

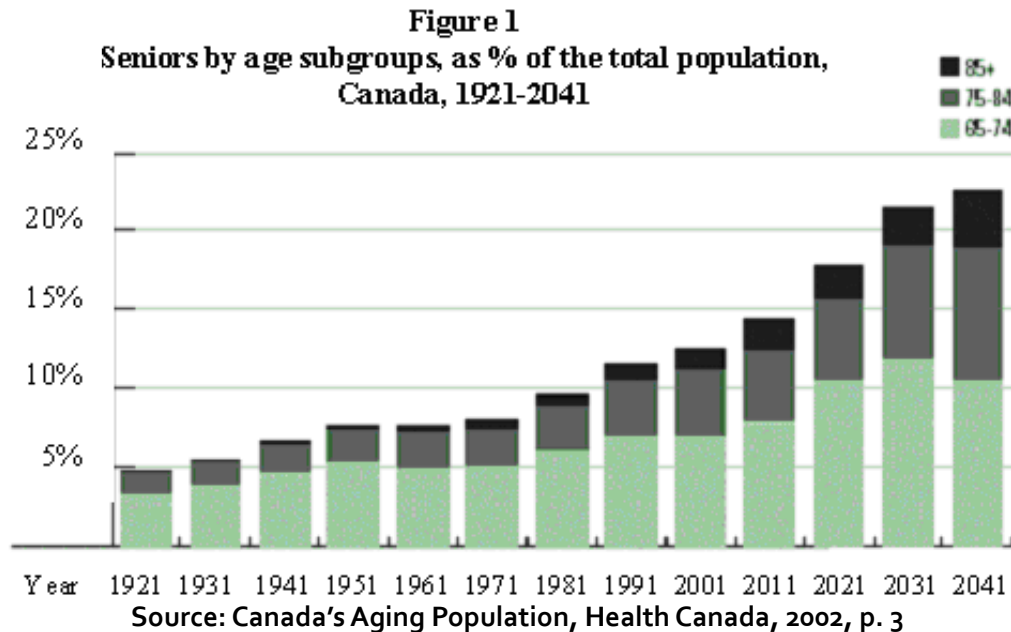
CFDR Semi Annual Research Showcase – May 1st, 2014

Foods specially fortified with vitamin D preserve winter-time status and BMD in elderly men

Isabelle Germain PhD(c) MSc RD, Catherine Vanstone MSc RN, Tom Hazell, Michelle Lee, Christina Bianchini RD, Sherry Agellon, Hope Weiler PhD RD (CDO)

