Vitamin D and Nutritional Management of Patients in Fracture Liaison Services and Vitamin D Status in Qatar

Prof. René Rizzoli M.D.

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Speaker Introduction

Prof. René Rizzoli M.D.

- Prof. René Rizzoli is an internist and endocrinologist, with a subspecialty focus on metabolic bone diseases, osteoporosis and disorders of mineral metabolism. He is emeritus professor of medicine at the University Hospitals of Geneva, and former head of the service of bone diseases.
- Prof. Rizzoli is currently the IOF Treasurer and former Chairman of the Committee of Scientific Advisors of the IOF.
- He is also the Chairman of the Scientific Advisory Board of the ESCEO and co-chairs the scientific program committee of the annual IOF-ESCEO congress.
- Throughout his extensive career, Prof. Rizzoli has been involved in both basic and clinical research projects investigating pathophysiology of osteoporosis and of calcium and phosphate homeostasis disorders, the role of nutrition, calcium, protein, bisphosphonates among other topics. He is author of more than 900 scientific articles, Editor-in-Chief of *Calcified Tissue International & Musculoskeletal Research* and associate editor of *Osteoporosis International*.

Vitamin D and nutritional management of patients in Fracture Liaison Services

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Disclosure

Speaker Bureau or Member of Scientific Advisory Board for
Abiogen, Danone, Echolight, EMF, Mithra, ObsEva, Pfizer Consumer Health, Radius Health, Sandoz, Theramex

Pathogenesis of Osteoporotic Fracture

Sarcopenia (-> Falls)

- Sway
- Walking
- Muscle Strength
- Neuro-muscular Impairment

Osteoporosis

- Bone Mass
- Geometry
- Microstructure
- Material level properties

Mechanical Overload

Mechanical Incompetence

Fracture

Fracture Repair

Rehabilitation

-> To Restore Independence

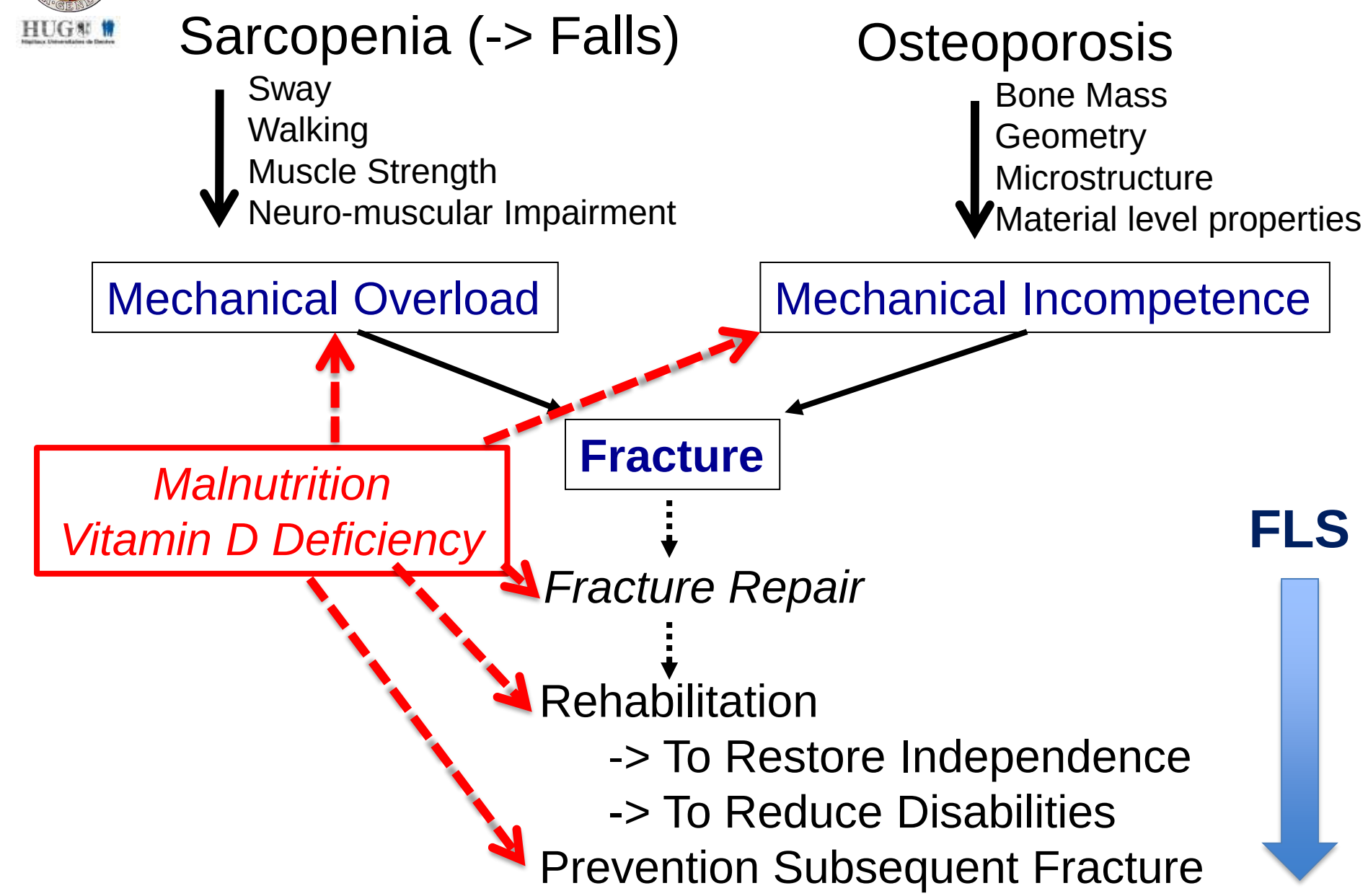
-> To Reduce Disabilities

Prevention Subsequent Fracture

FLS

Adapted from Rizzoli, Best Pract Res Clin Endocrinol Metab 2014

Pathogenesis of Osteoporotic Fracture



Adapted from Rizzoli, Best Pract Res Clin Endocrinol Metab 2014

Circulating calcifediol (25OHD) levels in patients admitted to orthopedic wards for fragility fracture

Study	Country	Population (% female)	Mean (SD) age, years	Mean (SD) 25(OH)D nmol/l	% 25(OH)D <50 nmol/l
Awal et al. {Awal, 2020}[#]	Australia	313	79.5		34
Hao et al. {Hao, 2020}[*]	USA	290 (73)	82 (7)	55 (24)	46
Bischoff-Ferrari et al. {Bischoff-Ferrari, 2008}[*]	Switzerland	222 (77)	86	34.6 (community) 24 (nursing homes)	80
Cher et al. {Cher, 2020}[*]	Singapore	801 (71)	77.7 (8)	-	47.4
Niikura et al. {Niikura, 2019}[*]	Japan	360 878)	84.7 (8.2)	41.3 (18)	71.7
Papaiannou et al. {Papaioannou, 2011}[*]	Canada	65 (56)	78.5 (10.3)	52.3	-
Ish-Shalom et al. {Ish-Shalom, 2008}[*]	Israel	48 (100)	81 (89	39.3 (25.3)	-
Mak et al. {Mak, 2014}[*]	Australia	218 (77)	83.9 (7.2)	52.7 (23.5)	47
Moo et al. {Moo, 2020}[*]	Singapore	796 (71)	77.7 (8)	50.1 (18.5)	53.9

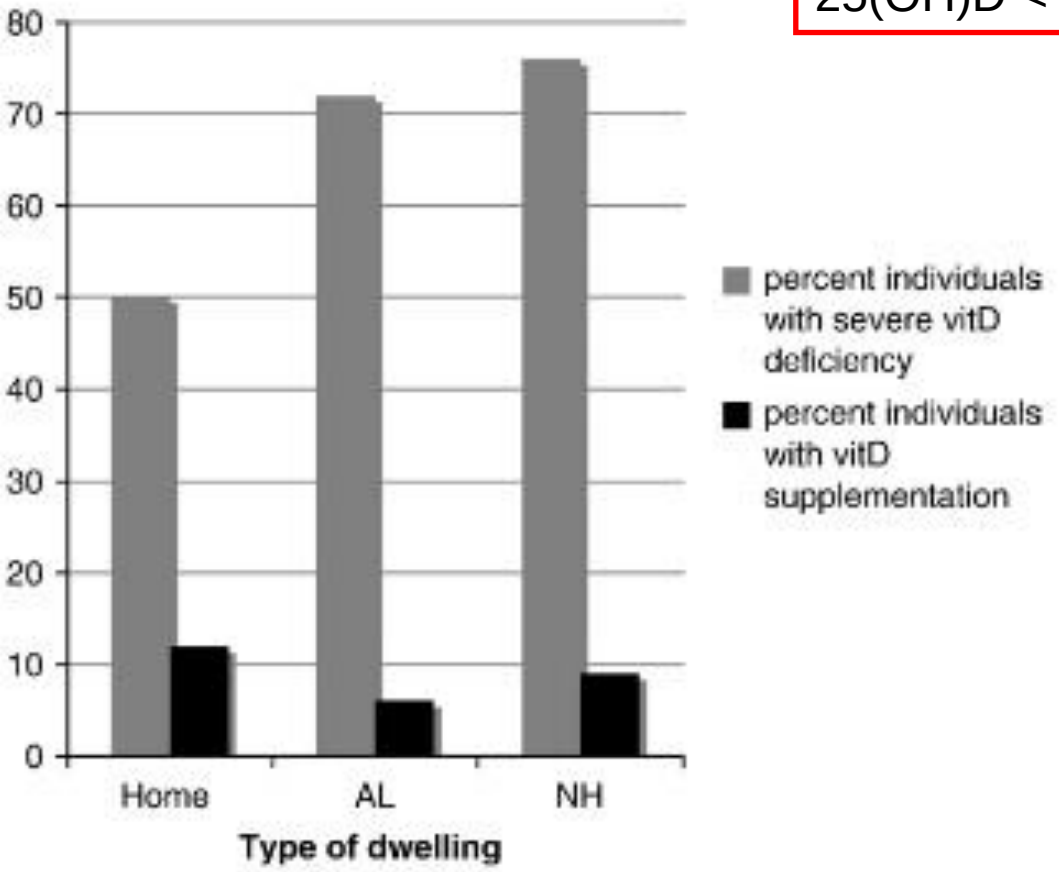
[#]Proximal femur fracture ; [*]Hip fracture

Chevalley et al 2021 submitted

Severe vitamin D deficiency in Swiss hip fracture patients

Severe 25(OH)D deficiency:

