	67.31 ± 12.59	62.69 ± 13.12	62.33 ± 13.00	63.08 ± 12.31	69.06 ± 13.48	65.18 ± 13.17
Maternal history of Fx (%)	10.7	10.6	8.2	6.2	7.3	8.63
Personal history of Fx (%)	25.0	24.3	17.4	20.7	26.0	23.0
Body Mass Index (%)						
Underweight	3.8	7.7	8.5	1.5	3.0	4.7
Normal	21.7	26.5	22.4	20.7	15.0	21.2
Overweight	45.2	42.4	27.4	42.1	47.8	41.9
Obese	29.3	23.4	12.5	35.7	34.3	27.9
Height loss (%)	56.43	35.2	27.76	60.84	37.25	44.59
Calcium ≥ 800mg (%)	22.4	22.2	5.3	25.9	52.8	26.9
Use of steroids (%)	3.1	3.4	5.3	3.7	1.5	3.3
HRT (%)	13.6	12.0	28.5	19.5	32.8	20.75
Smoking (%)						
Current smoking	16.0	8.7	8.5	15.3	37.5[b]	17.6
Ever smokers	23.1	18.8	24.6	11.3		28.1
Never smokers	61.0	72.5	66.9	73.4	62.5	54.3
Alcohol intake (%)						
Never	34.5	81.7	75.8	75.1	85.3	69.9
1-10 gr/day	63.6	16.6	23.8	23.4	9.3	27.8
10-40 gr/day	1.7	1.2	0.0	1.5	4.8	1.9
>40 gr/day	0.2	0.5	0.4	0.0	0.8	0.4
Physical activity (%)						
≥ 30 min/day	55.5	25.1	33.5	35.7	21.5	34.4

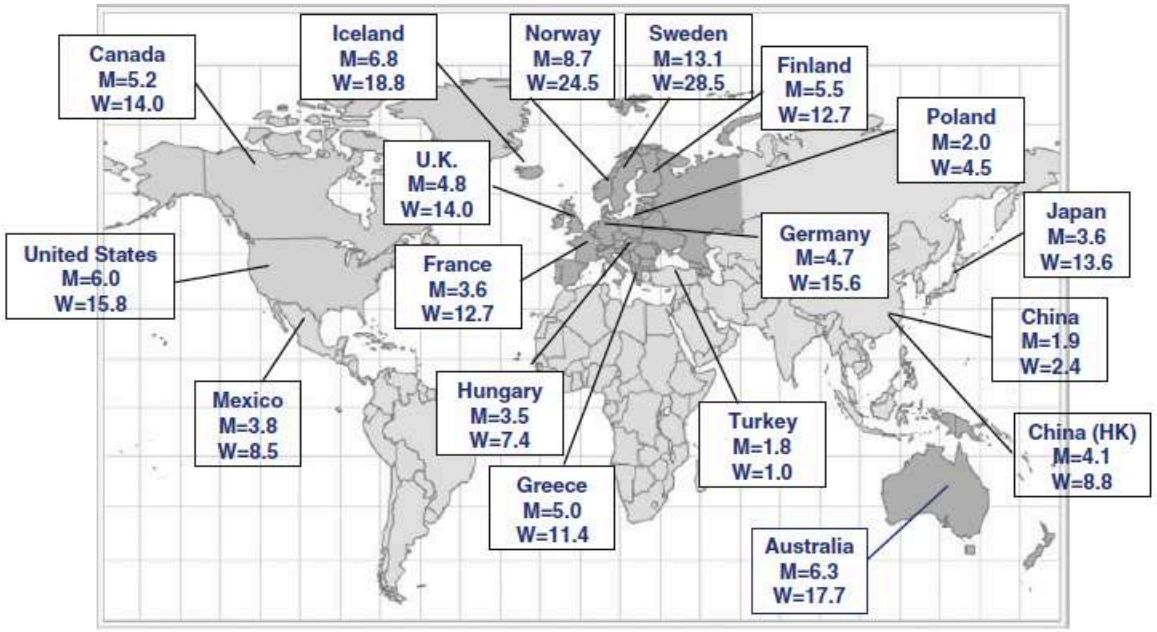
[a] The 20 participants aged 80 and over from Colobia were included in the risk factors analysis