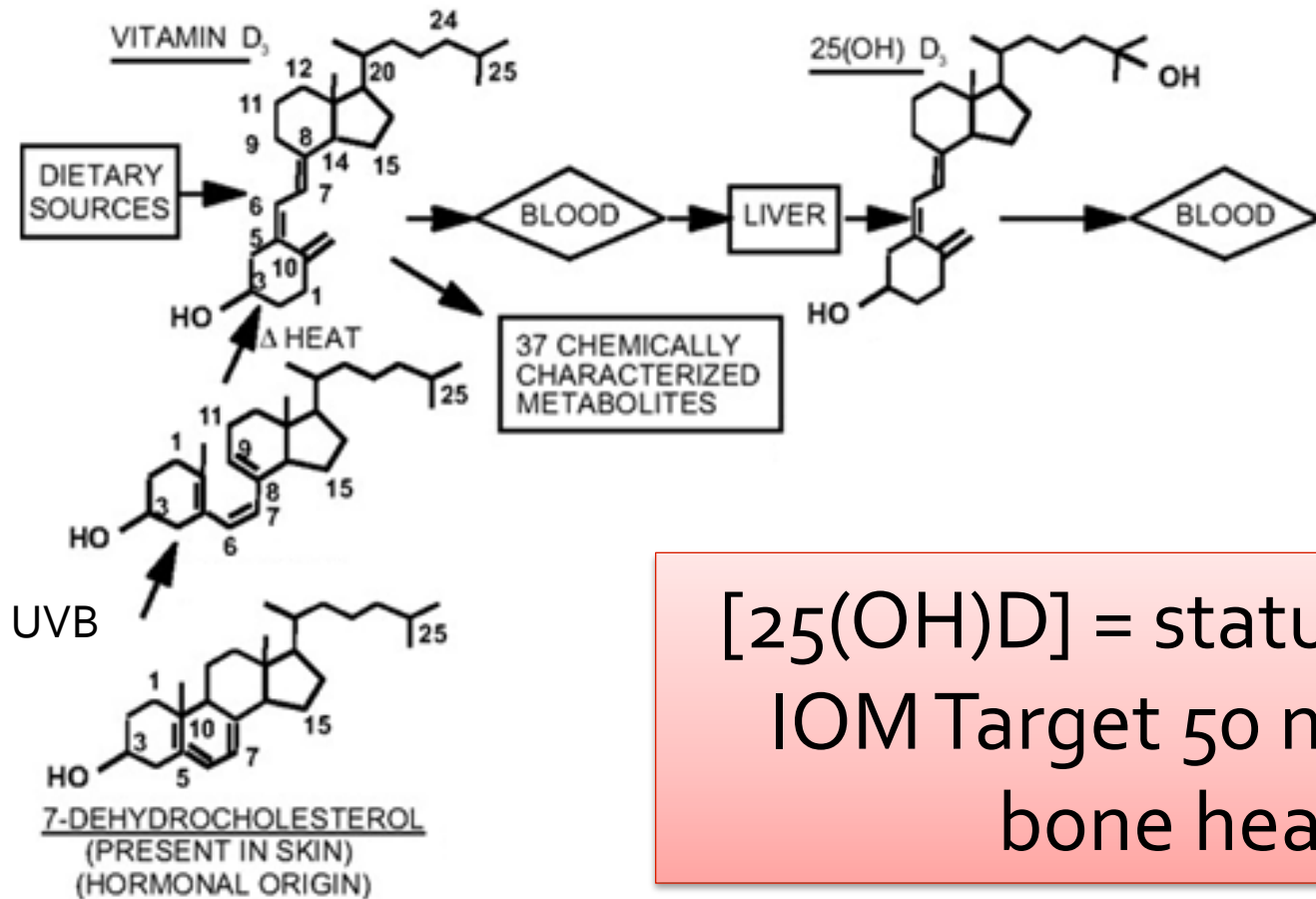


Aging Canadian Population



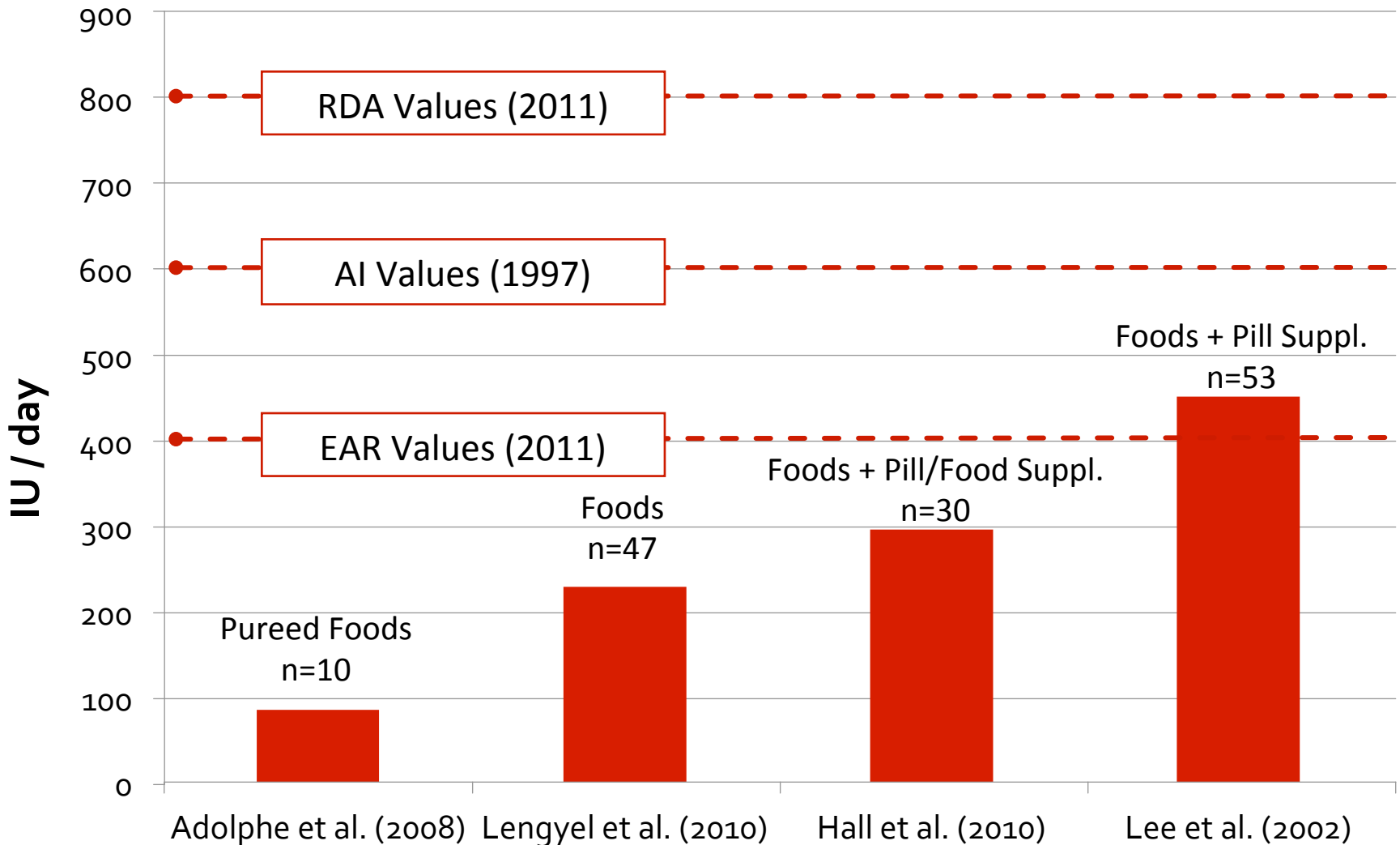
- ◆ The 2006 Census revealed that 4.3 million Canadians were > 65 y
- ◆ Almost 7% lived in health care and related facilities
- ◆ Bone health is an important driver of functional capacity
- ◆ Fractures ↓ mobility and ↑ institutionalization
