XXVIII IFSO World Congress

9-12 September 2025 | Santiago, Chile

Bone Health in Women Across the Life Course

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Bone Health in Women Across the Life Course

Dr. Juan Patricio Valderas, MD, MSC

Universidad de Antofagasta, Chile

Disclosure

Regarding the content of this presentation:

I have nothing to disclose

Epidemiology of osteoporosis and fragility fractures

1. Worldwide, up to 37 million fragility fractures occur annually in individuals aged over 55, the equivalent of 70 fractures per minute.
2. 1 in 3 women over age 50 will experience osteoporotic fractures.
3. Osteoporosis affects close to 21.2% of women.
4. Hip fractures carry a mortality rate of 20–24% within the first year, and the increased risk of death persists for at least five years following the fracture.
5. 40% of survivors are unable to walk independently, 60% requiring assistance a year later.
6. The higher fracture risk in women is related to having smaller, thinner bones, a lower peak bone mass, and experiencing bone loss earlier in life, especially after menopause due to estrogen decline.

https://www.osteoporosis.foundation/facts-statistics/epidemiology-of-osteoporosis-and-fragility-fractures

The Global Burden of Osteoporosis, Low Bone Mass, and Its Related Fracture in 204 Countries and Territories, 1990-2019

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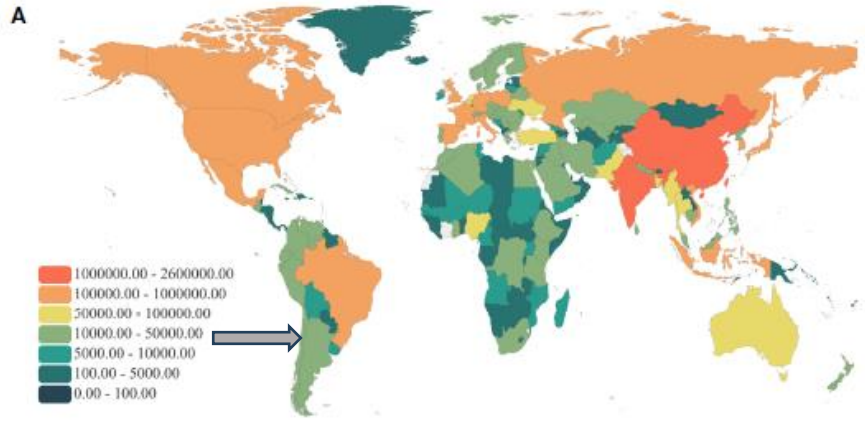
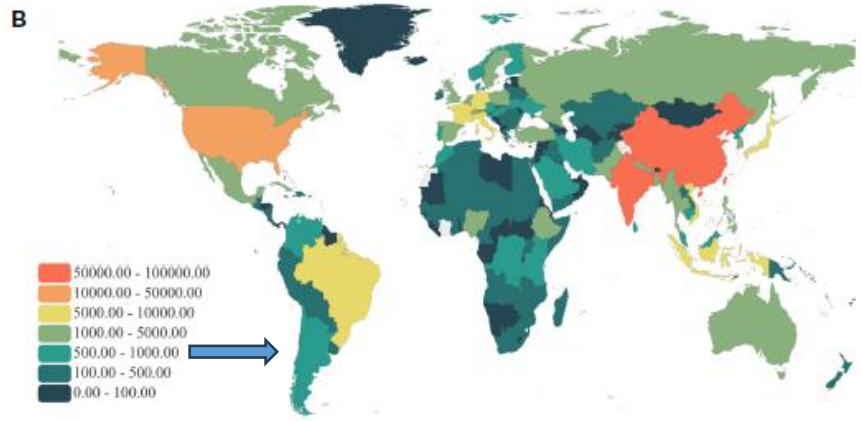
DALYs, Disability-adjusted life years



Fragility fractures rank as the fourth most burdensome condition worldwide based on disability-adjusted life years (DALYs), surpassed only by ischemic heart disease, dementia, and lung cancer.

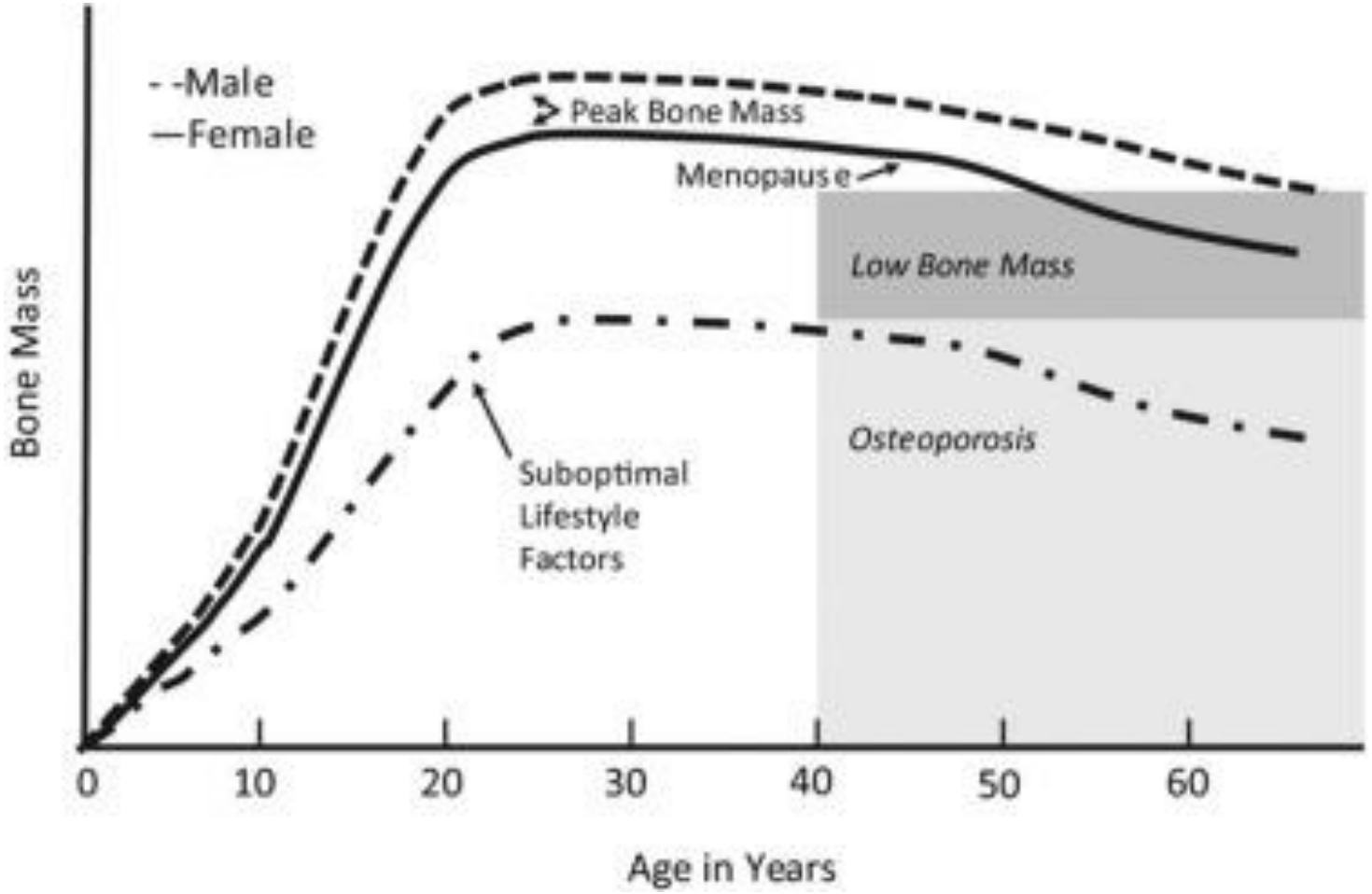
Death number



The combined lifetime risk for hip, forearm and vertebral fractures is around 40%, equivalent to the risk of cardiovascular disease.