25(OH)D < 30 nmol/l

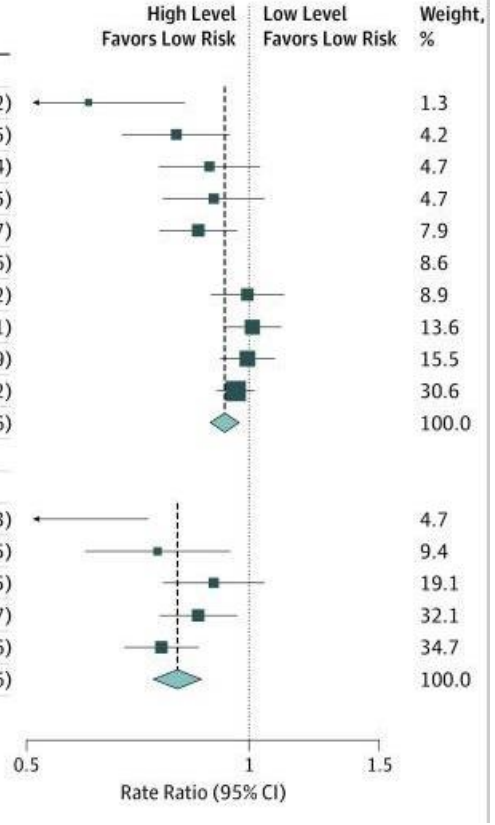


Bischoff-Ferrari et al Bone 2008

Vitamin D and Calcium for the Prevention of Fracture
A Systematic Review and Meta-analysis

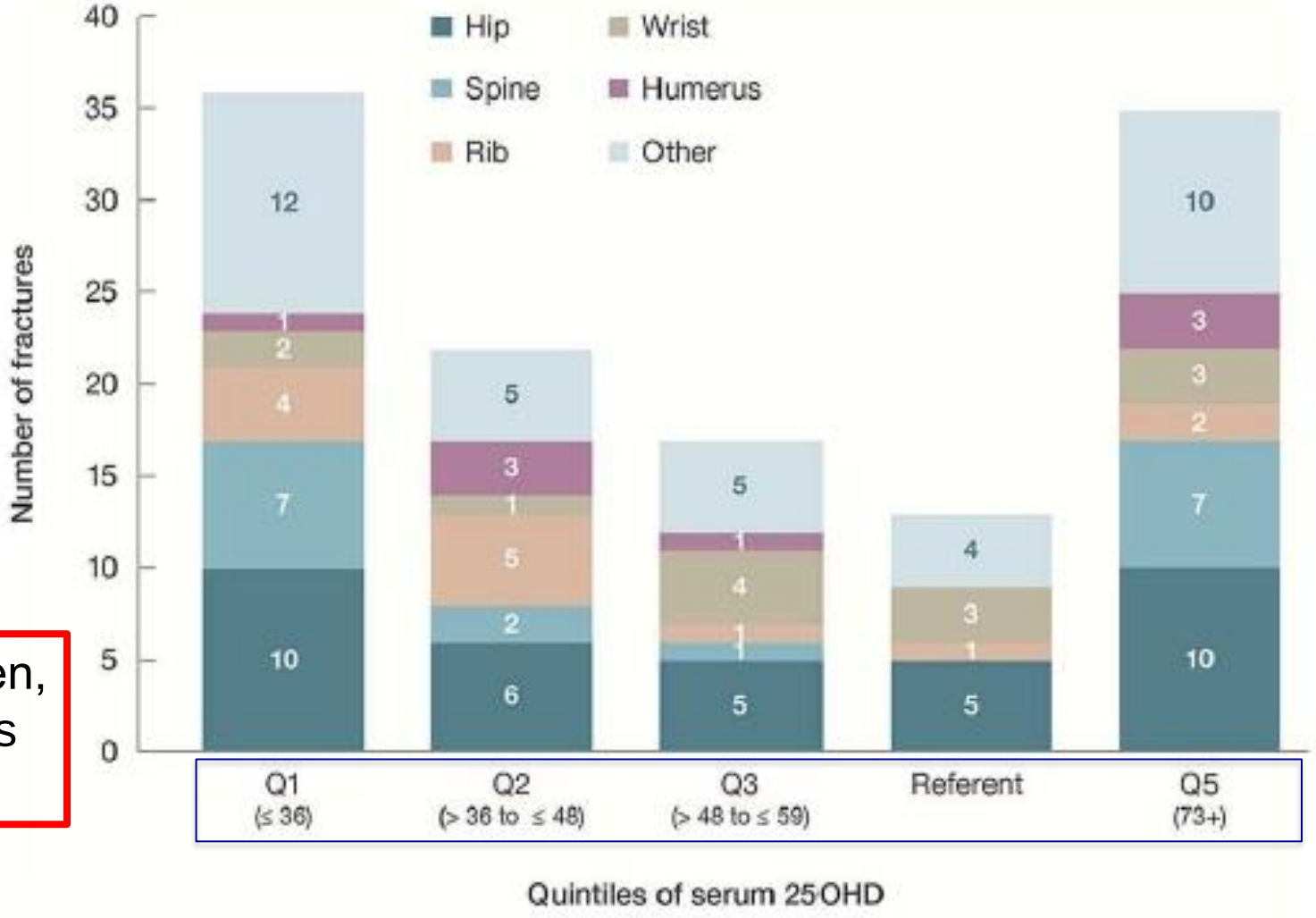
Meta-analysis of **Observational Studies** of Risk of Any Fracture or of Hip Fracture Associated With an Increase of 25 nmol/L in Blood 25-Hydroxyvitamin D Concentration

Source	Baseline 25-Hydroxyvitamin D, nmol/L	Cases No./ Total Participants, No.	Degree of Adjustment	Rate Ratio (95% CI)	Weight, %
Any fracture					
Looker,[28] 2013	59.8	525/4749	+++	0.61 (0.45-0.82)	1.3
Buchebner et al,[29] 2014	62.0	349/1044	+++	0.80 (0.67-0.95)	4.2
Barbour et al,[30] 2012	60.6	247/2614	++++	0.88 (0.75-1.04)	4.7
Robinson-Cohen et al,[31] 2011	62.8	244/2294	++++	0.90 (0.76-1.05)	4.7
Holvik et al,[32] 2013	55.9	1175/2613	++	0.85 (0.75-0.97)	7.9
Steingrimsdottir et al,[33] 2014	53.6	261/5764	++++	0.76 (0.68-0.86)	8.6
Cauley et al,[34] 2011	53.5	1132/2264	++++	0.99 (0.88-1.12)	8.9
Swanson et al,[36] 2015	62.3	432/1000	++++	1.01 (0.92-1.11)	13.6
Roddam et al,[37] 2007	81.0	730/2175	+++	0.99 (0.91-1.09)	15.5
Julian et al,[38] 2016	58.1	1183/14624	++++	0.96 (0.90-1.02)	30.6
All		6278/39141		0.93 (0.89-0.96)	100.0
Subtotal ($Q=31.0$, $df=9$, $P<.001$; $I^2=71.0\%$)					
Hip fracture					
Looker,[28] 2013	59.8	287/4749	+++	0.53 (0.38-0.73)	4.7
Cauley et al,[34] 2011	57.8	400/800	++++	0.75 (0.60-0.95)	9.4
Robinson-Cohen et al,[31] 2011	62.8	244/2294	++++	0.90 (0.76-1.05)	19.1
Holvik et al,[32] 2013	55.9	1175/2613	++	0.85 (0.75-0.97)	32.1
Steingrimsdottir et al,[33] 2014	53.6	261/5764	++++	0.76 (0.68-0.86)	34.7
All		2367/16220		0.80 (0.75-0.86)	100.0
Subtotal ($Q=10.0$, $df=4$, $P=.04$; $I^2=59.9\%$)					



Yao et al JAMA Netw Open 2019; 2: e1917789.

U-Shaped Association Between Serum 25-Hydroxyvitamin D and Fracture Risk in Older Men: Results From the Prospective Population-Based CHAMP Study



1’662 Men,
70-97 Yrs
4.3 Yrs

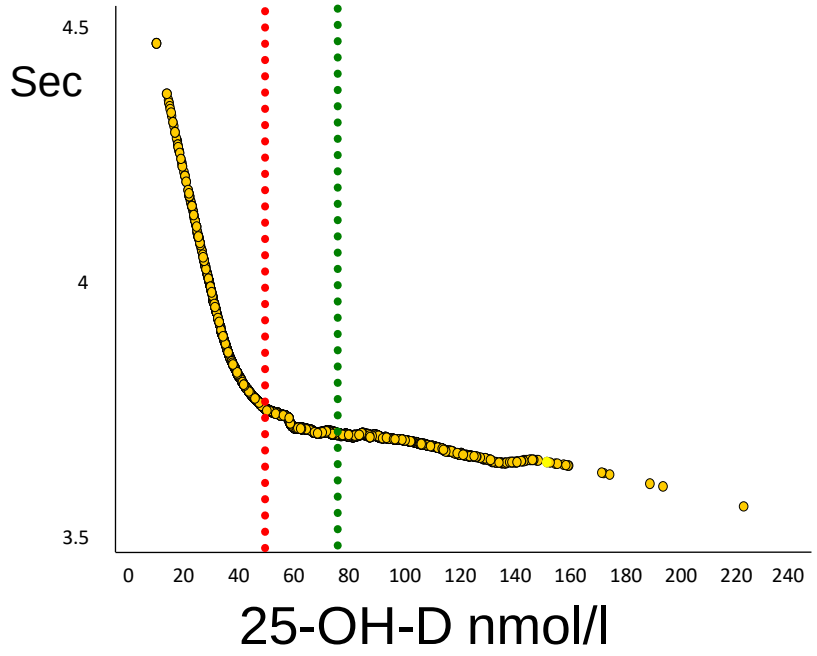
nmol/l

Bleicher et al JBMR 2014

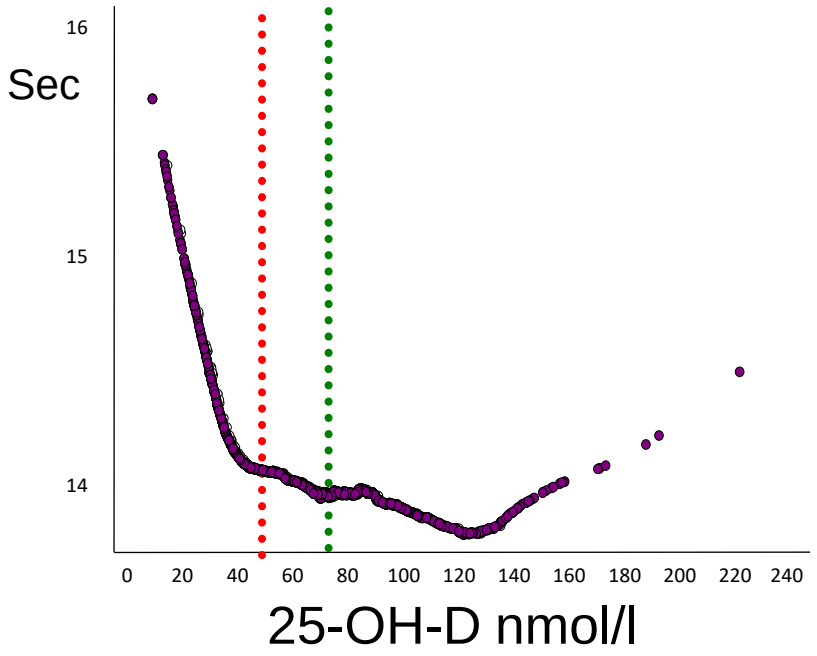
Dose-response for 25-OH-D and function

NHANES III: n = 4100 community –dwelling older individuals age 60+

8-Foot walk



Repeated sit-to-stand



Effect was similar between more or less active individuals, men or women, calcium intake

Bischoff-Ferrari HA, et al. Am J Clin Nutr. 2004;80:752–758.