- ◆ Key element: Vitamin D

Sources of vitamin D



Modified from Norman, A. W
Am J Clin Nutr 2008;88:1455-1456

Vitamin D Intake in Long-Term Care



RDA = Recommended Dietary Allowance (97-98%) **EAR** = Estimated Average Requirement (50%) **AI** = Adequate Intake

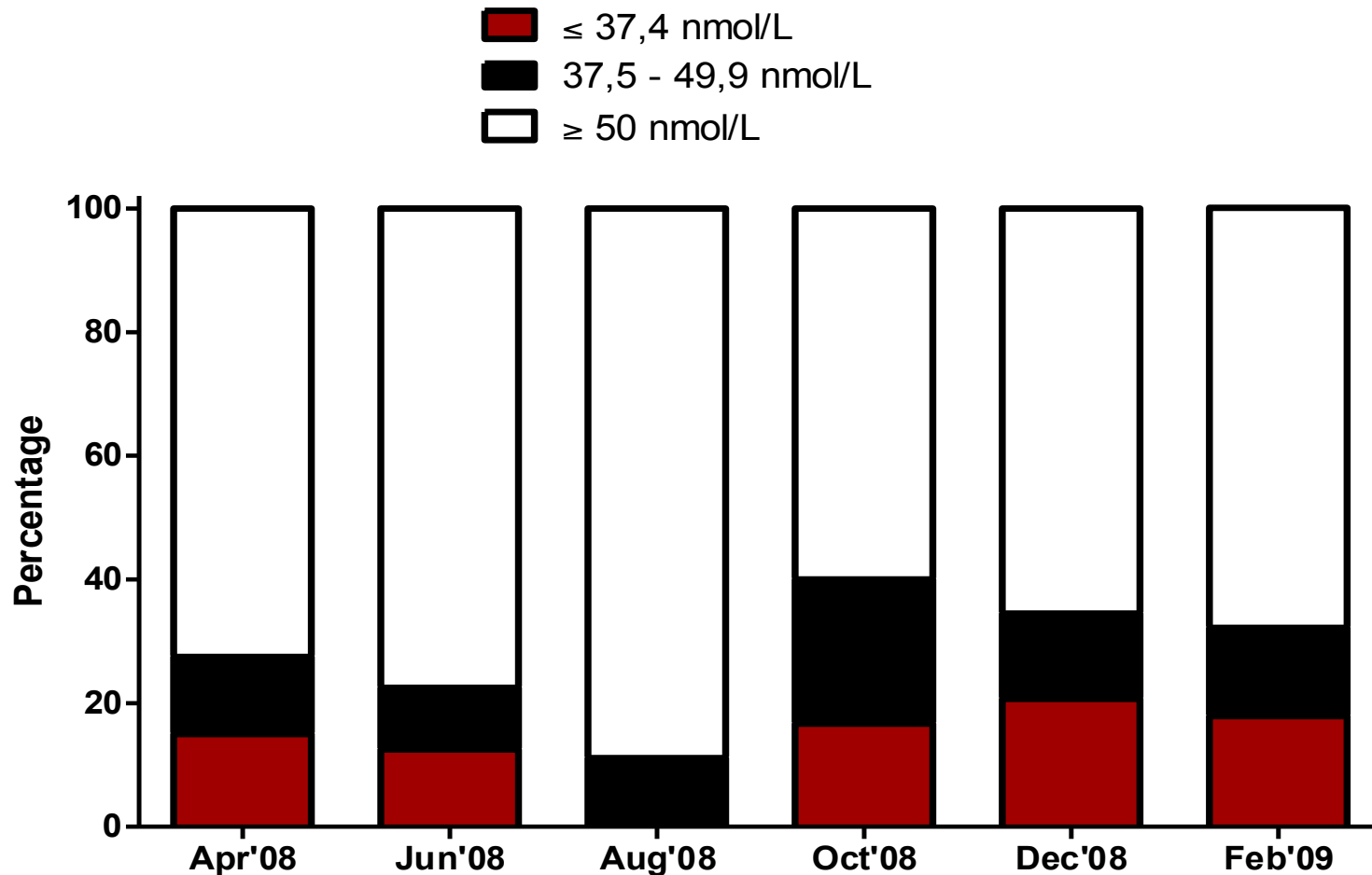
Vitamin D Intake and Status of Elderly in Ste-Anne's Hospital