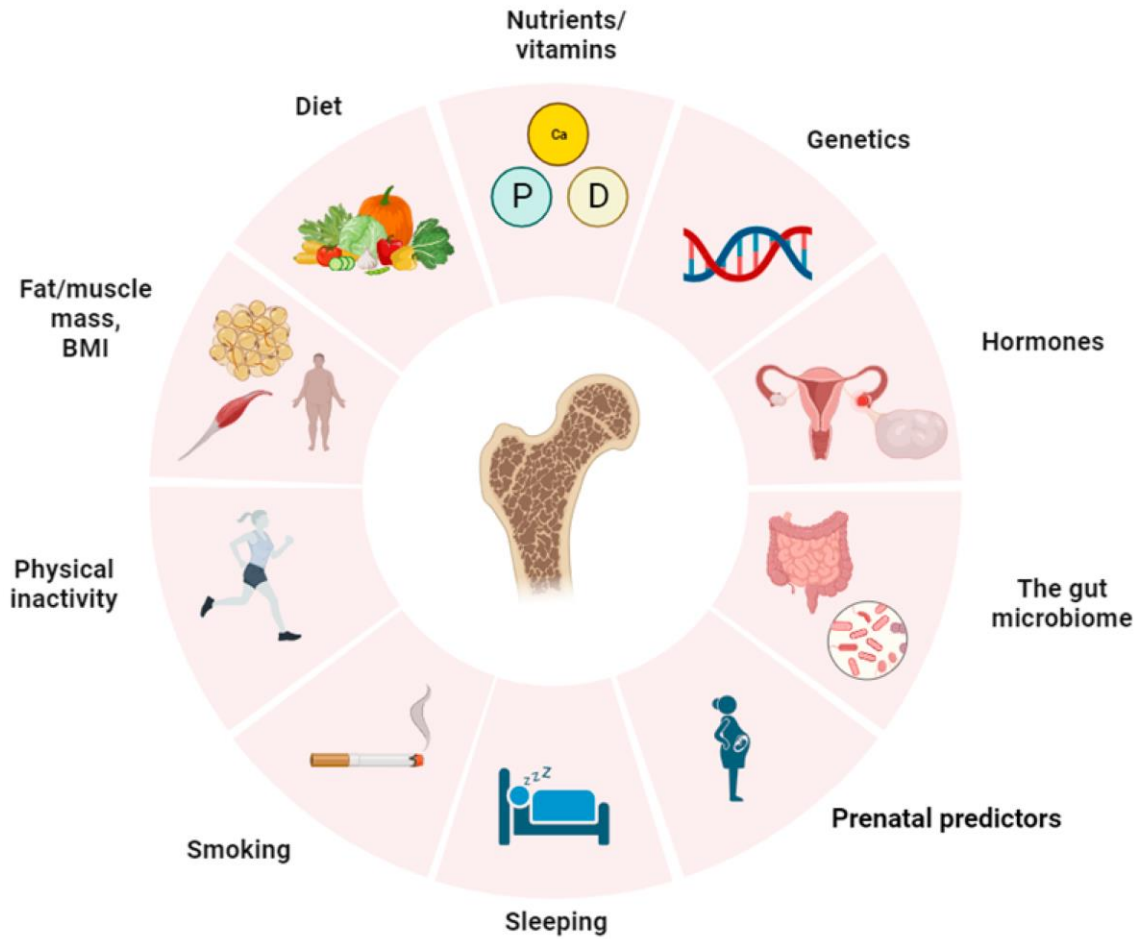
Shen et al. Front. Endocrinol. 13:882241.

Peak Bone Formation



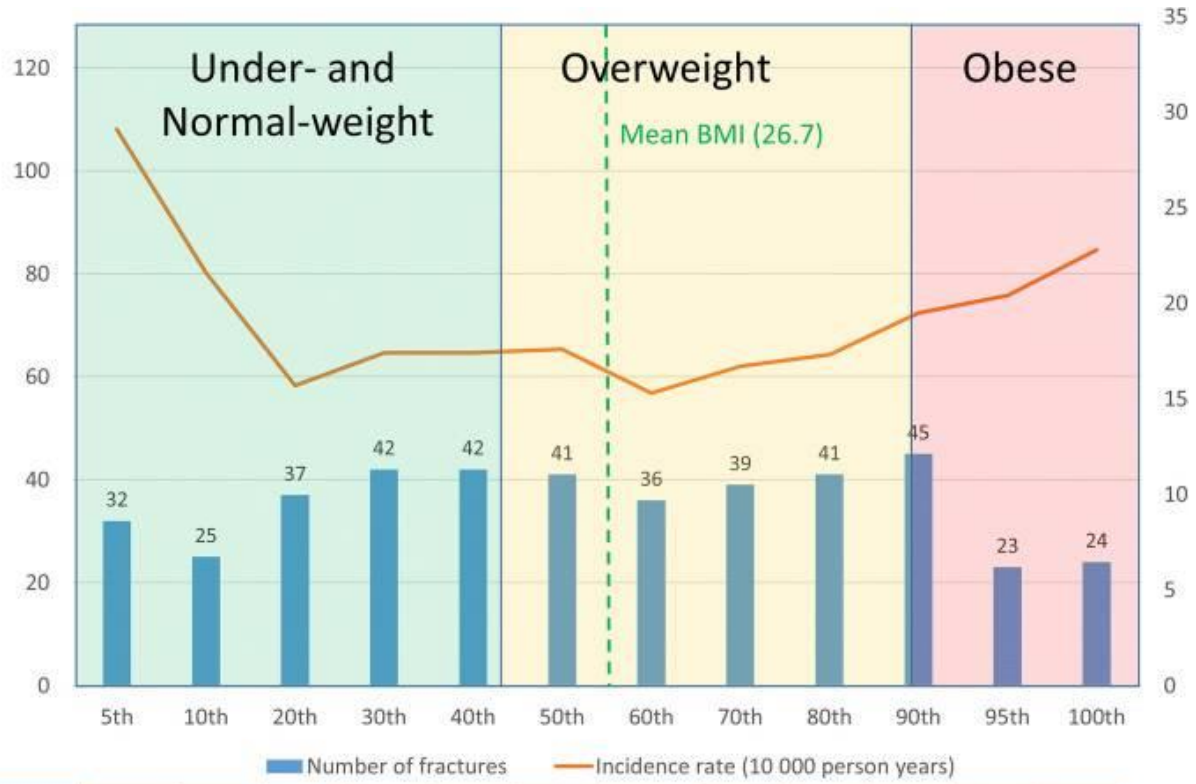
Hereford et al. J Pediatr Soc North Am . 2024 Apr 5:7 .

Endogenous and Exogenous factors affecting Peak Bone Formation



Akhiiarova et al. Biomedicines 2023, 11(11), 2982

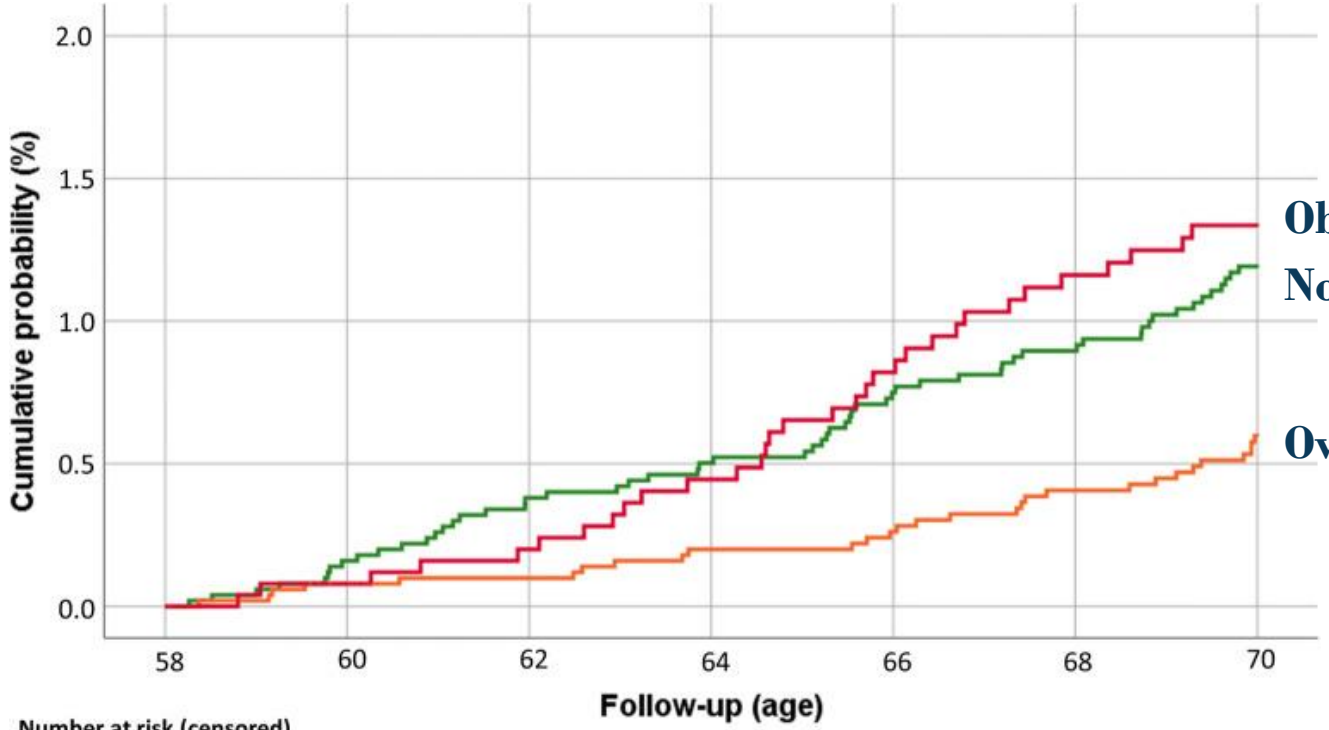
Obesity is associated with early hip fracture risk in postmenopausal women: a 25-year follow-up (12,715 finnish women)