Nutritional Status and Nutritional Treatment Are Related to Outcomes and Mortality in Older Adults with Hip Fracture

Table 1. Prevalence of malnutrition or risk of malnutrition and nutritional screening tool used in the included studies.

Reference	Total *n*	WN *n*	RMN *n*	MN *n*	Cut-Off for Malnutrition
[21]	17,651	9549	-	8102	Albumin < 3.5 g/dL
[22]	173	49	-	57	BMI < 22 kg/m^2
[23]	23	9	7	7	BMI †
[20]	96	59	-	37	BMI < 18.5 kg/m^2
[24]	60	34	-	26	Weight loss ≥ 5% 1 m, or ≥ 10% 6 m, and/or albumin < 2.7 g/dL
[14]	25	11	11	3	Hospital's own screening tool §
Total of subjects	18,028	9711	18	8232	
Percentage		53.9%		45.7%	

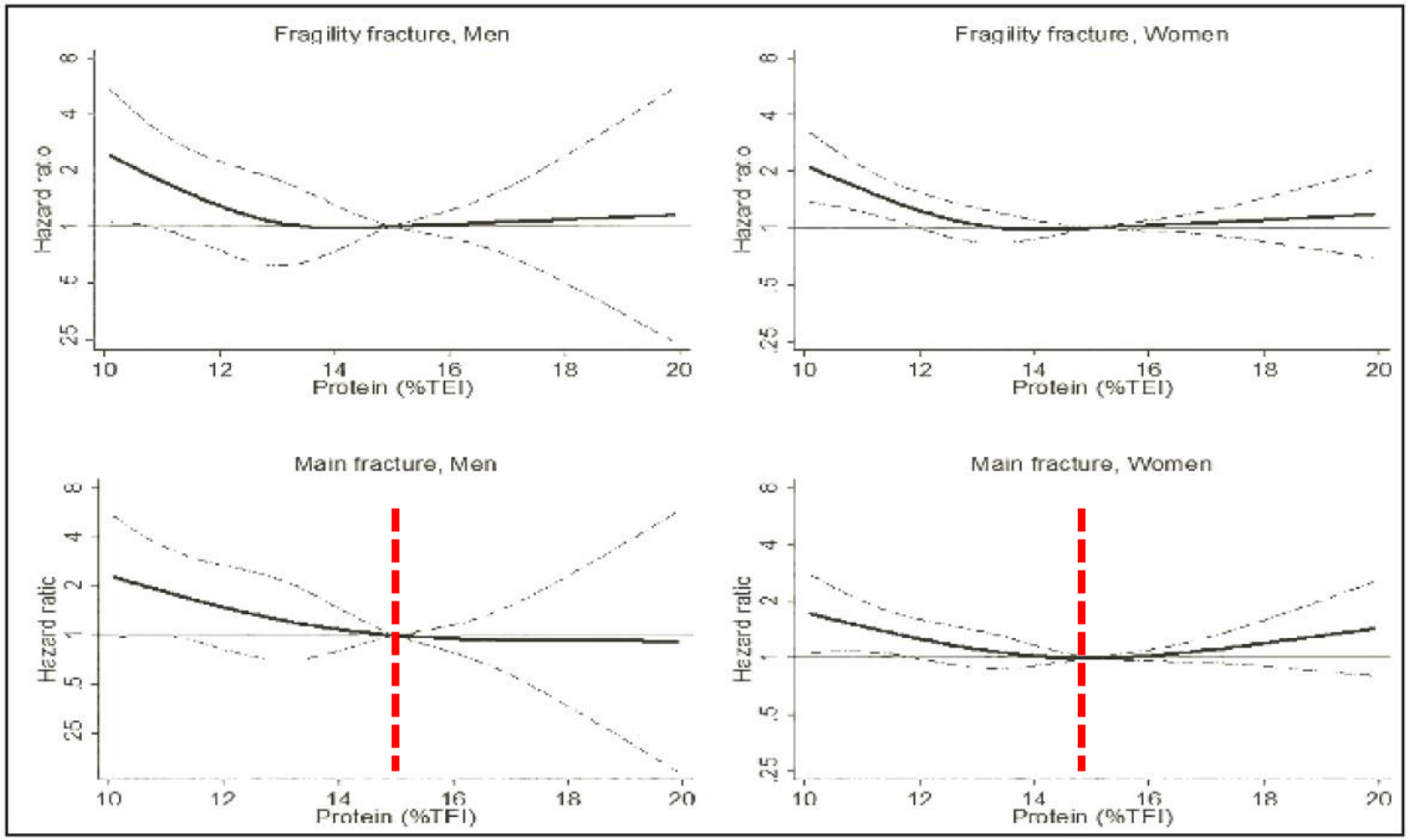
Reference	Total *n*	WN *n*	RMN *n*	MN *n*	Cut-Off for Malnutrition
[15]	49	18	23	8	MNA ‡
[19]	80	38	35	7	MNA
[25]	127	89	36	2	MNA
[17]	50	32	18	0	MNA
[26]	50	7	29	14	MNA
[27]	97	44	37	16	MNA
[28]	162	59	-	103	MNA
[29]	152	87	-	65	MNA
[18]	215	95	95	25	MNA-SF ¥
[30]	204	55	98	51	MNA-SF
[31]	594	316	236	42	MNA-SF
[32]	415	152	185	78	MNA-SF
Total of subjects	2195	992	774	411	
Percentage		45.2%	35.3%	18.7%	