[b] Puerto Rico asked current and ever in the same category

Health determinants WHO

- Income and social status
- Education
- Physical environment
- Social support networks
- Genetics
- Health services
- Gender

Defining Ethnic and Racial differences in OP and FF
Lifetime risk probability of hip fracture



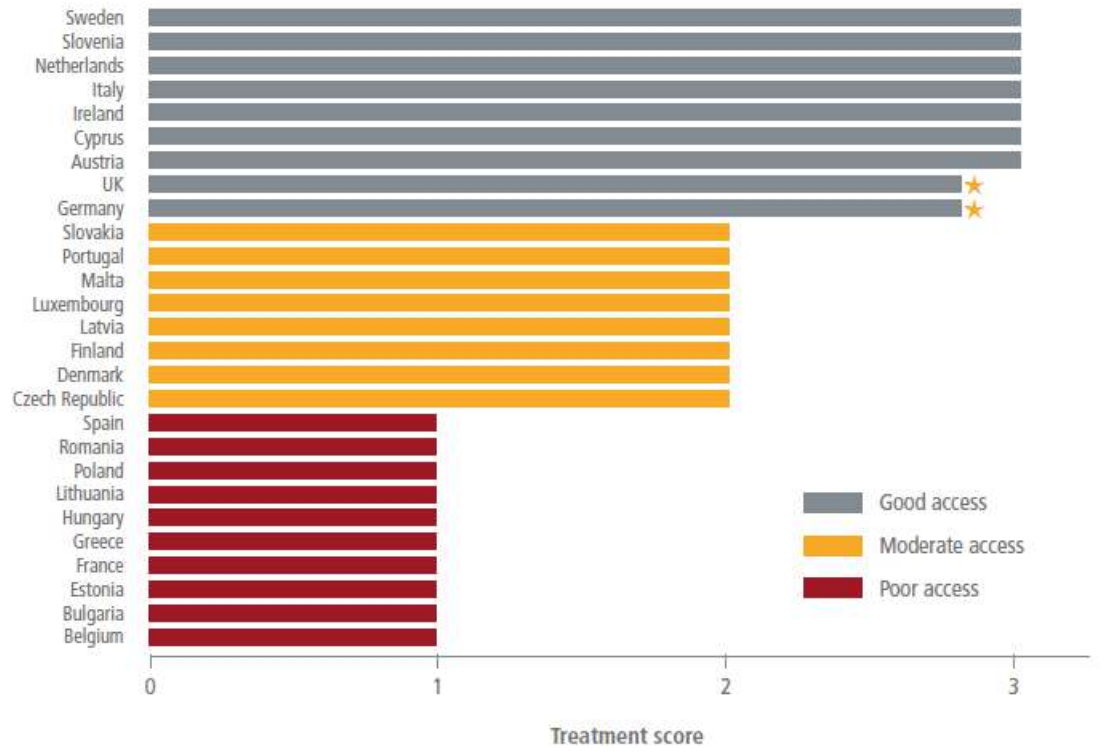
Cauley J. A. Clin Orthop Relat Res 2011

Race: a word with many meanings

- Human race
- For biologists, different races of a particular species of plant or animal
- Race identification: for social or cultural determinants
- Race as political weapon for discrimination

The term race is a recipe of confusion

Ranking and score for access to medical intervention in the European Union. Kanis JA, Borgstrom F, Compston J, Dreinhofer K, Nolte E, Jonsson L, Lems WF, McCloskey EV, Rizzoli R, Stenmark J (2013) SCOPE: a scorecard for osteoporosis in Europe. Arch Osteoporos 8:144



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Ethnicity

- Ethnic group or ethnic background reflects group characteristics an shared environments such as country of origin, language, religious practices, diet and typical activities.