Percentile	5th	10th	20th	30th	40th	50th	60th	70th	80th	90th	95th	100th
BMI cutoff	<20.8	<21.8	<23.1	<24.0	<25.0	<26.0	<27.1	<28.3	<30.0	<32.5	<35.9	<68.6
Incidence rate	29.1	21.6	15.7	17.4	17.4	17.6	15.3	16.7	17.3	19.5	20.4	22.8

Osteoporos Int. 2021; 32(4): 769–777

Obesity is associated with early hip fracture risk in postmenopausal women: a 25-year follow-up (12,715 finnish women)



Number at risk (censored) in 3-year intervals	58 years	61 years	64 years	67 years	69.9 years
Normal	5039(0)	5000 (39)	4901(138)	4829(210)	4685(354)
Overweight	5082(0)	5010(72)	4929(153)	4864(218)	4681(401)
Obese	2535(0)	2488(47)	2416(119)	2340(195)	2261(274)

During the first half of the follow-up before age 70, women with obesity or normal weight had a higher risk of hip fracture compared with women who were overweight

Osteoporos Int. 2021; 32(4): 769–777

Obesity and risk of fracture in postmenopausal women: a meta-analysis of cohort studies (8 studies, 671,532 women & 40,172 fractures)

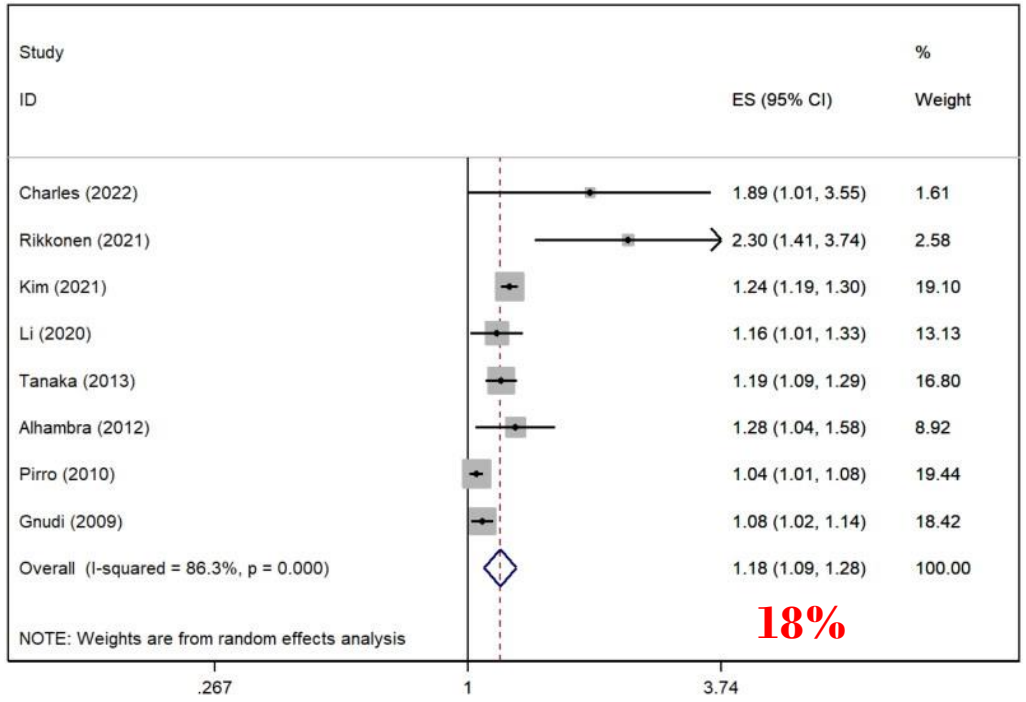


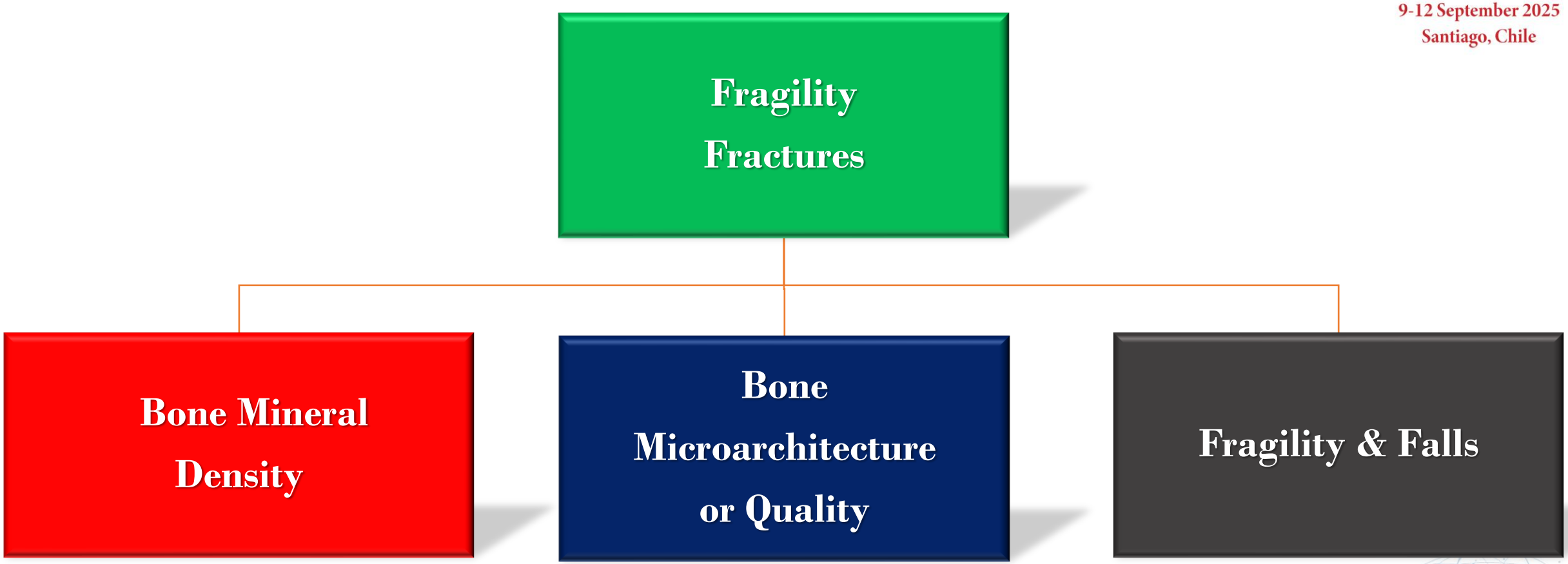
Table 2. Subgroup analysis for the risk of fracture caused by obesity.