Malafarina et al Nutrients 2018

Association between Protein Intakes and Fracture Risk

Men

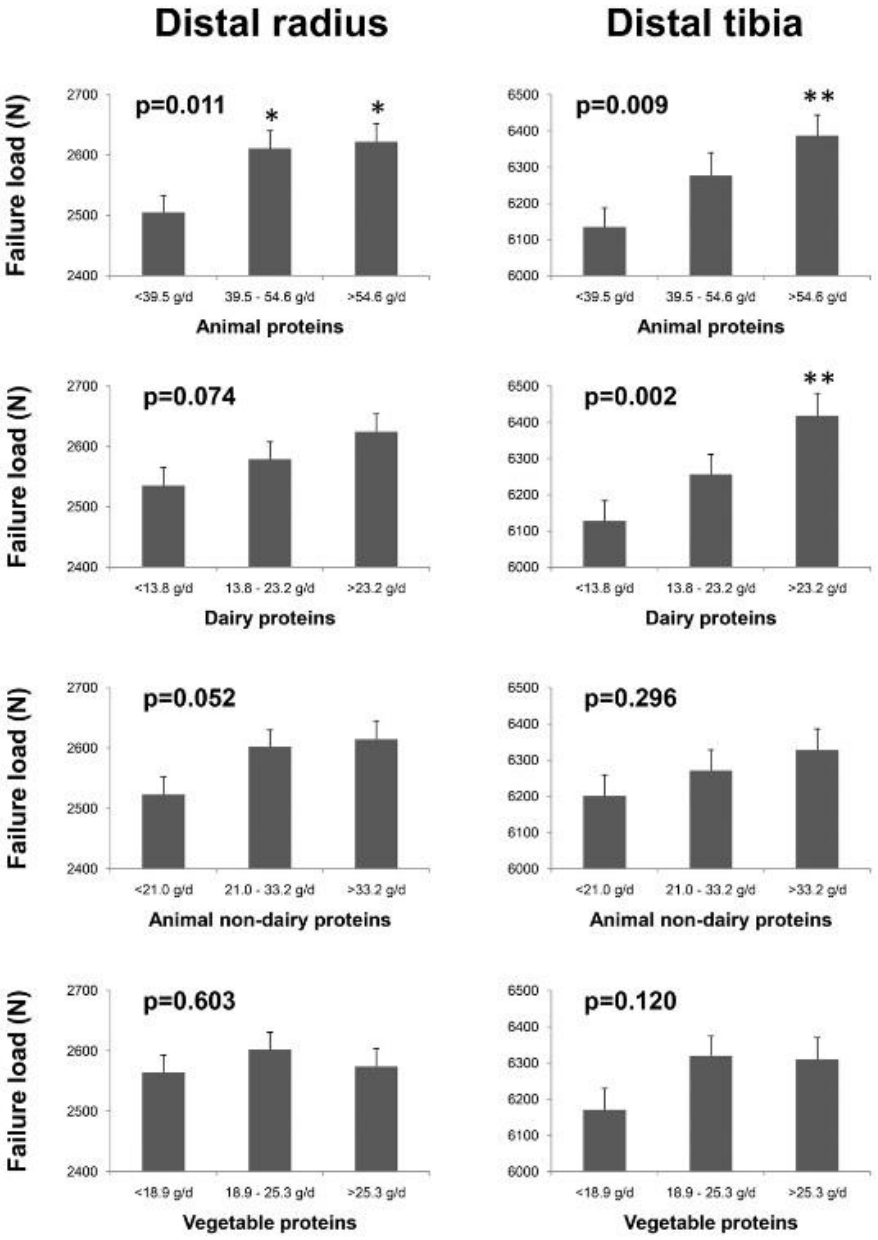
Women



15% of Total Energy Intakes
-> 0.9 g/kg BW if 1'600 Kcal

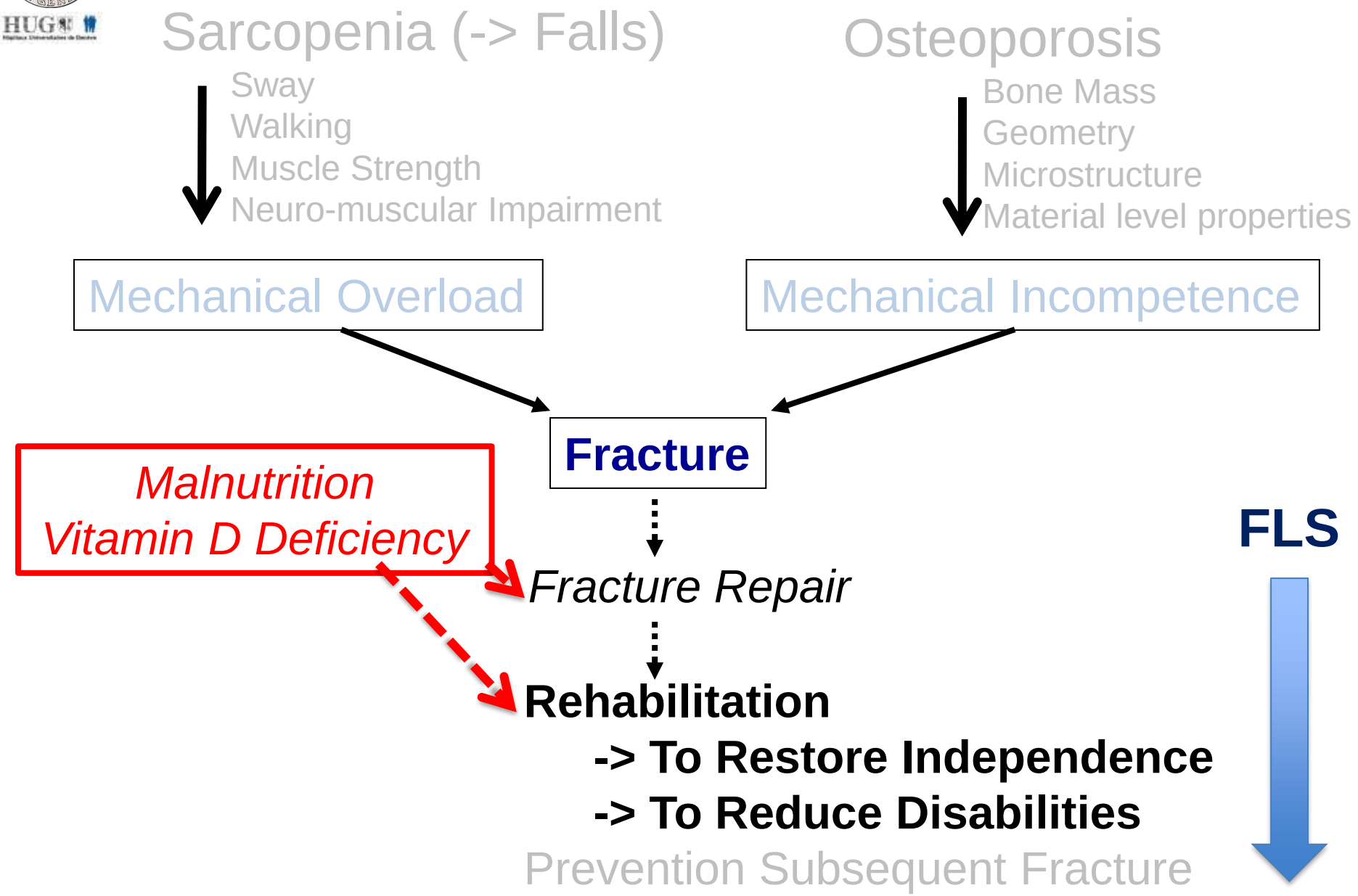
Langsetmo et al J Nutr Health Aging 2015

Peripheral skeleton bone strength is positively correlated with total and dairy protein intakes in healthy postmenopausal women[1,2]



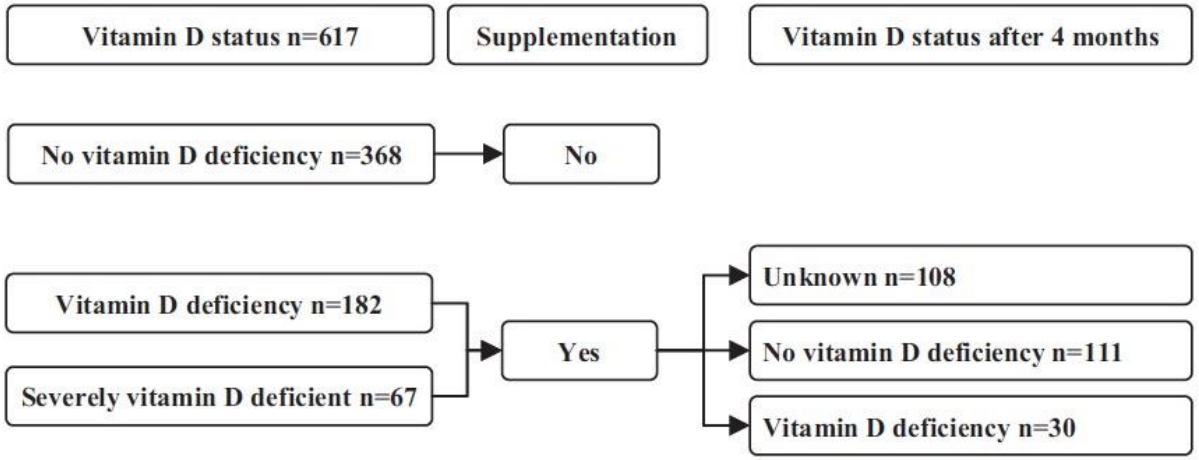
Durosier-Izart et al
AJCN 2017

Pathogenesis of Osteoporotic Fracture



Adapted from Rizzoli, Best Pract Res Clin Endocrinol Metab 2014

Vitamin D status and adult fracture healing



Vitamin D
1'200 IU/day

Incidence of clinical and radiological delayed union in patients with extremity fractures, by vitamin D status.

Delayed union[a]	Initially not vitamin D deficient	Initially vitamin D deficient status after supplementation		
		Not vitamin D deficient	Still vitamin D deficient	p^b
Clinical	1/382 (0.3%)	2/117 (1.7%)	3/30 (9.7%)	<0.001
Radiological	20/42 (48%)	11/21 (52%)	4/6 (67%)	0.67

Gorter et al J Clin Orthop & Trauma 2017

Vitamin D deficiency is associated with reduced mobility after hip fracture surgery: a prospective study

TABLE 2 Association between preoperative vitamin D status and outcomes after hip fracture surgery[1]

< 30 nmol/l

	Vitamin D concentration				
	<12 ng/mL	12 to <20 ng/mL	20 to <30 ng/mL	≥30 ng/mL	*P* overall
Ability to walk					
30 d, % who walk	35	56	64	58	
Unadjusted OR (95% CI)	—	2.30 (1.03, 5.17)	3.24 (1.45, 7.26)	2.57 (1.04, 6.36)	0.040
Adjusted OR (95% CI)	—	2.61 (1.13, 5.99)	3.48 (1.53, 7.95)	2.84 (1.12, 7.20)	0.031
60 d, % who walk	51	67	74	73	
Unadjusted OR (95% CI)	—	1.89 (0.86, 4.15)	2.70 (1.22, 5.95)	2.62 (1.05, 6.55)	0.079
Adjusted OR (95% CI)	—	2.67 (1.14, 6.25)	3.42 (1.46, 8.00)	3.67 (1.37, 9.82)	0.028

50–75 nmol/l

TABLE 1 Baseline characteristics of patients[1]

	Values
Age, y	82 ± 7 (65–102)
Female sex, %	73
Caucasian race, %	93
BMI, kg/m^2	24.5 ± 4.7 (12.9–50.8)
<18.5 (underweight), %	6
18.5 to <25.0 (normal weight), %	54
25.0 to <30.0 (overweight), %	30
≥30 (obese), %	10
25-Hydroxyvitamin D, ng/mL	22.0 ± 9.6 (2.9–57.4)
<12, %	12
12 to <20, %	34
20 to <30, %	37
≥ 30, %	17
Intact parathyroid hormone, pg/mL	55.1 ± 44.3 (4.4–326.5)
≤65 (normal), %	74
>65 (high), %	26
Albumin, g/dL	3.7 ± 0.5 (2.2–5.1)
Geriatric Nutritional Risk Index	95.1 ± 7.7 (67.5–117.5)
<92 (major/moderate risk), %	34
92 to ≤98 (some risk), %	33
>98 (no risk), %	33