- It is certainly more specificity than race

Embodiment

- A concept referring to how we literally incorporate, biologically the social world in witch we live, from conception to death. No aspect of our biology can be understood absent knowledge of history, individual and societal ways of living
- Early nutrition in utero, low birth weight will influence low bone mass and the risk of OP and fractures later in life

Krieger, 2005

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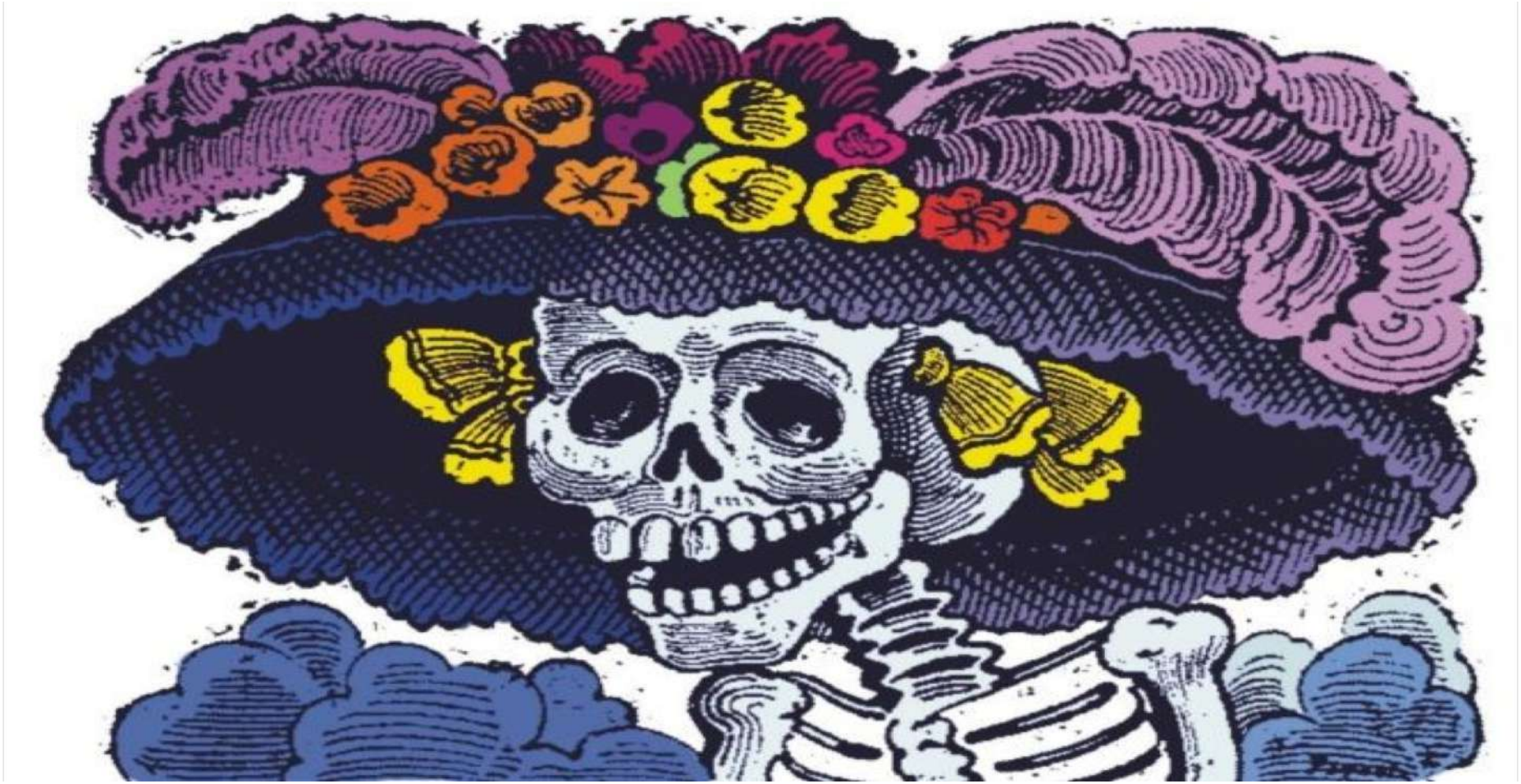

Conclusions

- There is a 10 fold
- environmental factors may play a greater role than genetic factors

in different countries:

- Fracture rates marked varied in different regions and different countries
- Death and life expectancy varied as well
- Health determinants varies across countries

Disparities of fracture rates among different countries

- Fuleihan and colleagues investigated the prevalence and incidence of vertebral fractures worldwide.
- In terms of prevalence, the highest rates were reported for Scandinavia (26%), intermediate rates for Western Europe, USA and Mexico (20%), and low rates for Latin America (15%)