Fracture sites	Included studies	RR (95% CI)	Heterogeneity I^2	Heterogeneity *p*-value
Hip fracture	3[21,25,27]	1.031 (0.780–1.363)	91.0%	.830
Vertebral fracture	3[22,24,26]	1.154 (1.020–1.305)	94.5%	.023
Pelvic fractures	2[20,25]	0.575 (0.470–0.702)	0.0%	.000
Humerus fracture	2[25,27]	1.139 (0.972–1.334)	58.9%	.107

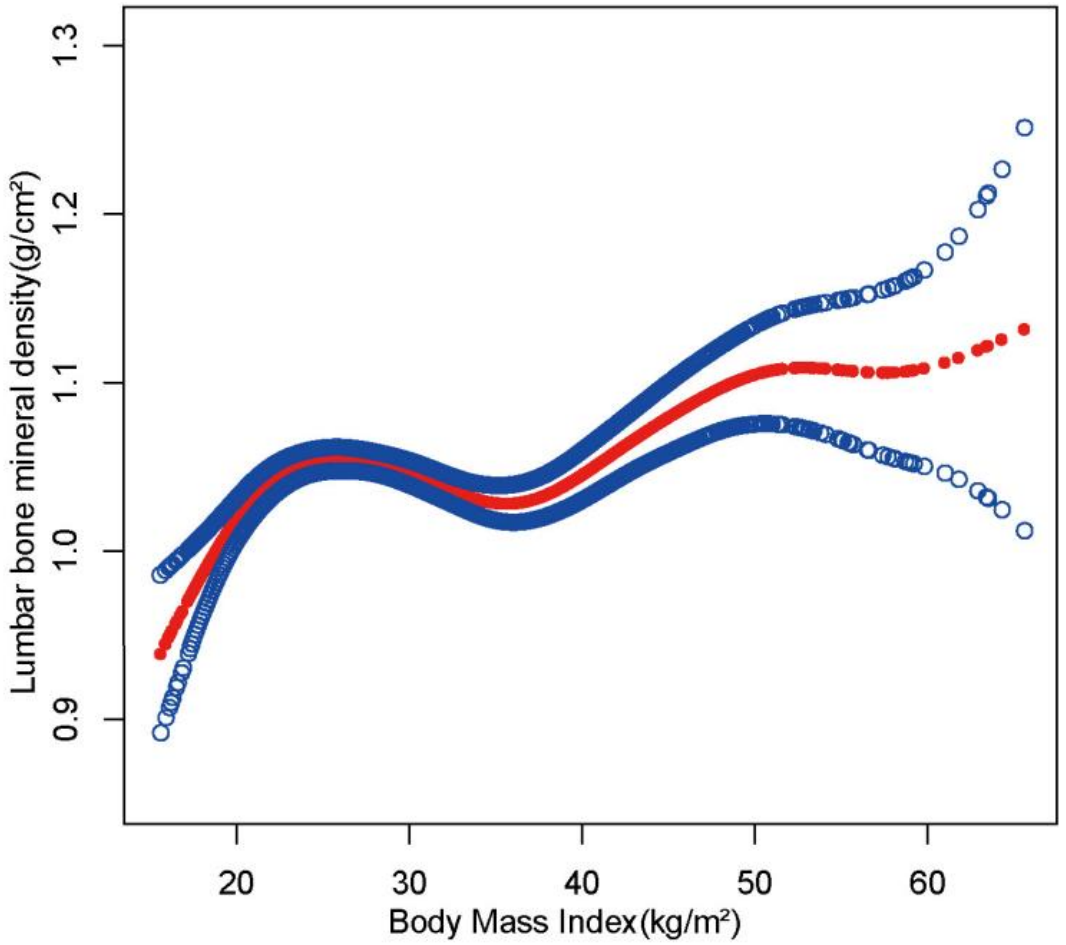
Obesity was associated with an 18% increased risk of all-cause fractures, including a higher risk of vertebral fractures but a reduced risk of pelvic fractures.

Liu et al. Ann Med. 2023 Dec;55(1):220351

Bone Health Across the Life



BMI and bone mineral density in U.S. adults: analysis in the NHANES (11075 adults, 50% women, lumbar DMO)



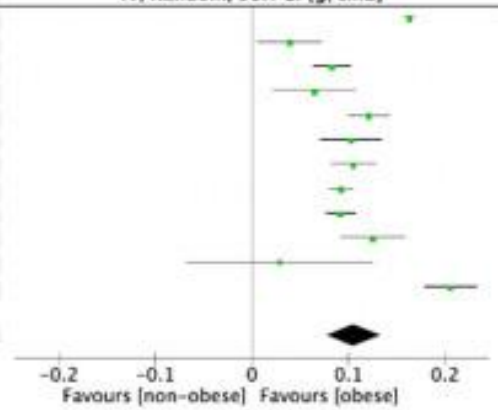
Front Nutr. 2023 Mar 7;10:1132234

Association between obesity and risk of fracture, bone mineral density and bone quality in adults: A systematic review and meta-analysis

A) BMD total hip premenopausal women

Study or Subgroup	Obese Mean [g/cm2]	Obese SD [g/cm2]	Obese Total	Non-obese Mean [g/cm2]	Non-obese SD [g/cm2]	Non-obese Total	Weight	Mean Difference IV, Random, 95% CI [g/cm2]
Al-Shoumer 2012	0.9136	0.0221	403	0.75	0.02	51	9.4%	0.16 [0.16, 0.17]
Asli 2020	0.835	0.114	117	0.796	0.121	83	8.3%	0.04 [0.01, 0.07]
Khukhlina 2019	1.029	0.036	30	0.946	0.04	30	9.0%	0.08 [0.06, 0.10]
Kim 2016	0.924	0.124	52	0.859	0.117	72	7.6%	0.07 [0.02, 0.11]
Machado 2016	0.8351	0.1273	266	0.7142	0.1016	167	8.9%	0.12 [0.10, 0.14]
Mazocco 2017	0.9324	0.1345	299	0.83	0.138	93	8.4%	0.10 [0.07, 0.13]
Mendez 2013	0.9455	0.1363	690	0.84	0.12	123	8.8%	0.11 [0.08, 0.13]
Olmos 2018	0.9055	0.1369	2094	0.8129	0.1221	503	9.2%	0.09 [0.08, 0.10]
Scott 2020	0.95	0.12	308	0.8584	0.1144	1384	9.2%	0.09 [0.08, 0.11]
Sornay-Rendu 2013	0.939	0.11	63	0.814	0.11	126	8.3%	0.13 [0.09, 0.16]
Tay 2018	0.847	0.13	10	0.819	0.12	20	4.4%	0.03 [-0.07, 0.12]
Zhou 2010	0.8775	0.1409	750	0.6718	0.3664	829	8.6%	0.21 [0.18, 0.23]
Total (95% CI)			**5082**			**3481**	**100.0%**	**0.11 [0.08, 0.13]**

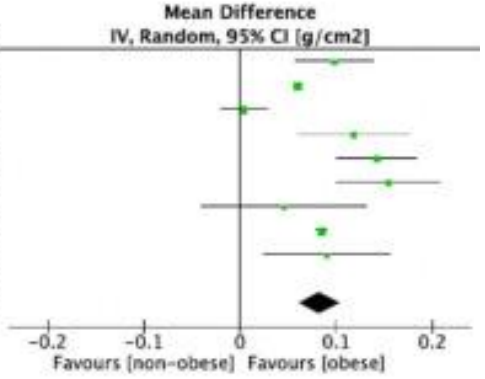
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 283.80$, df = 11 ($P < 0.00001$); $I^2 = 96\%$
Test for overall effect: Z = 7.53 ($P < 0.00001$)