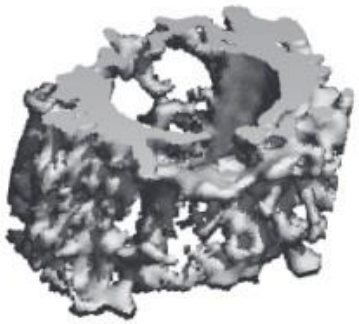
46% ≤ 50 nmol/l

67% -> Risk of Malnutrition

Hao et al AJCN 2020

Low Protein Intake Is Associated With Impaired Titanium Implant Osseointegration

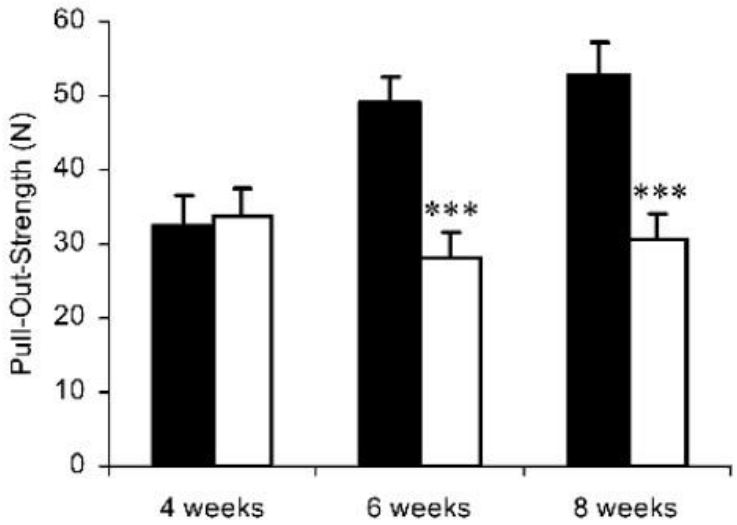
Normal protein Control



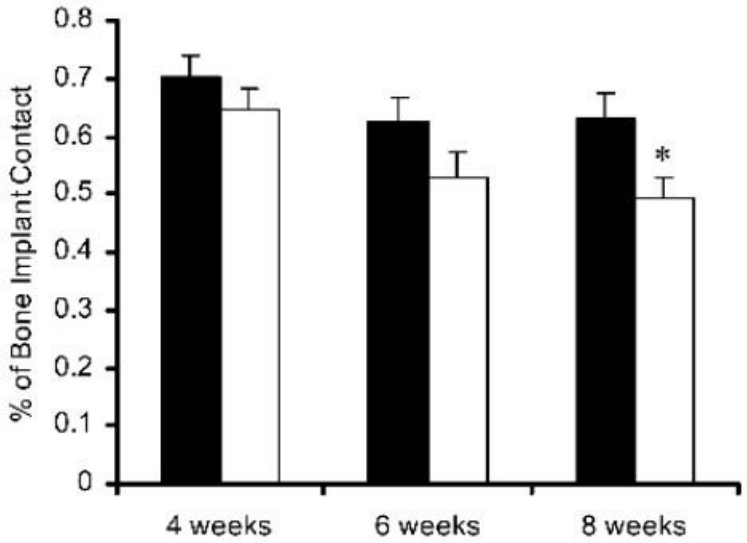
BV/TV: 0.1830
BIC: 0.485

Low protein Control

BV/TV: 0.1228
BIC: 0.370



Strength

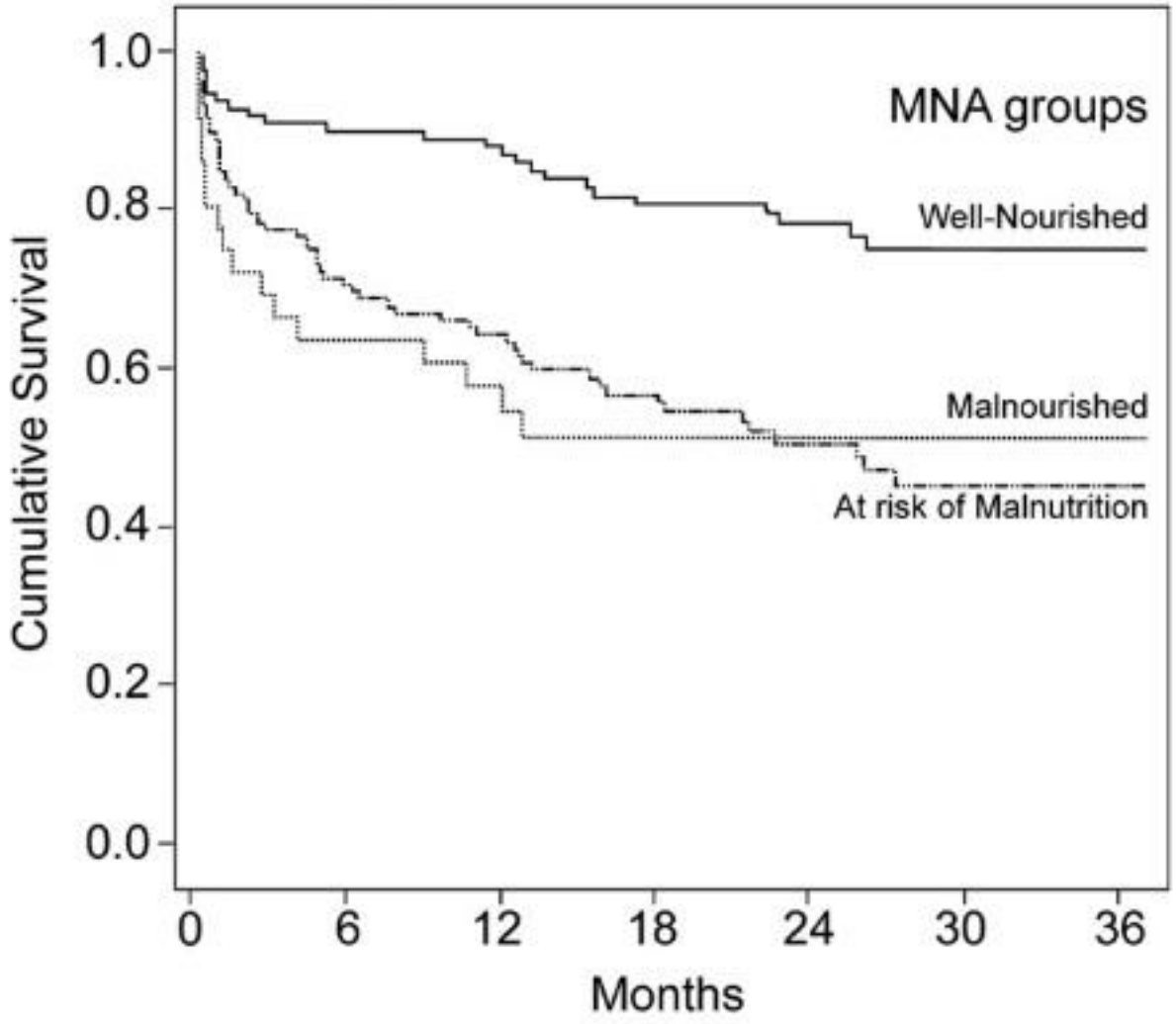


Contact

Dayer et al JBMR 2006

The relationship between nutritional status of hip fracture operated elderly patients and their functioning, comorbidity and outcome

Long-term mortality

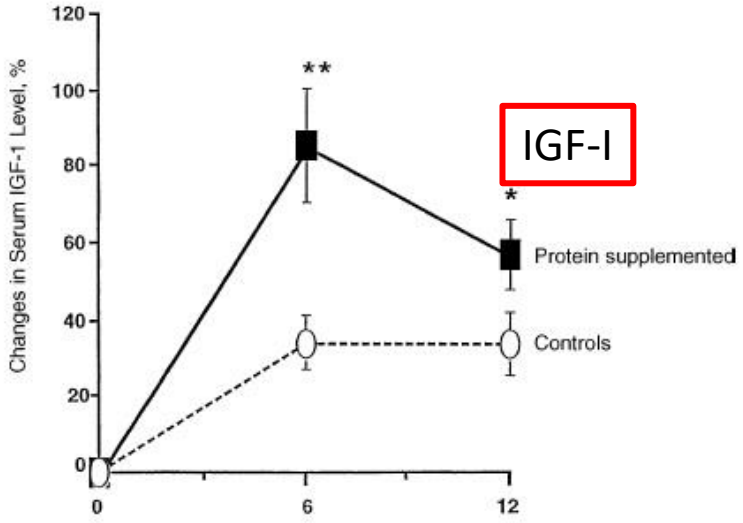


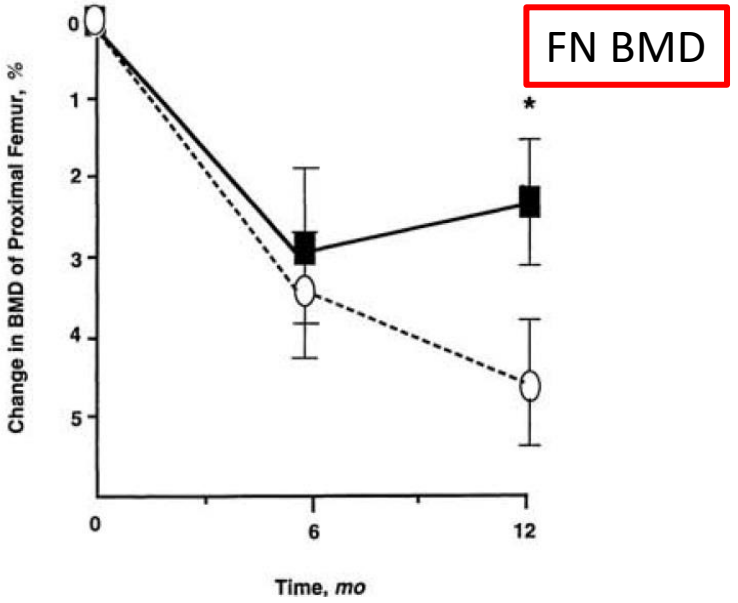
Koren-Hakim et al Clin Nutr 2012

Protein supplements increase serum insulin-like growth factor-I levels and attenuate proximal femur bone loss in patients with recent hip fracture. A randomized, double-blind, placebo-controlled trial.

Changes (% baseline value)	*Placebo*	*Protein supplementation (1)*	P
Prealbumin	+ 56 ± 9	+ 86 ± 14	0.07
IGF-I	+ 34 ± 7	+ 86 ± 15	0.01
IgM	+ 40 ± 6	+ 66 ± 9	0.02
Proximal femur (BMD)	–4.7± 0.8	–2.3 ± 0.7	0.03
Rehabilitation department stay: median length (days)	54	33	0.02

(1) Protein supplementation was with 20 g of protein per day. Both protein supplementation and the placebo supplied 550 mg of calcium per day. Each subject recieved 200,000 IU vitamin D at study initiation.





Median LoS: - 33%

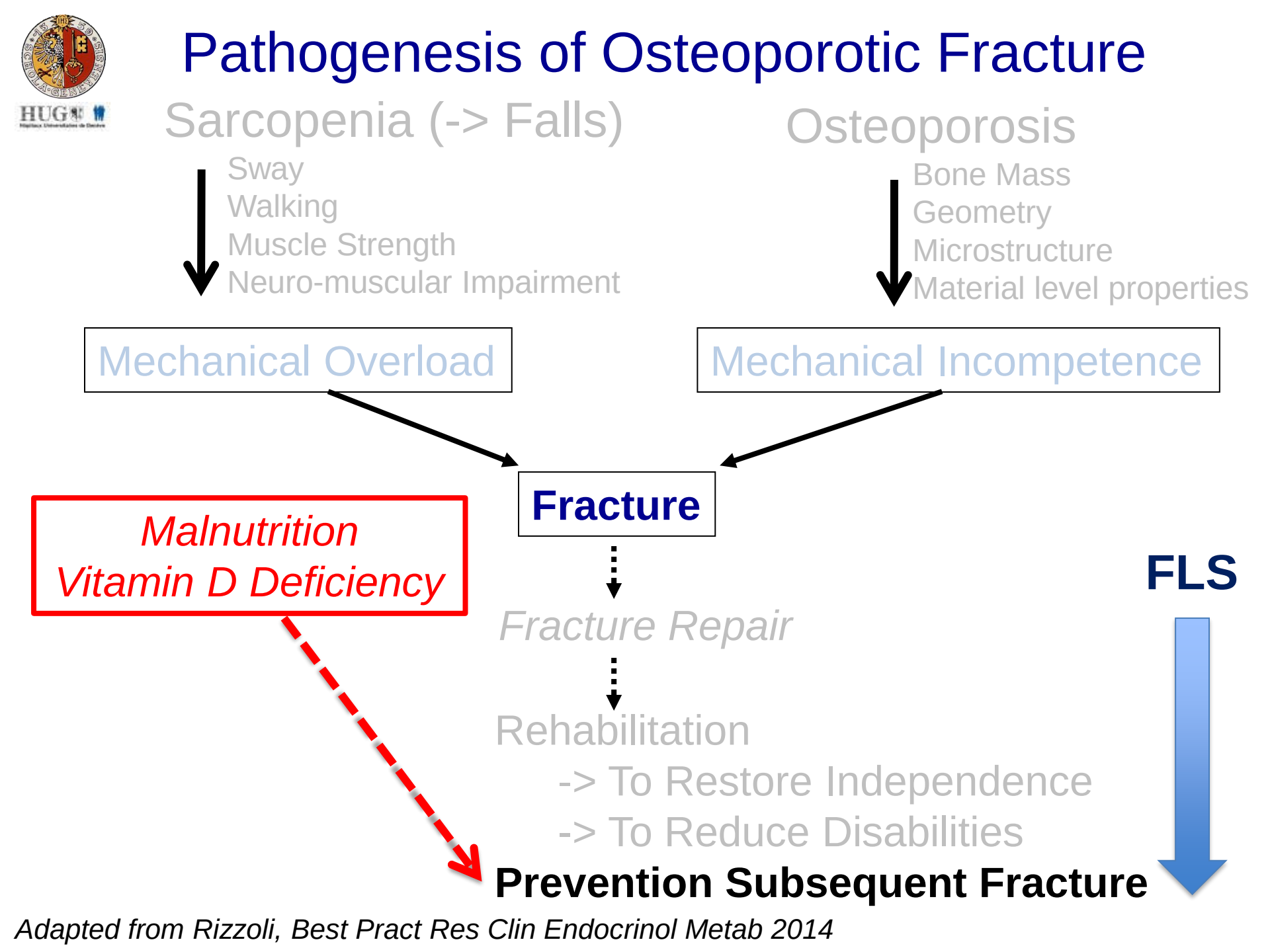
Schurch et al Ann Int Med 1998

Nutritional supplementation for hip fracture aftercare in older people (Review)