	Phase I (n=40) Spring - Summer	Phase II (n=30) Fall - Winter
	Average \pm SD	Average \pm SD
Age (y)	85.2 \pm 3.3	84.9 \pm 3.6
Weight (kg)	76.0 \pm 12.7	74.7 \pm 13.2
BMI (kg/m ²)	26.1 \pm 4.1	26.0 \pm 4.3
MMSE (score/30)	23 \pm 7	24 \pm 3
Nb medications – (Including Vitamin Tablets)	11 \pm 5	11 \pm 5

- Sun exposure was minimal for the majority of participants
- 33% participants received vitamin D supplements in tablet form
- 16 week follow-up each phase

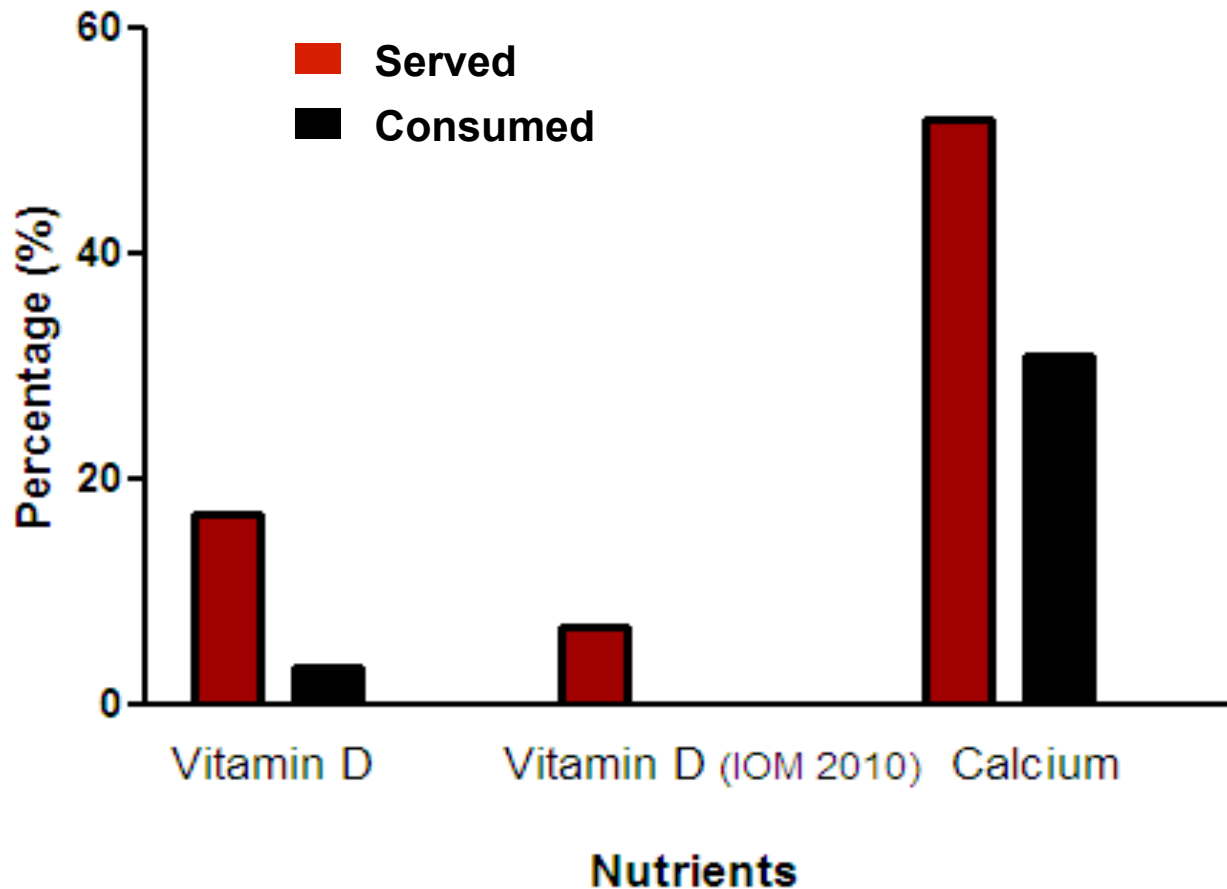
Seasonal Variation

Participants (%) per Category of 25(OH)D Status

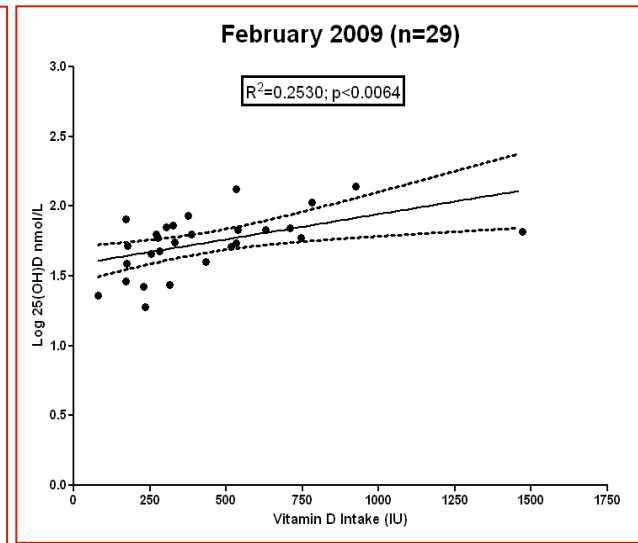
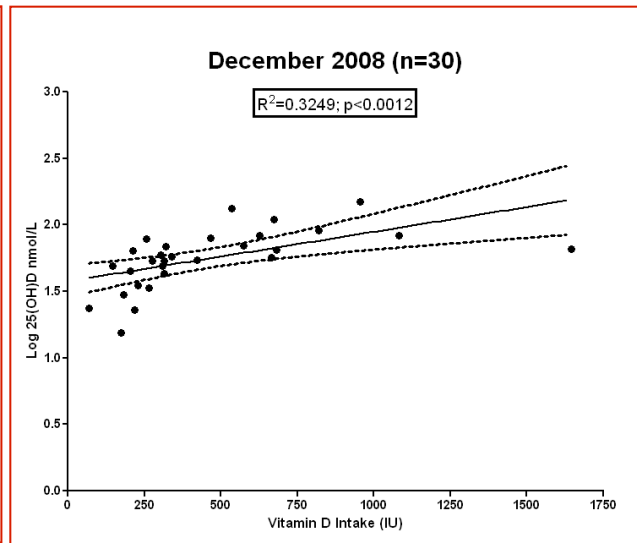
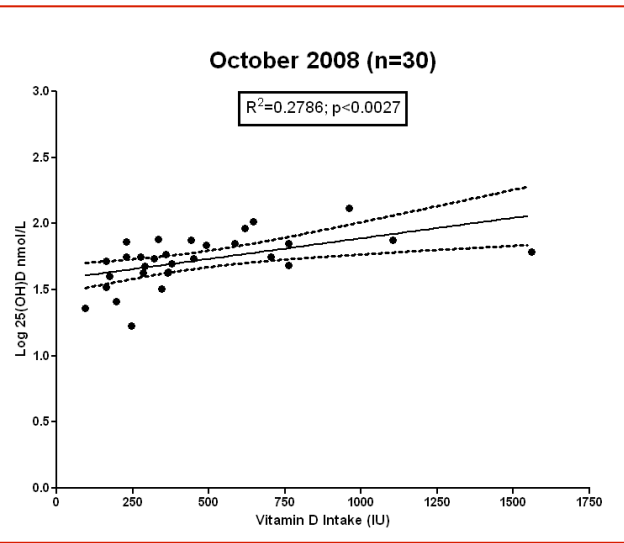


Vitamin D and Calcium

Percentage (%) of Participants that reached AI/RDA for Vitamin D and Calcium in February (n=29)



25(OH)D Status and Vitamin D Intake



Study Phase II - Percentage of Theoretical Intake per Food Group, including Meal Supplements and Vitamins

Study Phase II - Percentage of Theoretical Intake per Food Group, including Meal Supplements and Vitamins

20

30

25

Percent Vitamin D Intake

15

10

5

0

■ October 2008: Total Daily Average 14.5 µg (580 IU)

□ December 2008: Total Daily Average 14.2 µg (568 IU)

■ February 2009: Total Daily Average 14.3 µg (572 IU)

Milk
(3,4 µg ± 0.12 µg)

Milk based soups
(0,36 µg ± 0.04 µg)

Milk based sauces
(0,35 µg ± 0.01 µg)

Fish
(0,22 µg ± 0.18 µg)

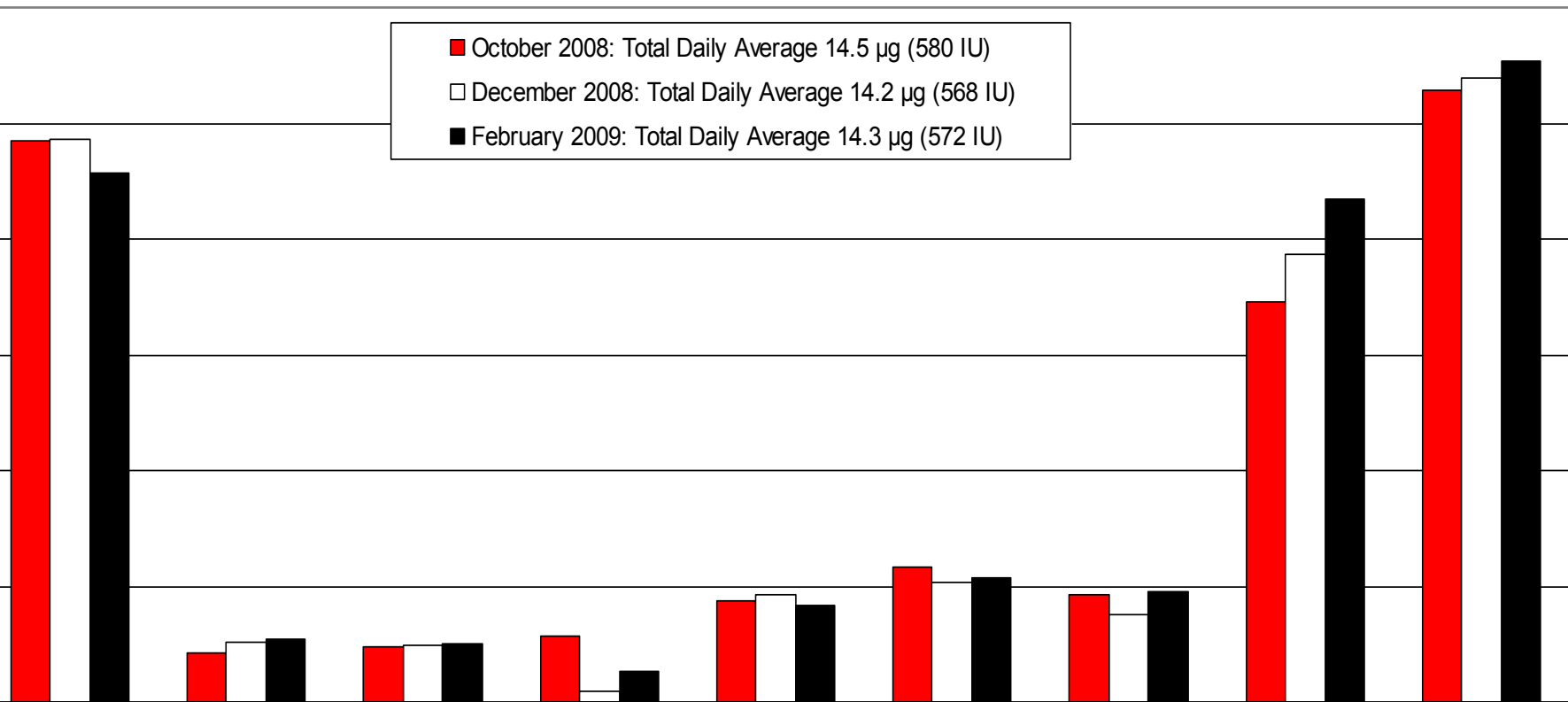
Eggs
(0,63 µg ± 0.03 µg)