B) BMD total hip postmenopausal women

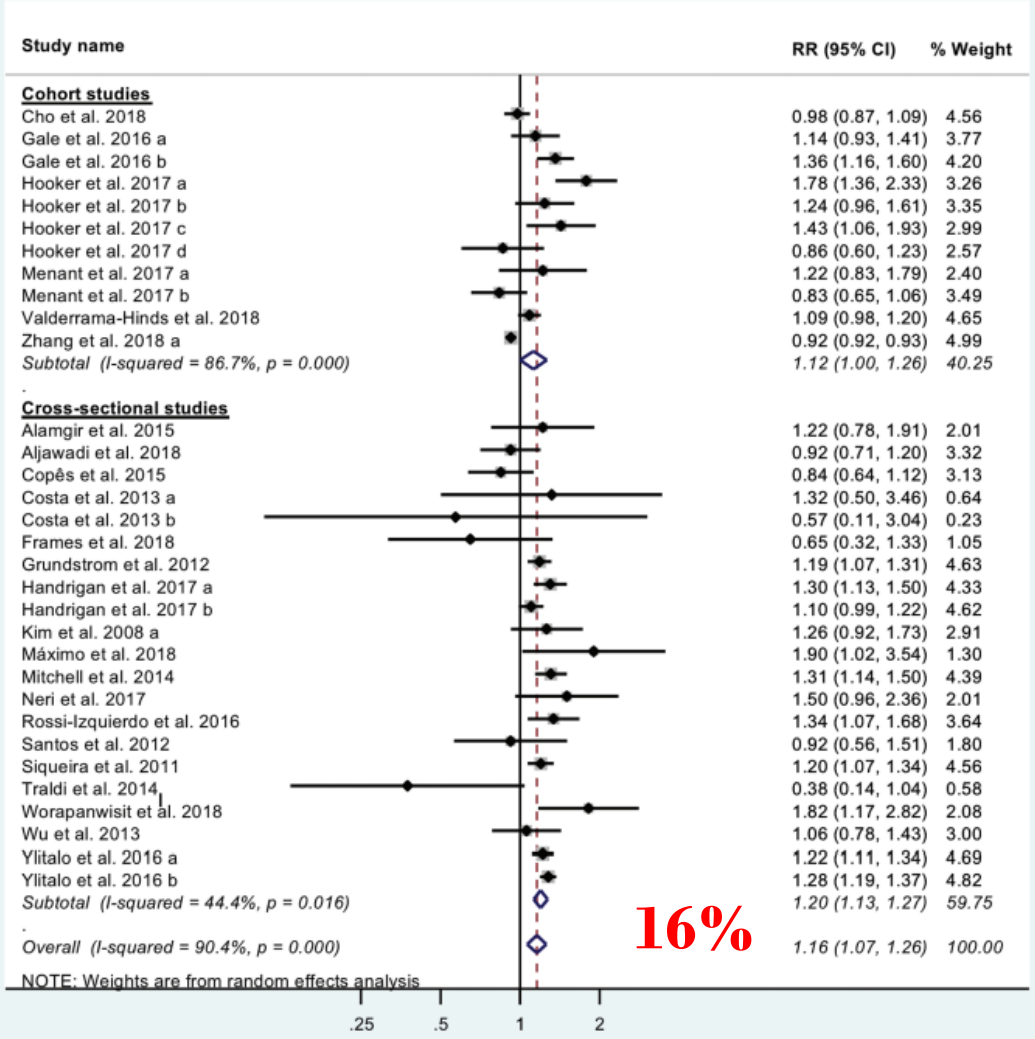
Study or Subgroup	Obese Mean [g/cm2]	Obese SD [g/cm2]	Obese Total	Non-obese Mean [g/cm2]	Non-obese SD [g/cm2]	Non-obese Total	Weight	Mean Difference IV, Random, 95% CI [g/cm2]
Bachmann 2014	1.065	0.111	53	0.967	0.118	69	10.8%	0.10 [0.06, 0.14]
Jang 2016	0.9998	0.0316	263	0.94	0.08	1033	18.2%	0.06 [0.05, 0.07]
Liu 2014	1.0073	0.1315	281	1.003	0.132	190	14.8%	0.00 [-0.02, 0.03]
Maimoun 2020	1.052	0.144	38	0.934	0.111	38	7.7%	0.12 [0.06, 0.18]
Maimoun 2020-2	1.028	0.13	139	0.886	0.115	40	10.7%	0.14 [0.10, 0.18]
Sukumar 2011	1.0695	0.1567	52	0.9154	0.1258	59	8.4%	0.15 [0.10, 0.21]
Takata 1999	1.006	0.156	20	0.961	0.148	31	4.5%	0.05 [-0.04, 0.13]
Wampler 2005	0.867	0.0991	2693	0.782	0.084	1744	18.3%	0.08 [0.08, 0.09]
Zantut-Wittmann 2020	1.03	0.11	22	0.94	0.13	30	6.6%	0.09 [0.02, 0.16]
Total (95% CI)			**3561**			**3234**	**100.0%**	**0.08 [0.06, 0.10]**

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 90.69$, df = 8 ($P < 0.00001$); $I^2 = 91\%$
Test for overall effect: Z = 7.77 ($P < 0.00001$)



Turquote et alPLoS One. 2021 Jun 8;16(6):e0252487

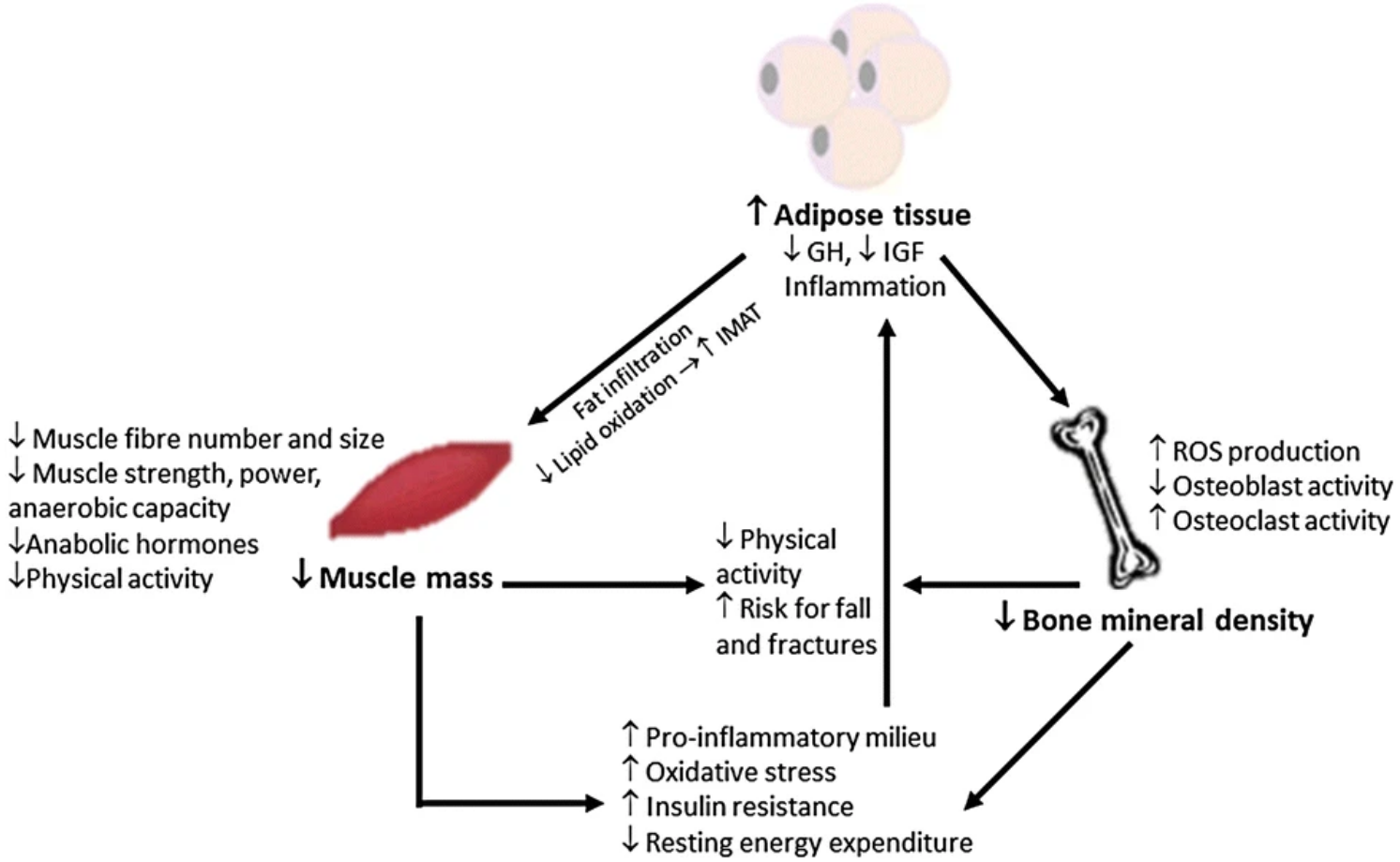
Obesity Increase the Risk and Severity of Falls: Meta-análisis (31 studies, 1,758,694 participants)



Obesity increases the risk of falls by approximately 16% in people aged 60 years and older, including a higher likelihood of experiencing multiple falls.