Outcome	Trials (n)	Relative Risk with Oral Nutritional Supplements	95 % CI
Mortality (1-12 months follow-up)	15	0.81	0.49-1.31
Complications (pressure sore, infections)	11	**0.71**	0.59-0.86
Unfavourable outcome (deaths & complications)	6	**0.67**	0.51-0.89
GI side effects	6	0.99	0.47-2.05

Avenell et al Cochrane Database of Systematic Reviews 2016

Pathogenesis of Osteoporotic Fracture



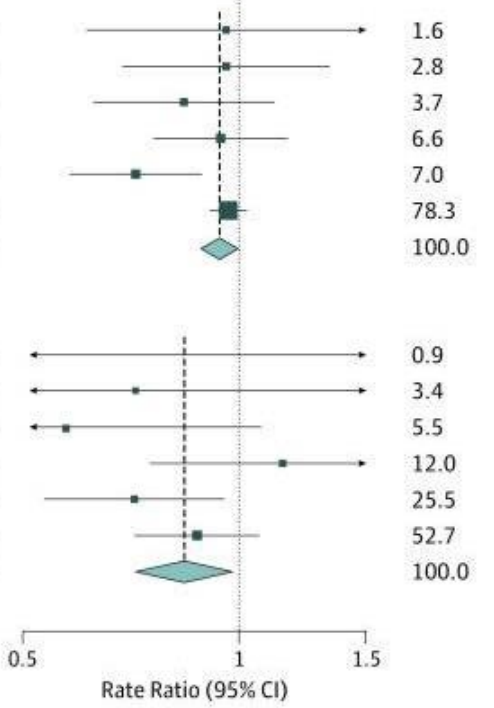
Adapted from Rizzoli, Best Pract Res Clin Endocrinol Metab 2014

Vitamin D and Calcium for the Prevention of Fracture

A Systematic Review and Meta-analysis

Meta-analysis of **Randomized Clinical Trials** of Supplementation **With Calcium Plus Vitamin D** vs Placebo or No Treatment for Prevention of Any Fracture or of Hip Fracture

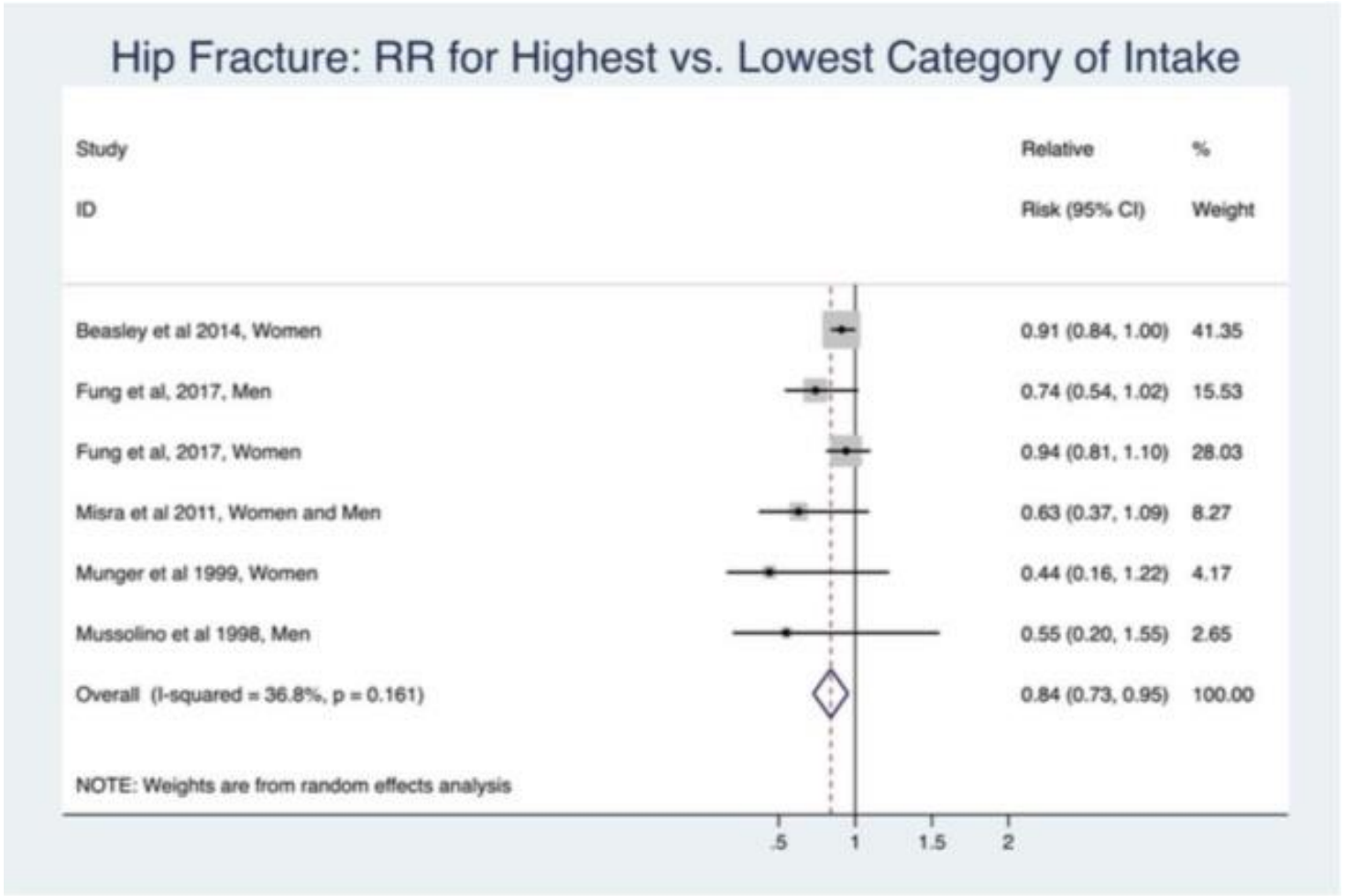
Source	Calcium + Vitamin D: Calcium, mg/d	Calcium + Vitamin D: Vitamin D, IU/d	Calcium + Vitamin D: Events, No./ Total Participants, No.	Control: Events, No./ Total Participants, No.	Risk of Bias	Rate Ratio (95% CI)	Weight, %
Any fracture							
Chapuy et al,[50] 2002	1200	800	70/393	35/190	High	0.96 (0.61-1.51)	1.6
Porthouse et al,[51] 2005	1000	800	58/1321	91/1993	High	0.96 (0.69-1.34)	2.8
Salovaara et al,[52] 2010	1000	800	86/1586	103/1609	High	0.84 (0.63-1.13)	3.7
Grant et al,[47] 2005	1000	800	179/1306	192/1332	High	0.94 (0.76-1.17)	6.6
Chapuy et al,[53] 1992	1200	800	160/1634	215/1636	High	0.72 (0.58-0.89)	7.0
Jackson et al,[54] 2006	1000	400	2102/18176	2158/18106	Low	0.97 (0.91-1.03)	78.3
All			2655/24416	2794/24866		0.94 (0.89-0.99)	100.0
Subtotal ($Q = 7.3$, $df = 5$, $P = .20$; $I^2 = 31.4\%$)							
Hip fracture							
Salovaara et al,[52] 2010	1000	800	4/1586	2/1609	High	1.98 (0.40-9.81)	0.9
Porthouse et al,[51] 2005	1000	800	8/1321	17/1993	High	0.72 (0.32-1.61)	3.4
Chapuy et al,[50] 2002	1200	800	27/393	21/190	High	0.58 (0.31-1.08)	5.5
Grant et al,[47] 2005	1000	800	46/1306	41/1332	High	1.15 (0.75-1.76)	12.0
Chapuy et al,[53] 1992	1200	800	80/1634	110/1636	High	0.72 (0.53-0.96)	25.5
Jackson et al,[54] 2006	1000	400	175/18176	199/18106	Low	0.87 (0.71-1.07)	52.7
All			340/24416	390/24866		0.84 (0.72-0.97)	100.0
Subtotal ($Q = 6.0$, $df = 5$, $P = .31$; $I^2 = 16.5\%$)							



Yao et al JAMA Netw Open 2019; 2: e1917789.

Dietary Protein Intake above the Current RDA and Bone Health: A Systematic Review and Meta-Analysis