Margarine
(0,78 µg ± 0.05 µg)

Sweets
(0,63 µg ± 0.08 µg)

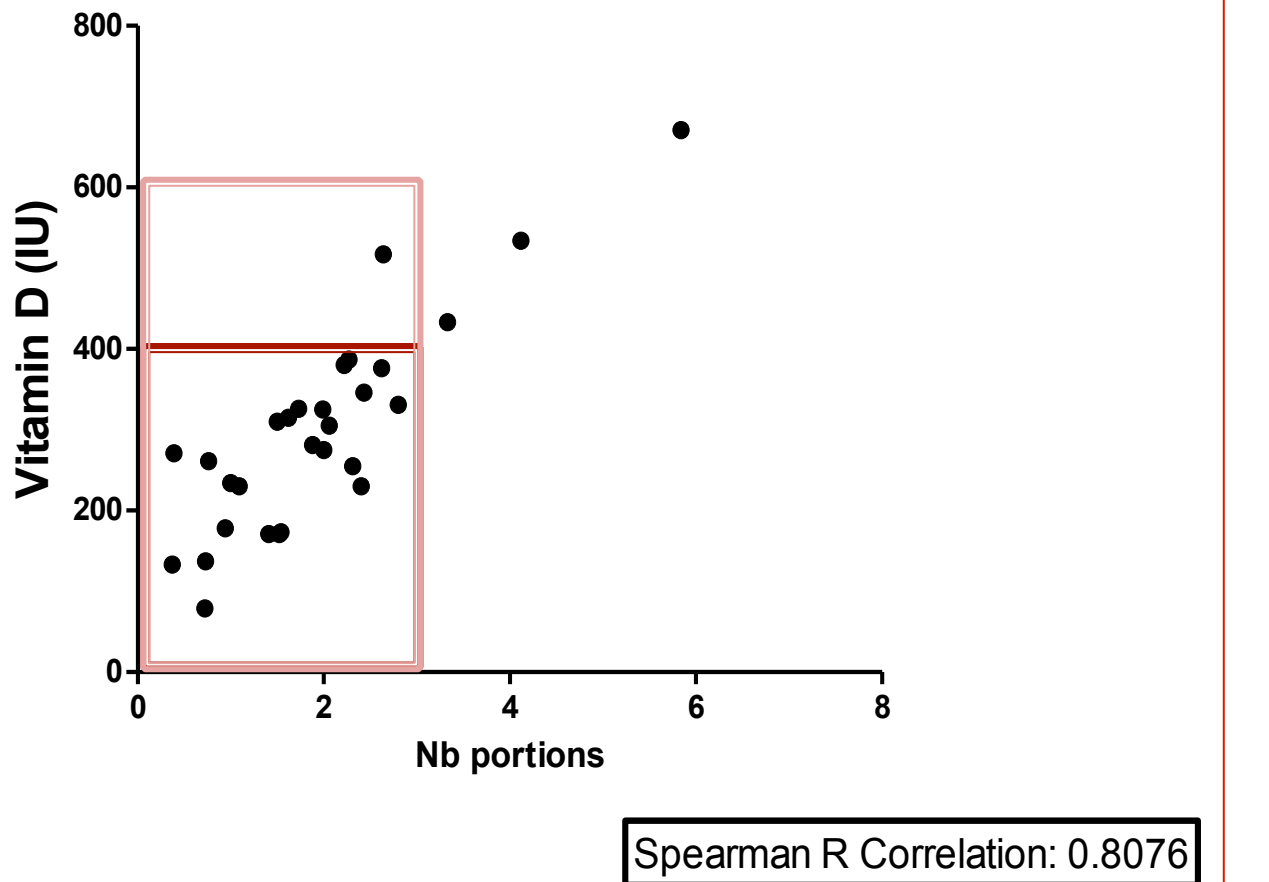
Supplements:
Ensure®, Boost®,
Fortified Soups and
Milk
(2,79 µg ± 0.31 µg)

Vitamins
(pills; 3,88 µg ±
0.08µg)



Vitamin D and Milk and Alternatives Intake as per Canada's Food Guide

Relationship between Number of Portions of Milk and Alternatives (Canada's Food Guide) and Vitamin D intake at Final (Feb'09)



Goals and Objectives

Phase I – Before and After Study (8 weeks)

- Evaluate the impact of 2000 IU per day of vitamin D₃ on serum concentrations of 25(OH)D, PTH and other biomarkers of bone health

Phase II – Randomized Controlled Trial (24 weeks)

- Serum 25(OH)D response to foods fortified
 - Placebo
 - 500 IU
 - 1000 IU

Ethical Approval

- Ethical approval was obtained from Institutional Review Board of McGill University
- Letter of no objection from Health Canada
- Approval from Scientific Review Committee of Ste. Anne's Hospital (Veteran Affairs Canada)



Interventions

Fortified foods:

- ◆ Bite size portion: ↓ Energy
↓ Nutrients
- ◆ ↓ Appetite impact
- ◆ Selection of flavors
- ◆ Selection of texture and consistency
- ◆ Q/C for vitamin D content via HPLC
(Health Canada and McGill laboratories)



Inter-Laboratory Q/C



% Vitamin D₃ Recovery – Quality Control:

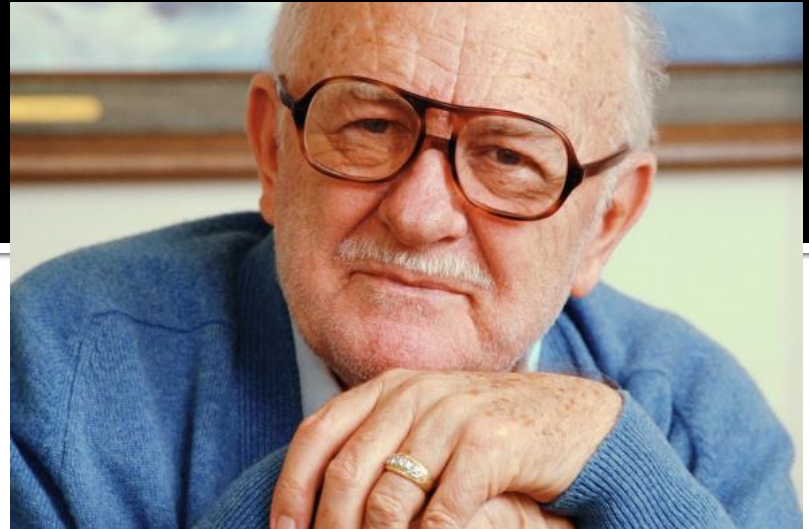


% Recovery McGill Laboratory	% Recovery Health Canada Laboratory
124.8% ± 28.8	107.4% ± 13.4

HPLC Method has a precision of ± 30%



Participants



- ◆ Male veterans
- ◆ Age : ≥ 70 years of age
- ◆ MMSE score ≥ 18 (/30) with capacity to collaborate
- ◆ Exclusion:
 - ◆ Palliative Care (Level of Care 4)
 - ◆ End stage liver disease
 - ◆ End stage renal disease or using vitamin D analogues
 - ◆ Untreated hyperparathyroidism
 - ◆ Oral feeding not permitted (NPO, TPN or Enteral only)

Assessments

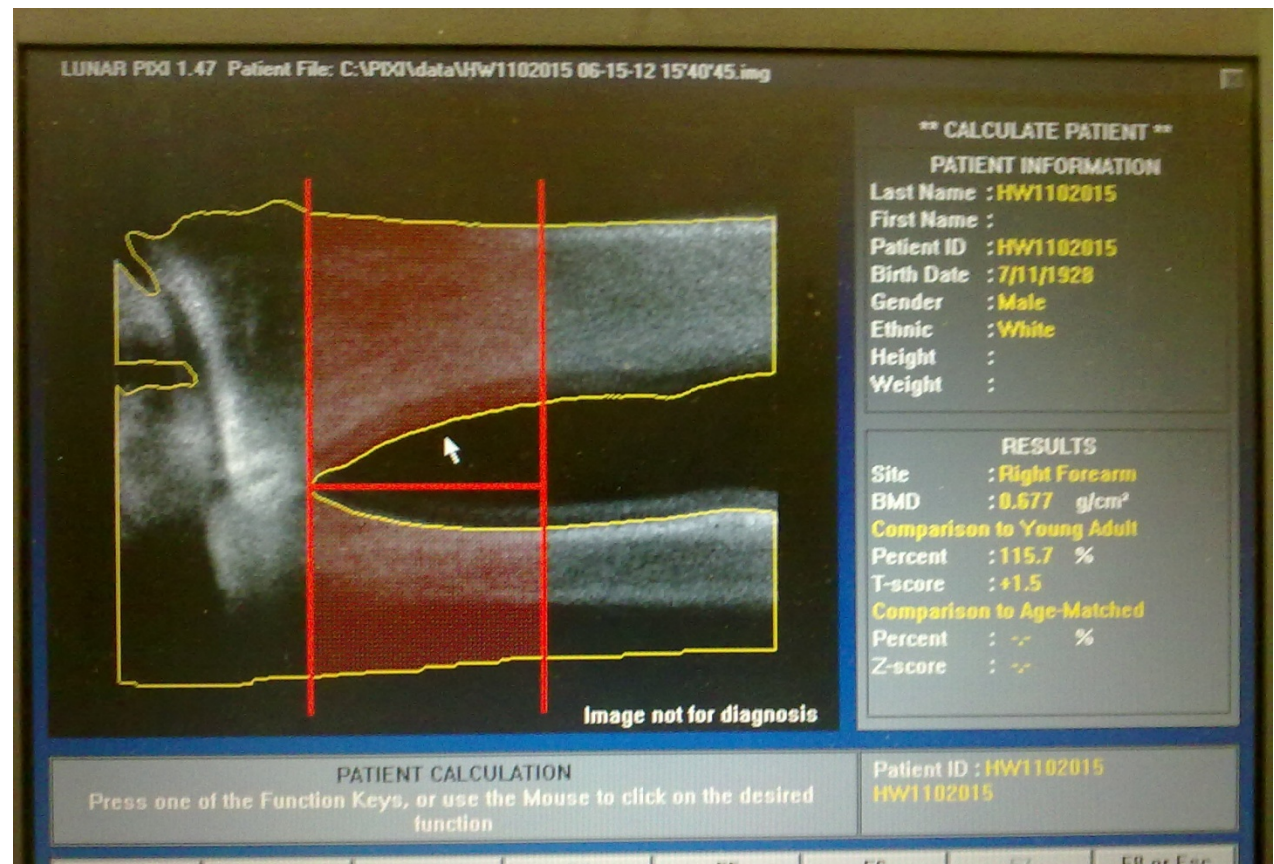
	Phase I – Before/ After 2000 IU/d			Phase II – RCT 1000 IU/d or 500 IU/d or Placebo					
	0	4	8	0	4	8	12	16	24
25(OH)D and PTH (Liaison)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Routine and bone biomarkers	✓		✓			✓		✓	✓
Anthropometry	✓	✓	✓	✓	✓	✓	✓	✓	✓
Functional quest.	✓								✓
Handgrip	✓		✓			✓	✓	✓	✓
Food Intake (3days)	✓		✓			✓		✓	✓
Bone Mineral Density			✓						✓