J Gerontol A Biol Sci Med Sci, 2020, Vol. 75, No. 5, 952–960

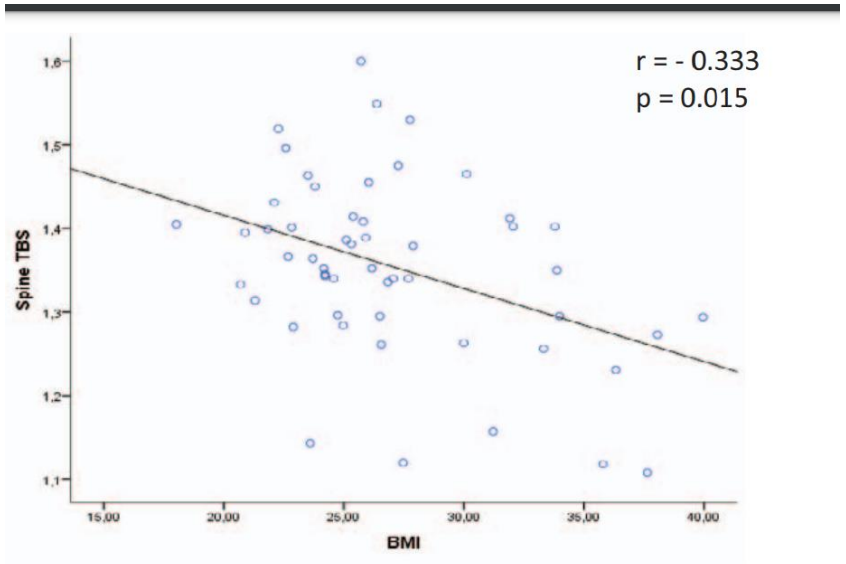
Osteosarcopenic Obesity
(10 to 20% of prevalence in older adults)



Calcified Tissue International volume 105, pages109–124 (2019)

Bone Microarchitecture in Obesity
Trabecular Bone Score

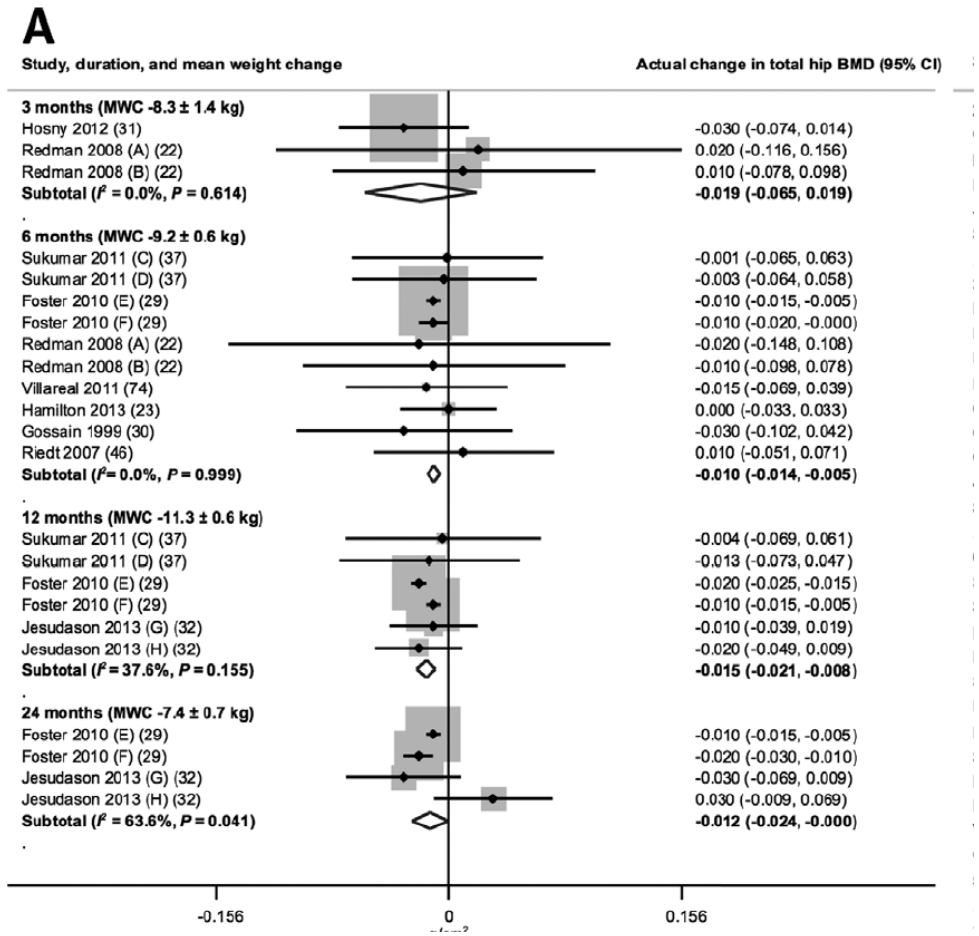
3 Study Groups → / Mean(SD) of the Parameter Studied ↓	Group—1 Non Obese (BMI ≤ 25 kg/m²) N = 85	Group—2 Obese (BMI ≥ 25–35 kg/m²) N = 80	Group—3 Morbidly Obese (BMI ≥ 35 kg/m²) N = 85	*p*-Value
Age (in years)	58.1 (4.4)	57.6 (5.1)	58.1 (6.3)	0.787
BMI (kg/m²)	21.1 (2.3)	27.2 (3.9)	38.5 (3.2)	<0.001
Albumin corrected calcium (mg/dL)	8.78 (0.46)	8.84 (0.5)	8.92 (0.06)	0.067
Serum phosphorus (mg/dL)	3.6 (0.4)	3.5 (0.6)	3.4 (0.9)	0.150
25-OH Vitamin D (ng/mL)	26.8 (8.7)	24.5 (11.3)	23.2 (12.6)	0.098
BMD at Femoral Neck (g/cm²)	0.756 (0.104)	0.762 (0.120)	0.723 (0.106)	0.002
BMD at Lumbar Spine (g/cm²)	0.825 (0.101)	0.875 (0.153)	0.866 (0.113)	0.051
BMD at Total Hip (g/cm²)	0.833 (0.113)	0.800 (0.141)	0.860 (0.124)	0.070
Trabecular bone score at Lumbar Spine	1.228 (0.050)	1.244 (0.090)	1.205 (0.105)	0.013



B

Med. Sci. 2021, 9, 69
Menopause. 2019 Oct;26(10):1166-1170.

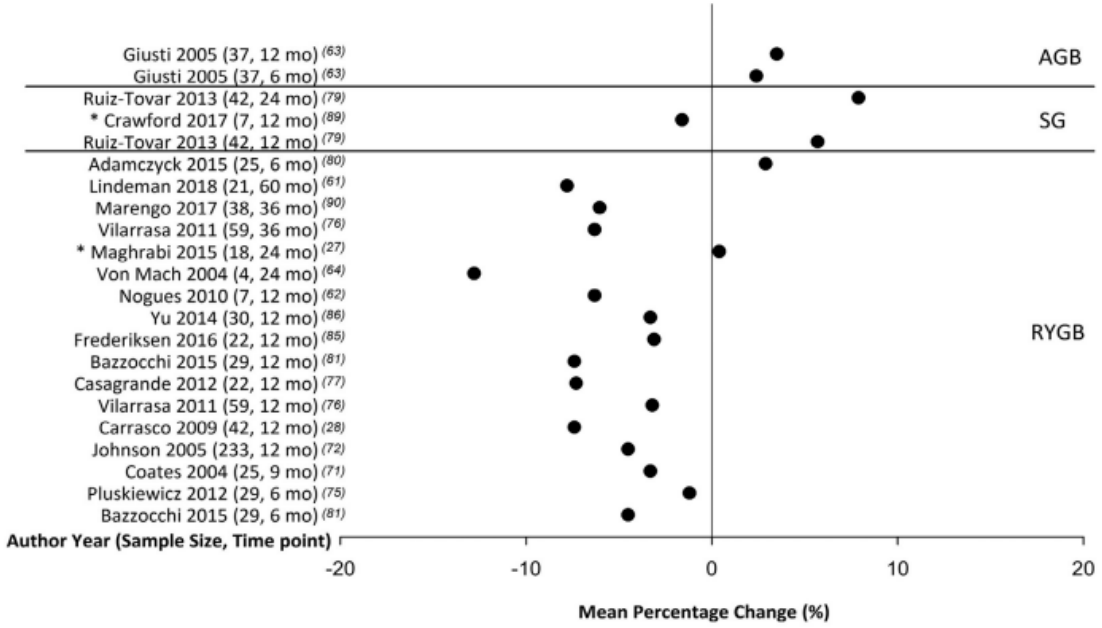
Diet-Induced Weight Loss Lead to Bone Loss in Overweight or Obese Adults A Systematic Review and Meta-Analysis of Clinical Trials