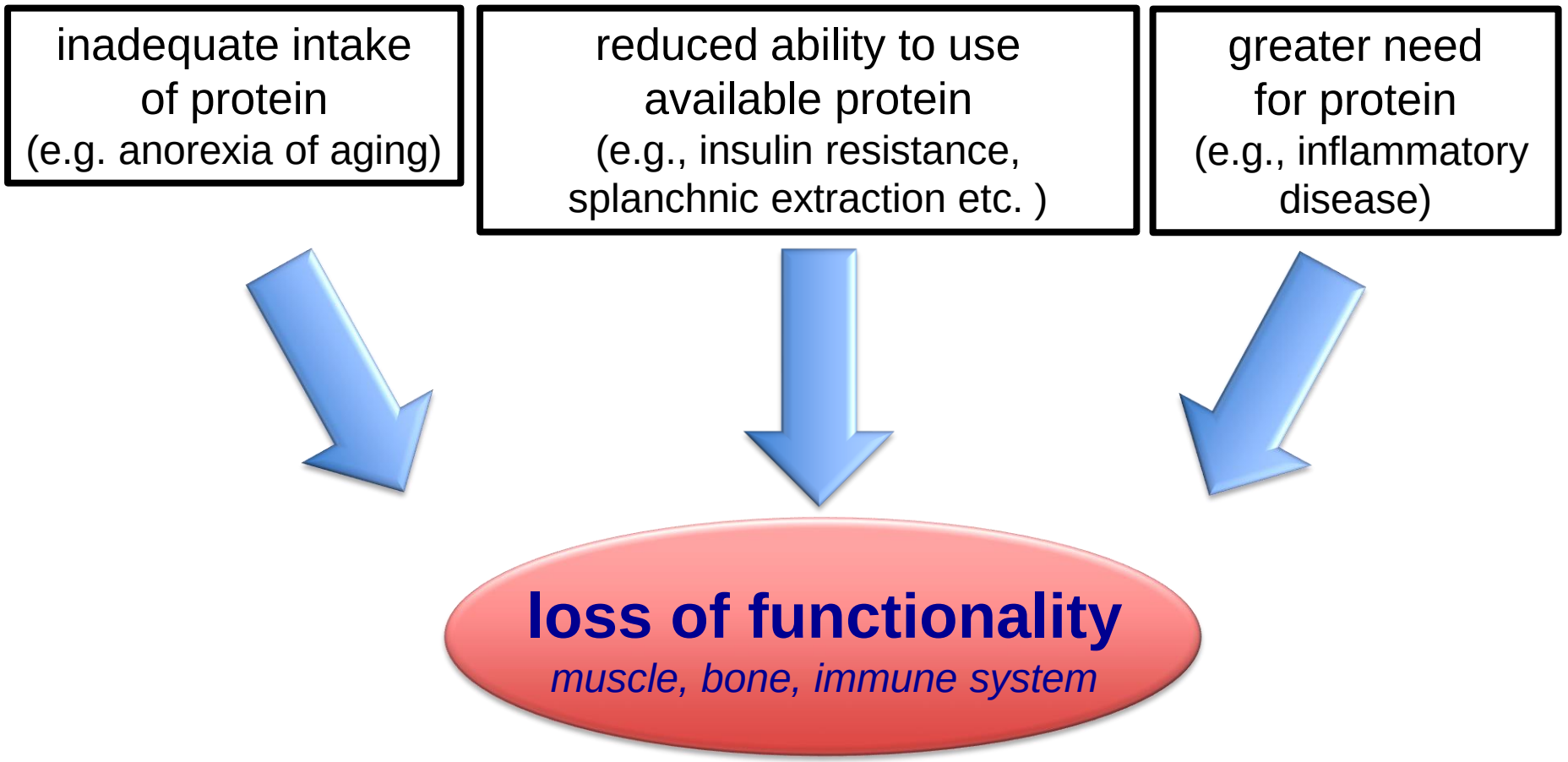
16 RCTs
13 Cohorts



- 16%

Wallace & Frankenfeld JACN 2017

Alterations of Protein Use in Older Persons



Recommended: 0.8 g/kg BW (RDA) -> 1.1 – 1.3 g/kg BW

Bauer et al JAMDA 2013

Osteoporosis Diagnosis and Management

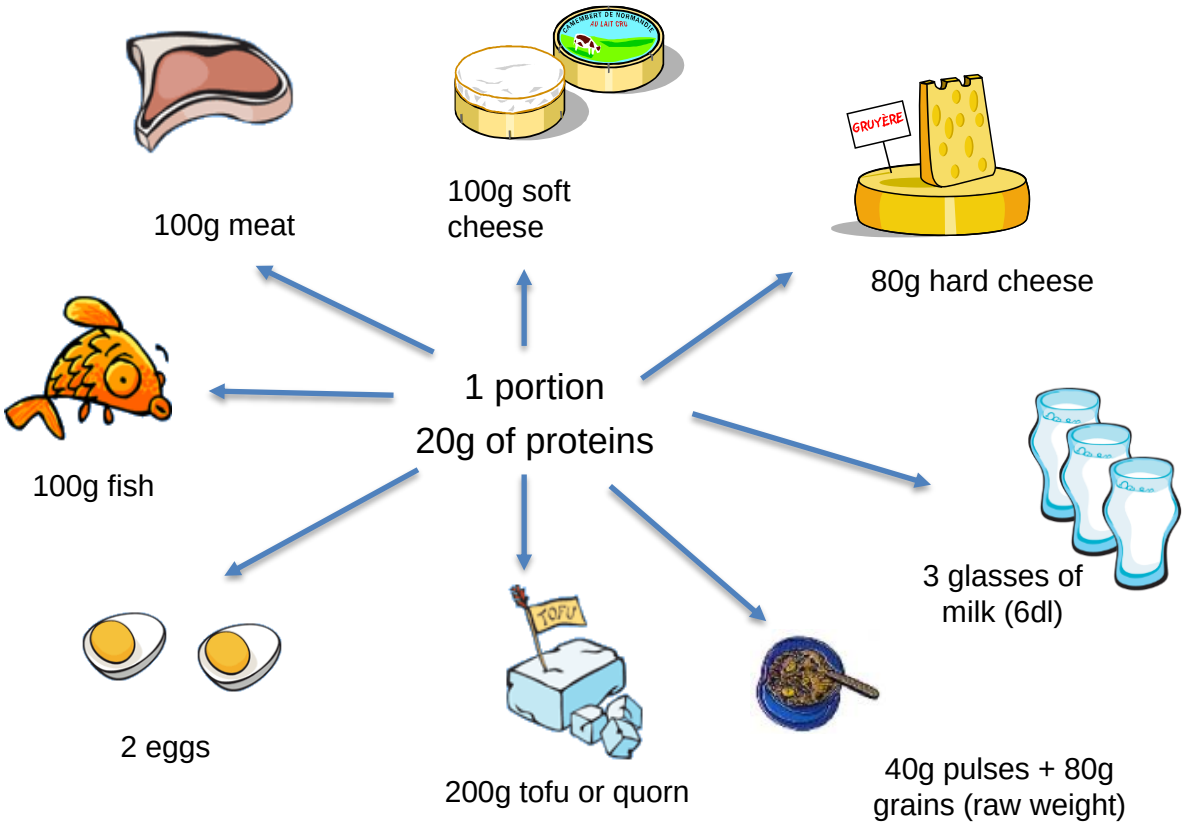
2019 European Guidance

Lifestyle

- Nutrition: calcium 800-1000 mg/day, protein ≥ 1g/kg BW/ day
- Vitamin D: 800 IU/day
- Daily weight-bearing physical activity
- Fall prevention measures

From Kanis, Cooper, Rizzoli, Reginster Osteoporos Int 2019, ACER 2019, CTI 2019

Protein equivalents



One fracture leads to another

- A prior fracture at any skeletal site doubles future fracture risk
- 2nd fracture often happens within 6-8 months


WORLD CONGRESS ON
OSTEOPOROSIS, OSTEOARTHRITIS
AND MUSCULOSKELETAL DISEASES
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IOF-ESCEO
2021 LONDON
August 26-29, 2021
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Speaker Introduction

Dr. Omar Alsaed M.D.

- Dr. Omar Alsaed is an Associate Rheumatology Consultant at the Rheumatology Division of the Hamad General Hospital, an operation of the Hamad Medical Corporation. Having graduated from Misr University for Science and Technology in Cairo, Egypt, Dr. Alsaed completed the Internal Medicine Residency Program and a Rheumatology Fellowship training at Hamad Medical Corporation.
- Dr. Alsaed is certified by the Internal Medicine Arab Board and is a member of the Royal College of Physicians in the UK.
- With a strong interest in research, he has initiated and received grants from the Medical Research Center of Hamad Medical Corporation for many research projects in the Rheumatology and Osteoporosis fields.
- Dr. Alsaed is also a team member of the Osteoporosis Task Force in Qatar.

Vitamin D status in Qatar

Omar Alsaed

Disclosure:

I have no conflict of interest related to the following presentation.

Outline

- Recommended vitamin D level across primary and secondary/tertiary centers.
- Vitamin D testing kit in primary and tertiary centers.
- Prevalence of Vit D deficiency and insufficiency in Qatar.

Vitamin D level cut off definitions in Qatar

The laboratory of primary and tertiary centers in Qatar are following the below definitions of vitamin D level:

- Vitamin D <20 ng/ml (50 nmol/L) is defined as **deficiency.**
- Vitamin D 20-30 ng/ml (50 -75 nmol/L) is defined as **insufficiency.**
- Vitamin D >30 ng/ml (>75 nmol/L) is defined as **sufficient.**

Vitamin D testing in Qatar

- There are two main labs that run 25-hydroxy vitamin D level in all primary health care centers and secondary and tertiary centers.
- Both labs are using Elisa technique (ROCH and Beckman kit).
- Our labs are accredited by College of American Pathologist and under regular quality control (3 time per year) by CAP.

Prevalence of Vit D deficiency and insufficiency in Qatar

pagepress

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Reviews and Meta-Analysis

Prevalence of vitamin D insufficiency in Qatar: a systematic review

Alaa Badawi,[1,2] Paul Arora,[2,3] Eman Sadoun,[4] Al-Anoud Al-Thani,[1] Mohamed H. Al Thani[1]

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- 8 studies were included in this metanalysis.
- Search was done from 1980 to 2012.
- Vitamin D insufficient/deficient was defined as subjects with Vit D less than 75 nmol (<30nmol/L).

Systematic review 1980-2012

Table 2. Average vitamin D serum levels and deficiency/insufficiency in the Qatari population at different age groups.

Age group Years*	n	Study	Study n	Average serum vitamin D levels (nmol/L)	Prevalence of vitamin D <75nmol/L (%)
<16	698	Bener *et al.*[42,43#]	170	46.2±23.0	85
		Bener *et al.*[37]	464	66.9±24.7	83
		Racinais *et al.*[39]	64	NS	100
		Weighted average[§]		(60.6-62.2)	(85.9-86.4)
				61.4±10.0	86.2±2.4
16-30	163	Hamilton *et al.*[40]	92	NS	100
		Shrief and Rizk[38]	71	NS	97
		Weighted average		^	93.9±5.3
					(93.5-94.3)
>30	838	Mahdy *et al.*[41]	340	29.2	97
		El-Menyar *et al.*[44]	498	35.9±27.5	91
		Weighted average		33.2±3.4	93.4±3.1
				(31.9-32.5)	(93.1-93.6)
Overall°	1699	Weighted overall average		45.3±14.3[$]	90.4±7.2**
				(44.6-46.0)	(90.1-90.8)

Open access Research

BMJ Open

Vitamin D status among adults (18–65 years old) attending primary healthcare centres in Qatar: a cross-sectional analysis of the Electronic Medical Records for the year 2017