Radiology Assessments

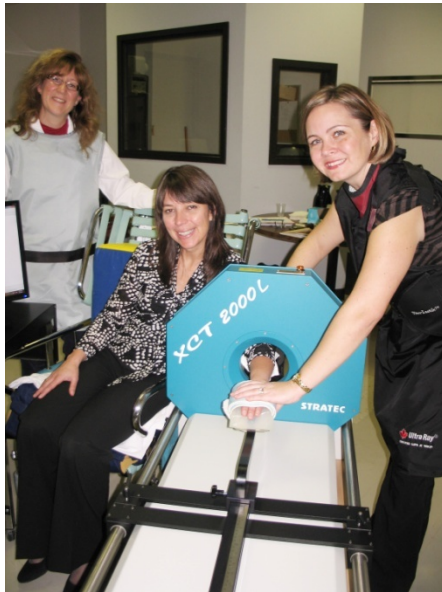


Areal Bone Mineral Density

PIXI, GE Medical Systems Lunar

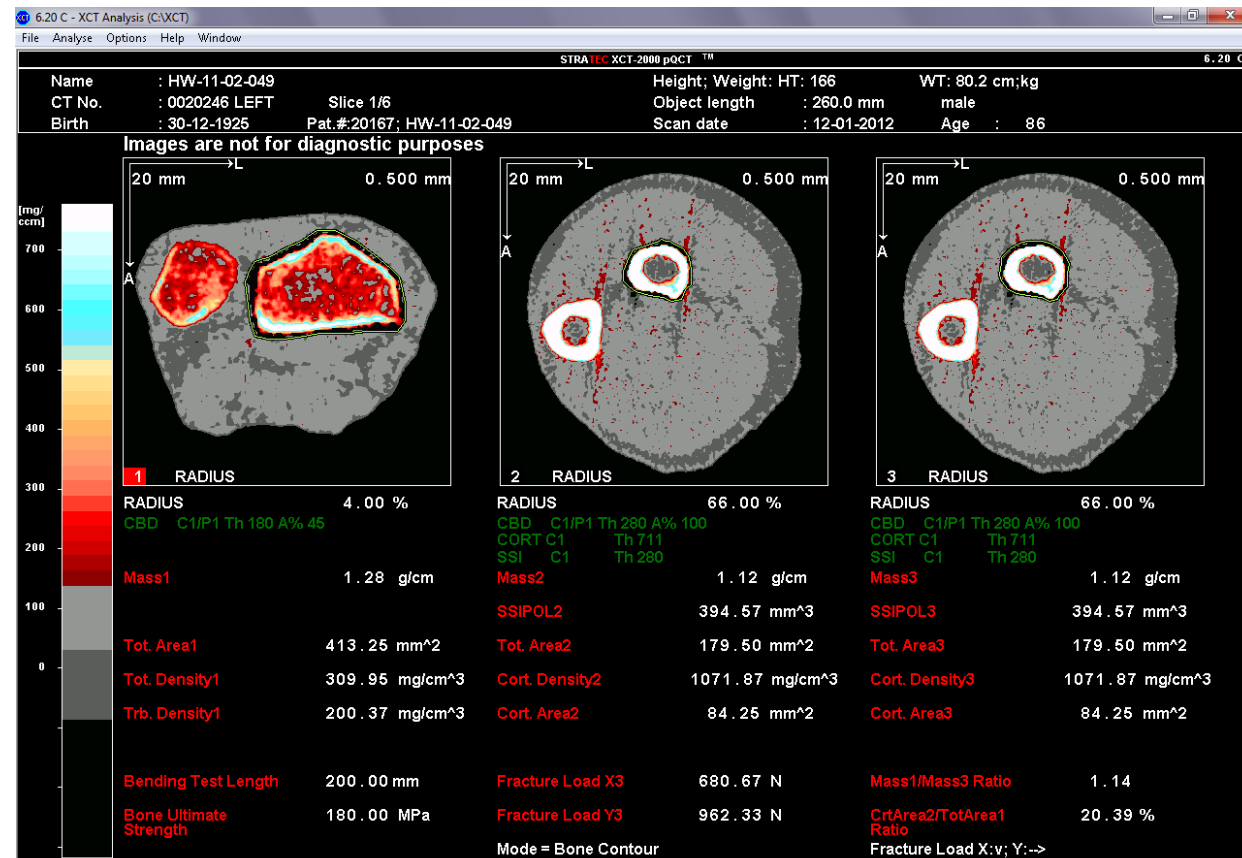


Radiology Assessments

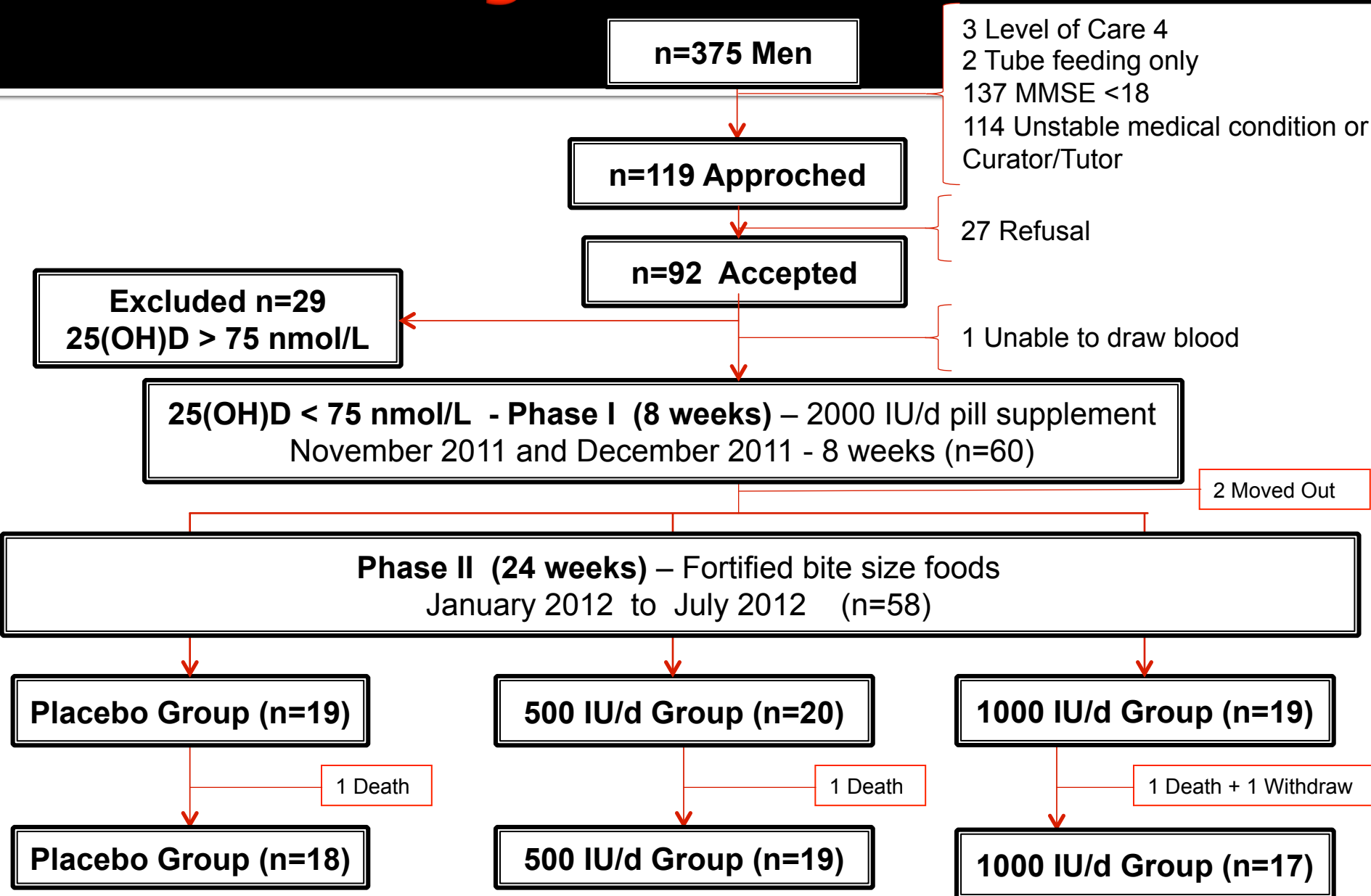


Volumetric Bone Mineral Density

pQCT, SCT-2000, Stratec Medizintechnik



Consort Diagram

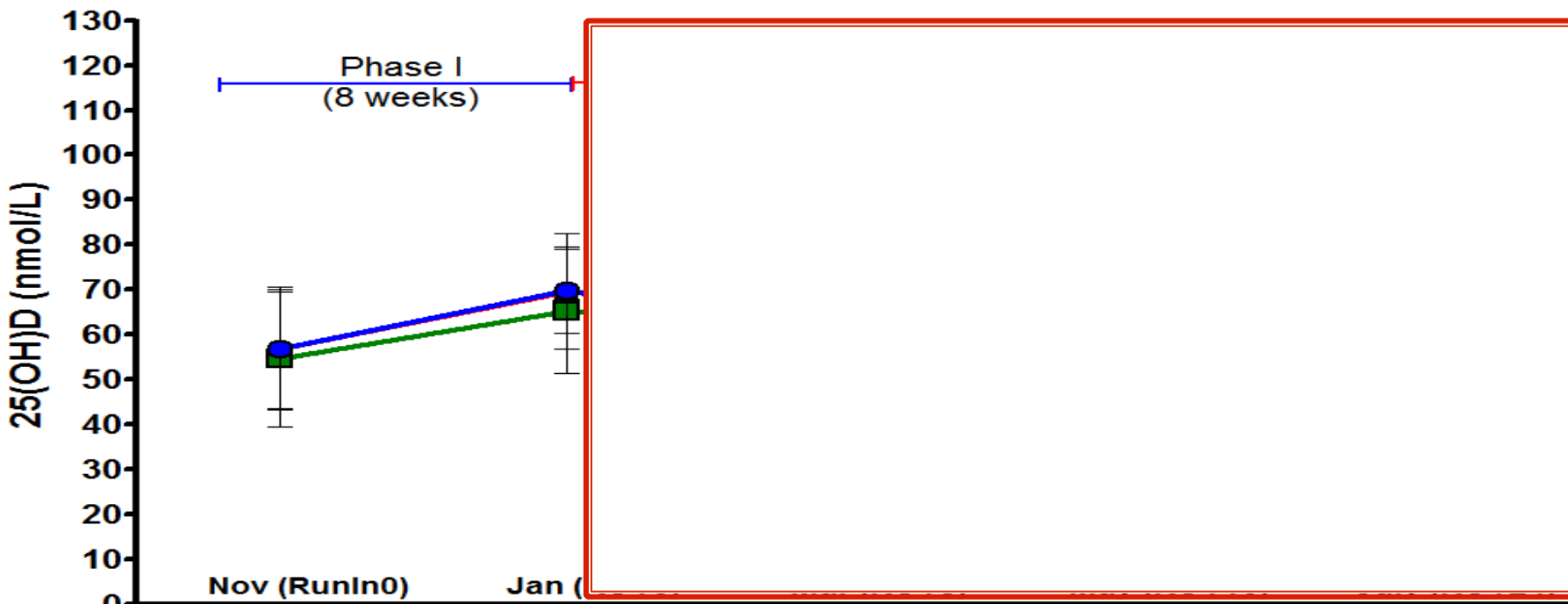


Descriptives Characteristics Before and After Phase I

	November 2011	January 2012		
		Placebo	500 IU/d	1000 IU/d
		Mean ± SD	Mean ± SD	Mean ± SD
Anthropometry				
Age	89.5 ± 3.4	88.9 ± 3.1	89.2 ± 3.2	90.9 ± 3.6
BMI (kg/m ²)	26.3 ± 4.6	26.5 ± 4.0	26.5 ± 5.5	26.1 ± 4.1
Grip Strength (kg)	N/A	19.5 ± 7.9	17.5 ± 3.2	17.8 ± 3.4
Biochemistry (Serum)				
iCalcium	1.06 ± 0.08	1.06 ± 0.05	1.07 ± 0.05	1.06 ± 0.06