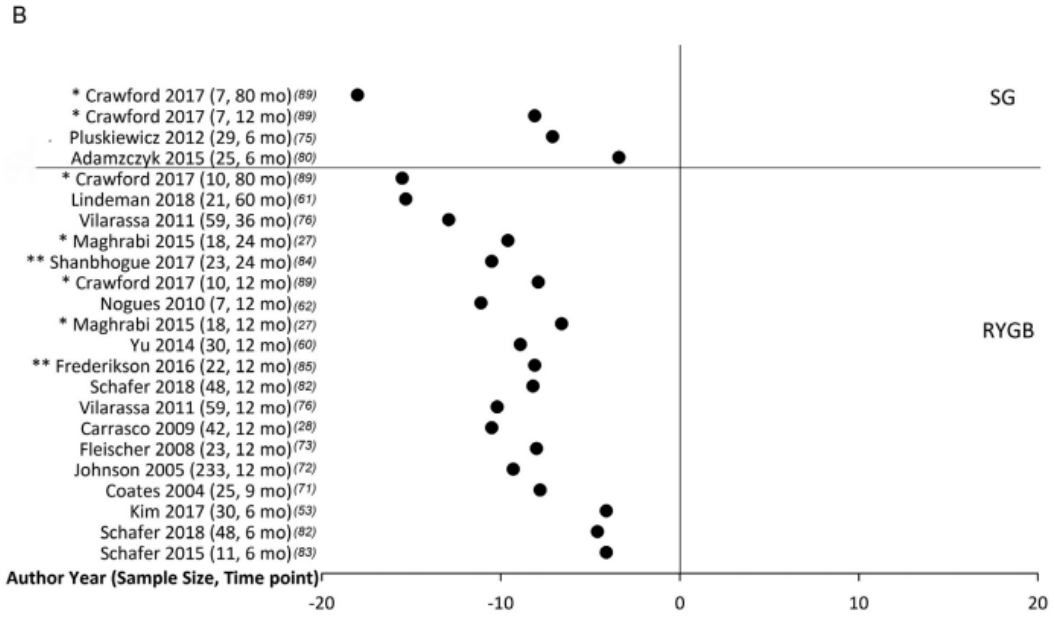
Diet-induced weight loss is associated with a significant decrease in total hip bone mineral density (BMD) near to 1 to 1.5%.

Zibellini et al Journal of Bone and Mineral Research, Vol. 30, No. 12, December 2015, pp 2168–2178