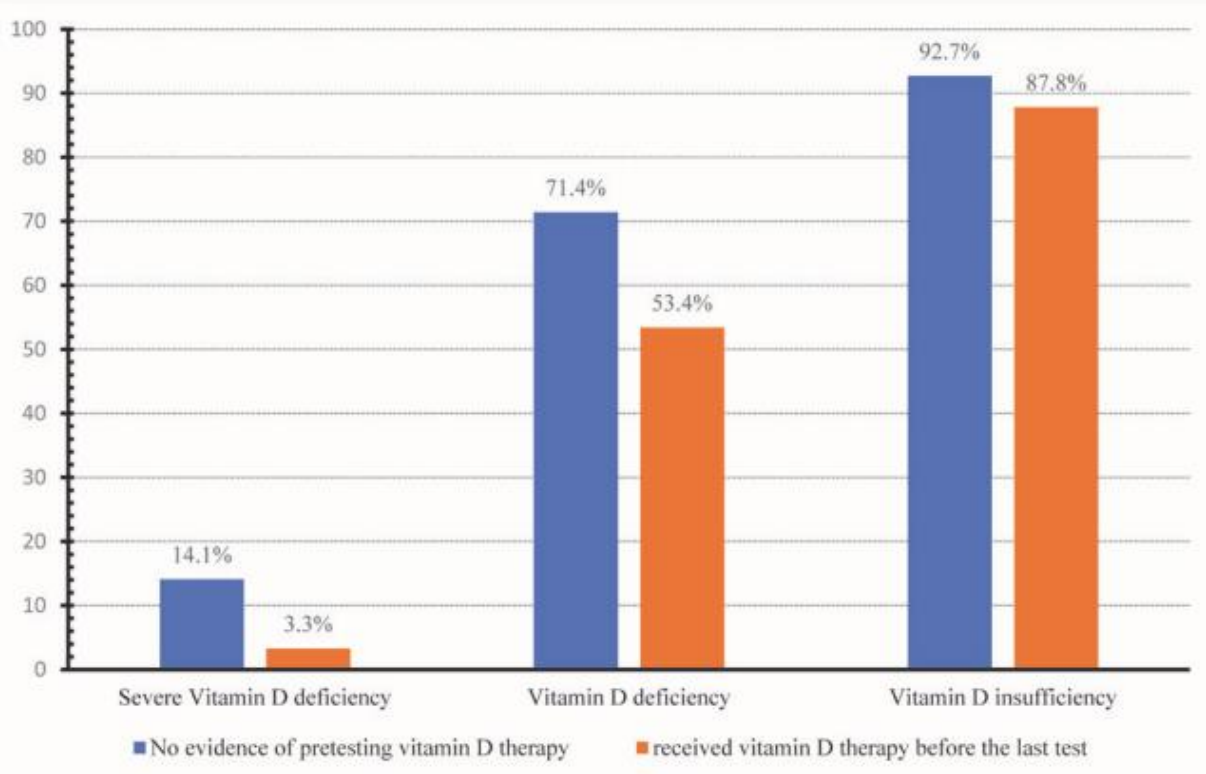
Abdul-Jaleel A Latif Zainel, Hamda Qotba, Ahmed Al Nuaimi, Mohamed Syed

- Include adult >18.
- 102,342 subjects were included in the analysis.
- Severe Vit D deficiency < 10 ng/ml.
- Vit D deficiency <20 ng/ml.
- Vit D insufficiency <30 ng/ml.

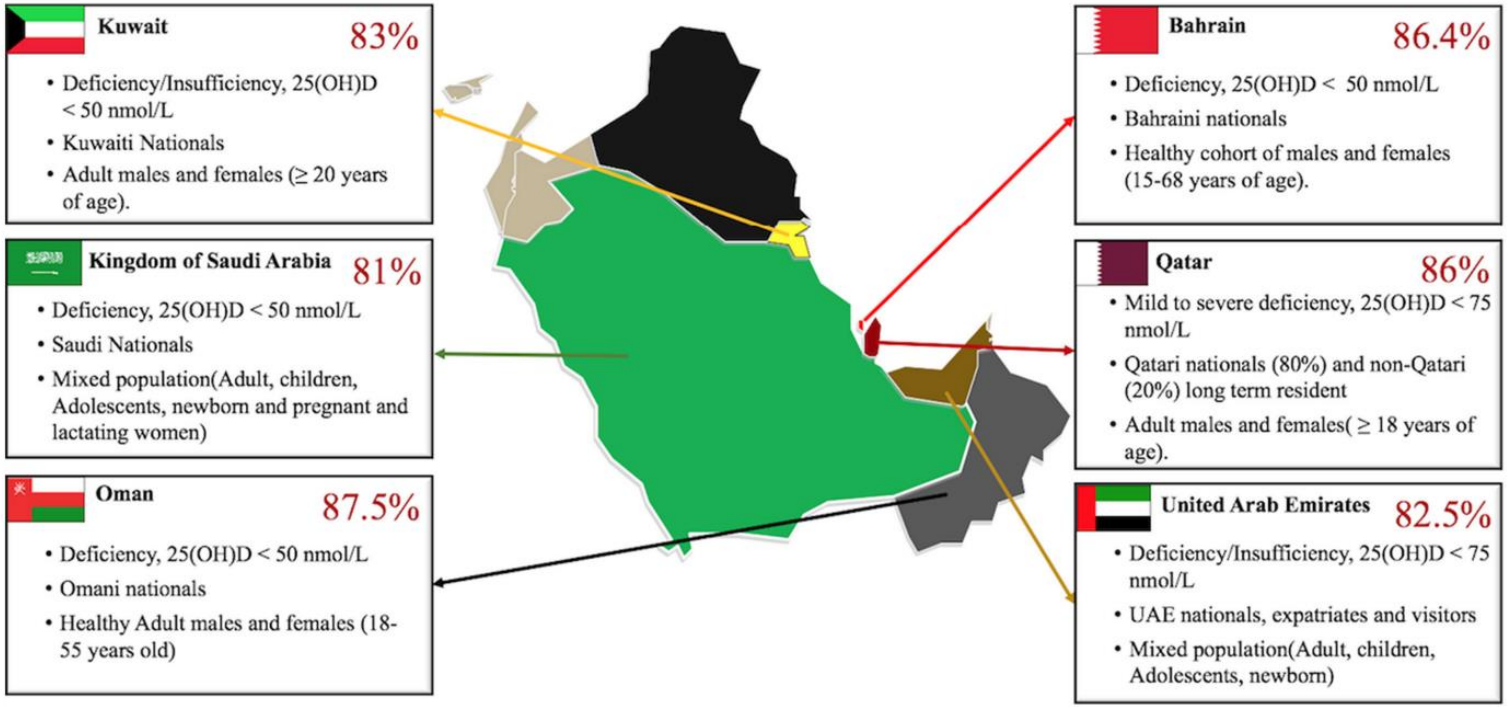
Cross-sectional study

Table 2 The prevalence of selected outcomes based on different serum vitamin D cut-off values for study participants with no evidence of vitamin D therapy before testing stratified by sociodemographic variables

	Total	Severe vitamin D deficiency		Vitamin D deficiency		Vitamin D insufficiency	
	N	N	%	N	%	N	%
Age group in years							
18–29	17 862	4712	26.4	14 610	81.8	17 036	95.4
30–39	22 788	2951	12.9	16 565	72.7	21 276	93.4
40–49	16 808	1536	9.1	11 482	68.3	15 522	92.3
50–65	13 234	775	5.9	7847	59.3	11 711	88.5
Gender							
Female	44 773	7459	16.7	32 649	72.9	41 328	92.3
Male	25 916	2514	9.7	17 852	68.9	24 214	93.4
Nationality							
Other nationalities	51 158	6277	12.3	36 344	71	47 905	93.6
Qatari	19 534	3697	18.9	14 160	72.5	17 640	90.3



Prevalence rate of vitamin D insufficiency, deficiency and severe deficiency among treated and untreated study participants



Vitamin D level status in the regional countries

Internal audit to test PTH suppression at different Vit D level intervals

- 54,828 sets of Vit D and PTH tests were processed from the same blood extraction from Jan 2017 till December 2019.
- Patients with chronic kidney disease, primary parathyroid diseases, metastatic bone malignancies, Vit D toxicosis and pregnant patients were excluded.

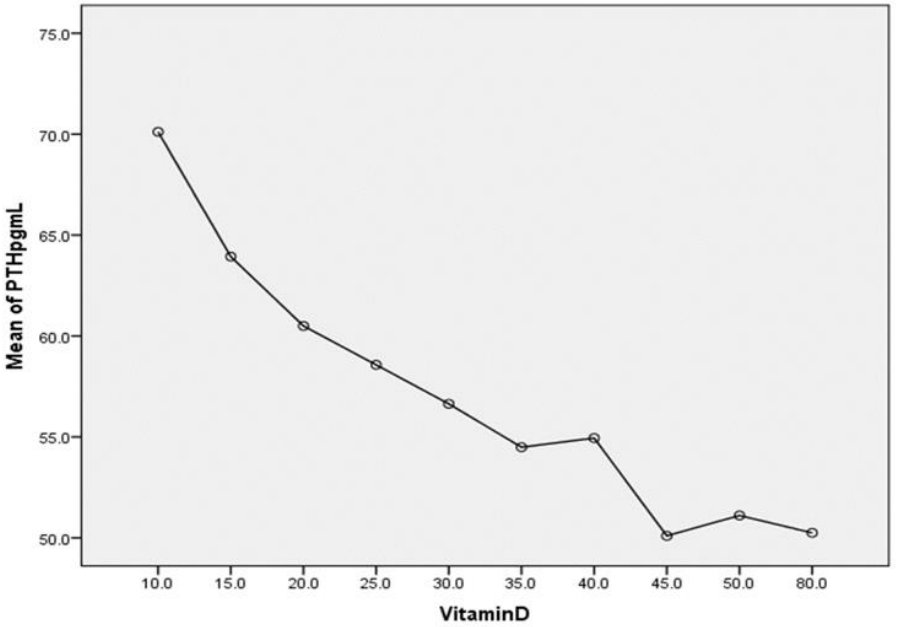
- 19,137 sets of Vit D and PTH tests were analyzed.

Internal audit to test PTH suppression with different Vit D level intervals

ANOVA analysis of different Vit D level intervals with corresponding p value and 95% CI

Vit D level intervals	P Value (Ref. Vit D > 50)	95% confidence interval	
<10	0.000	14.566	25.166
11 - 15	0.000	8.577	18.797
16 - 20	0.000	5.181	15.317
21 - 25	0.000	3.177	13.468
26 - 30	0.005	1.109	11.674
31 - 35	0.322	-1.335	9.817
36 - 40	0.263	-1.226	10.612
46 - 50	1.000	-6.662	8.381

Conclusion: The optimum PTH suppression is observed at Vit D of 30 ng/ml and above. PTH level will not be suppressed significantly more beyond Vit D level of 30 ng/ml



References

- AL-DABHANI, K., TSILIDIS, K. K., MURPHY, N., WARD, H. A., ELLIOTT, P., RIBOLI, E., GUNTER, M. & TZOULAKI, I. 2017. Prevalence of vitamin D deficiency and association with metabolic syndrome in a Qatari population. *Nutr Diabetes,* 7**,** e263.
- BADAWI, A., ARORA, P., SADOUN, E., AL-THANI, A. A. & THANI, M. H. 2012. Prevalence of vitamin d insufficiency in qatar: a systematic review. *J Public Health Res,* 1**,** 229-35.
- ZAINEL, A. A. L., QOTBA, H., AL NUAIMI, A. & SYED, M. 2019. Vitamin D status among adults (18-65 years old) attending primary healthcare centres in Qatar: a cross-sectional analysis of the Electronic Medical Records for the year 2017. *BMJ Open,* 9**,** e029334.

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Q & A

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