Bariatric Surgery and Bone Health



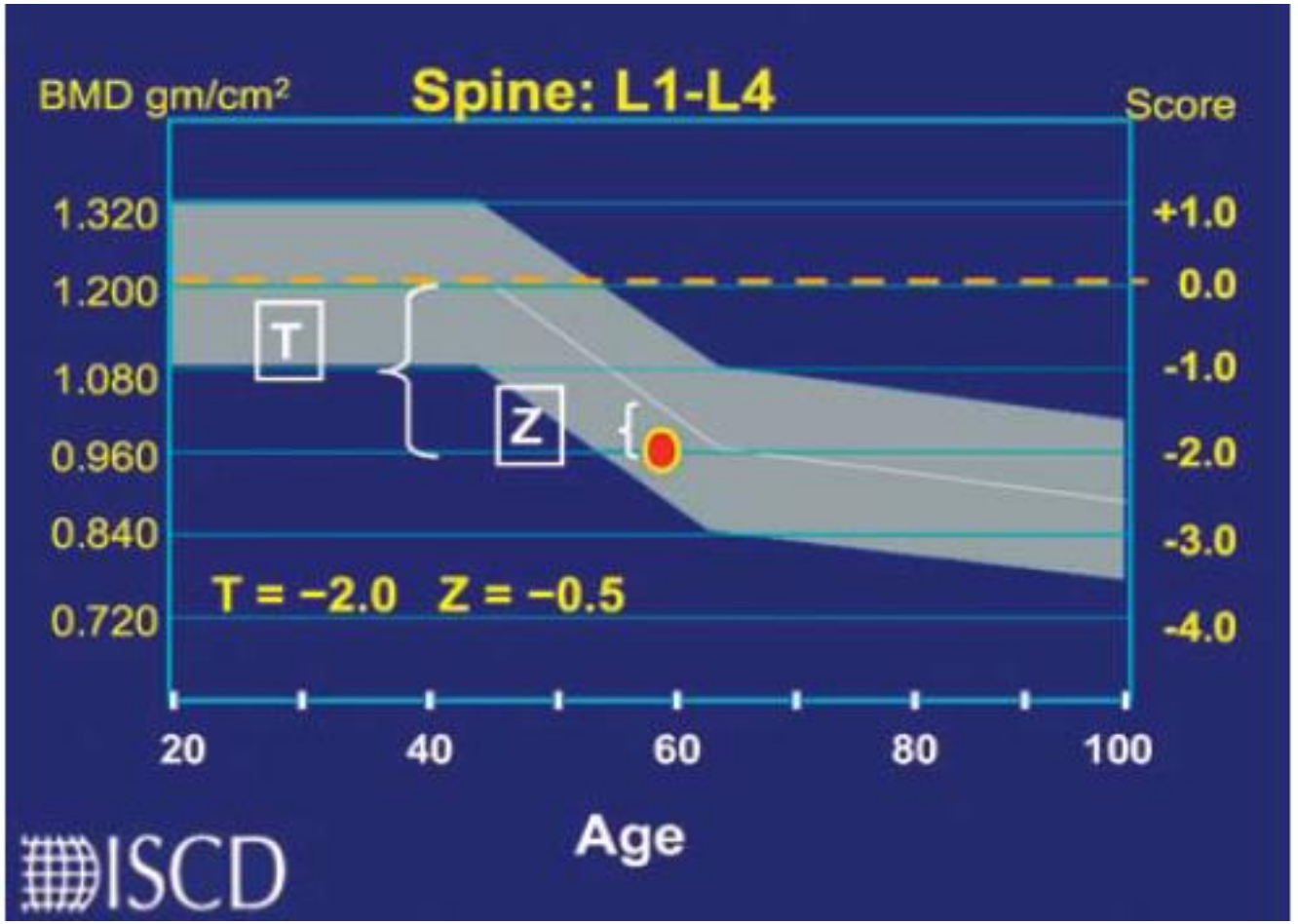
BMD Lumbar Spine



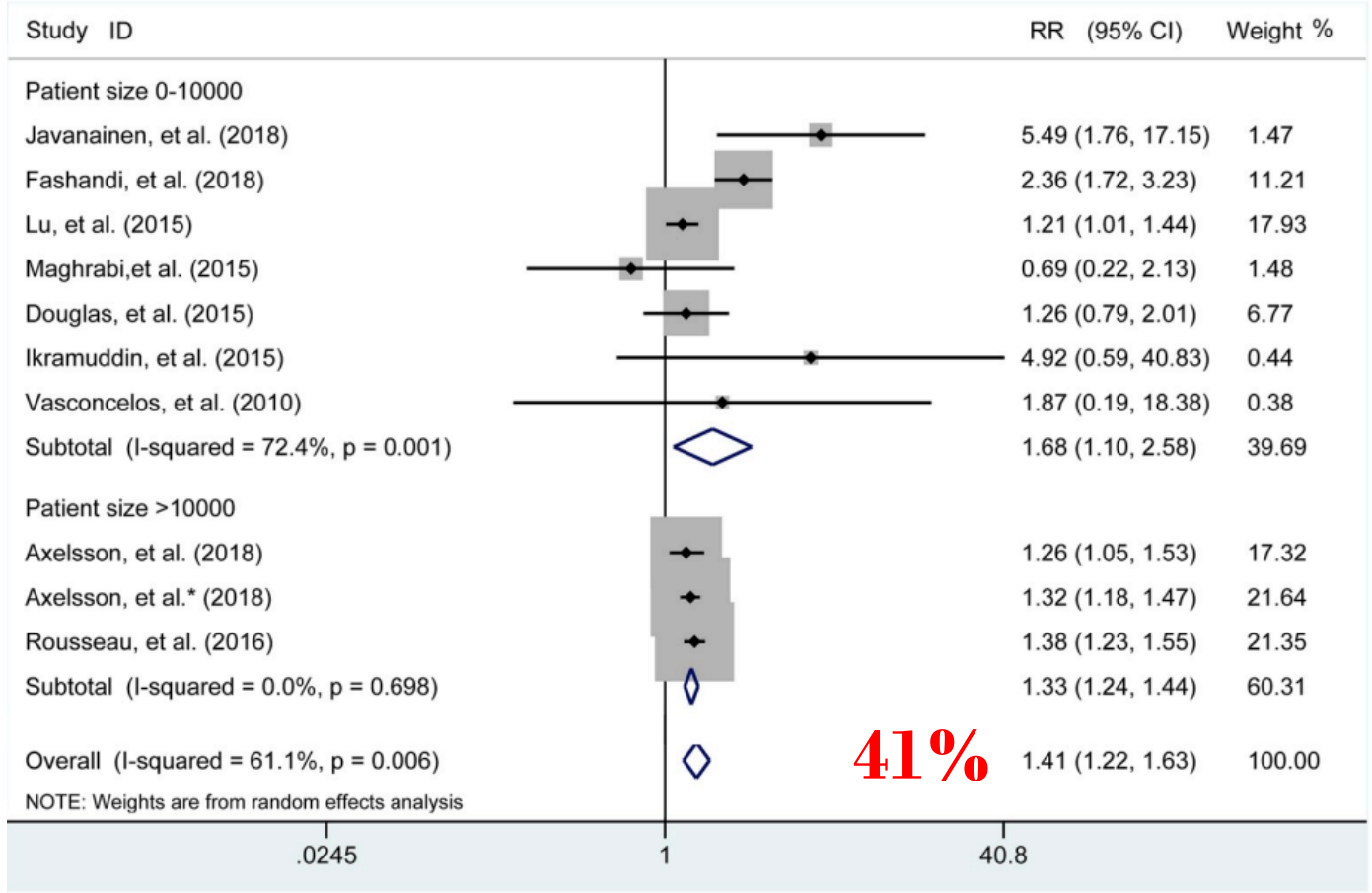
BMD Femoral Neck

Saad et al J Clin Densitom. 2020 Apr-Jun;23(2):165-181.

BMD loss after Bariatric Surgey
6 -10 %, near a 1 point of T-score



Comparative risk of fracture for bariatric procedures in patients with obesity: A systematic review and Bayesian network meta-analysis (12 studies. 159,916 participants)



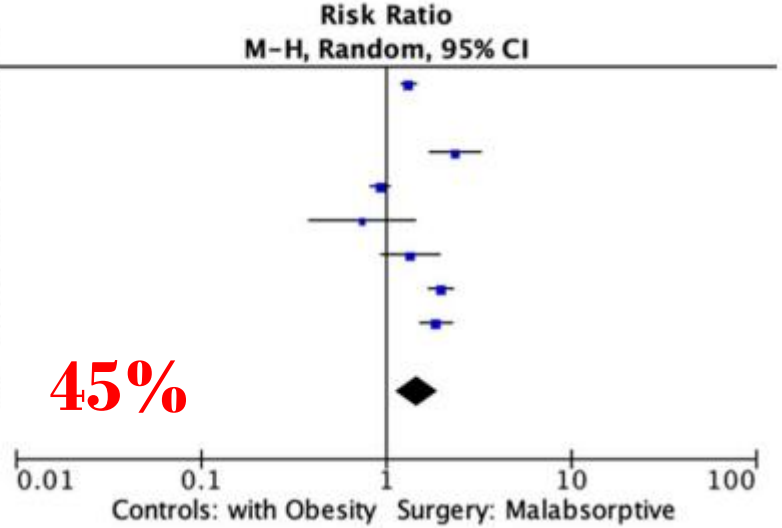
- Incidence of fracture 3% with medical treatment vs 5% with Surgical intervention
- 41% of risk increase
- Lower risk in AGB and SG

Zangh et al. Int J Surg. 2020 Mar;75:13-23

Fracture risk following bariatric surgery: a systematic review and meta-analysis

Study or Subgroup	Surgery: Malabsorptive Events	Total	Controls: with Obesity Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
Axelsson 2018	1019	38971	774	38971	16.7%	1.32 [1.20, 1.44]
Costa 2015	0	56	0	27		Not estimable
Fashandi 2018	125	1940	53	1940	13.7%	2.36 [1.72, 3.23]
Khalid 2020	523	16371	562	16371	16.5%	0.93 [0.83, 1.05]
Lalmohamed 2012	9	613	207	10442	8.3%	0.74 [0.38, 1.44]
Lu 2015	29	289	374	5027	13.0%	1.35 [0.94, 1.93]
Paccou 2020	292	14532	416	40992	16.2%	1.98 [1.71, 2.30]
Rousseau 2016	117	3427	514	27900	15.6%	1.85 [1.52, 2.26]
Total (95% CI)		**76199**		**141670**	**100.0%**	**1.45 [1.11, 1.89]**
Total events	2114		2900			

Heterogeneity: $Tau^2 = 0.11$; $Chi^2 = 89.83$, df = 6 ($P < 0.00001$); $I^2 = 93\%$
Test for overall effect: Z = 2.75 (P = 0.006)



Saad et al. Osteoporosis International (2022) 33:511–526

Prevention & Lifestyle Interventions

Calcium	Vitamin D	Exercise	Protein	Habits
Calcium (diet & supplement) 800 to 1200 mg/d. In BS 1500 mg/d (citrate).	800 a 1000 UI/d for 25OH > 20 ng/ml. In CB 2000 UI/d for 25OH > 30 ng/ml	Weight bearing, resistance, balance 3 times per week	> 1 gr/kg per day (ideal body weight)	Smoking cessation, Reduce intake of OH, caffeine, antiacids

Endocr Pract. 2020;26(Suppl 1)
Shan Hoong et al BMJ 2025;390:e081250

Indications for Bone Mineral Density Scan

- Women > 65 y
- Men > 70 y
- Women > 50 y
  - Fragility fracture
  - BMI < 20
  - Conditions associate to bone loss (AR, Intestinal surgery, anorexia)
  - Drugs (glucocorticoids, QMT)
- Women > 50 y
  - 1 or 2 RF
  - Diabetes Alcoholism, Smoking, Family history, > 2 falls per y

Endocr Pract. 2020;26(Suppl 1)
Shan Hoong et al BMJ 2025;390:e081250

Indications for Pharmacological Therapy

- Fragility fracture in spine or hip
- Fracture in other site plus osteopenia
- Osteoporosis
  T- Score ≤ -2.5
- T-Score -1 a -2.5
  (Osteopenia)
  - FRAX > 20%
    10 y
    for major fracture
    o > 3% to 10 y
    for Hip fracture

Endocr Pract. 2020;26(Suppl 1)
Shan Hoong et al BMJ 2025;390:e081250

Pharmacological Treatment

Biphosphonates (antiresorptives)	Denosumab (antiresorptive)	Teriparatide (anabolic)	Romosozumab (anabolic)	Others
Alendronate Risendronate 5 to 10 y Zolendronate (anual ev) 3 to 6 y	Subcutaneous each 6 months Until 10 y Follow by zolendronate	Subcutaneous dayly Until 2 years	Subcutaneous/ monthly 1 year NO in ECVA	Sequential therapy HRT SERMs (Raloxifene)

Endocr Pract. 2020;26(Suppl 1)
Shan Hoong et al BMJ 2025;390:e081250

Conclusions

1. Women face a lifetime risk of osteoporosis, fractures, and related morbidity and mortality.
2. Although obesity is associated with greater bone mineral density, the presence of osteosarcopenia increases fracture risk.
3. Additionally, obesity treatments that induce weight loss and malabsorptive surgical procedures can contribute to bone loss and elevate the risk of osteoporotic fractures.
4. Therefore, intensive prevention and treatment strategies are essential.
5. Key interventions include lifestyle changes, regular exercise, adequate calcium and vitamin D intake, bone health assessments, and pharmacological therapy.

Thank you for your attention

Dr. Juan Patricio Valderas, MD, MSC