25(OH)D (nmol/L)	55.5 ± 14.1	69.6 ± 12.8	65.2 ± 13.8	70.0 ± 9.7
1-84 PTH (pmol/L)	2.9 ± 1.8	2.8 ± 1.9	3.1 ± 2.0	2.7 ± 1.4
Dietary Intake (3-day food intake)				
Energy (kcal)	1720 ± 355	1643 ± 319	1605 ± 383	1816 ± 339
Protein (g)	67 ± 17	65 ± 18	64 ± 19	71 ± 16
Vitamin D (IU)	291 ± 144	307 ± 210	268 ± 151	295 ± 77
Calcium (mg)	994 ± 424	1008 ± 624	917 ± 440	973 ± 285

Vitamin D concentration (nmol/L) in Elderly Veterans (Nov. 2011 – July 2012)

● Placebo ■ 500 IU/d ▲ 1000 IU/d



Group 0:	56.9±13.3 ^{ab} A	69.8± 9.7 ^{cgh} A*	59.1± 9.7 ^{ab} A	60.3±10.5 ^{ib} A	56.1±10.3 ^{abj} A
Group 1:	54.6±15.0 ^{bdjk} A	65.2±13.8 ^{lm} A*	65.0±16.7 ^{lm} A*	71.2±17.3 ^e AB**	74.1±16.1 ^{ceno} B**
Group 2:	56.9±13.7 ^{bkpqu} A	69.6±12.8 ^{om} A*	69.3±17.7 ^{fr} A*	81.0±19.1 ^{cegstv} B**	78.5±17.3 ^{cegt} B**

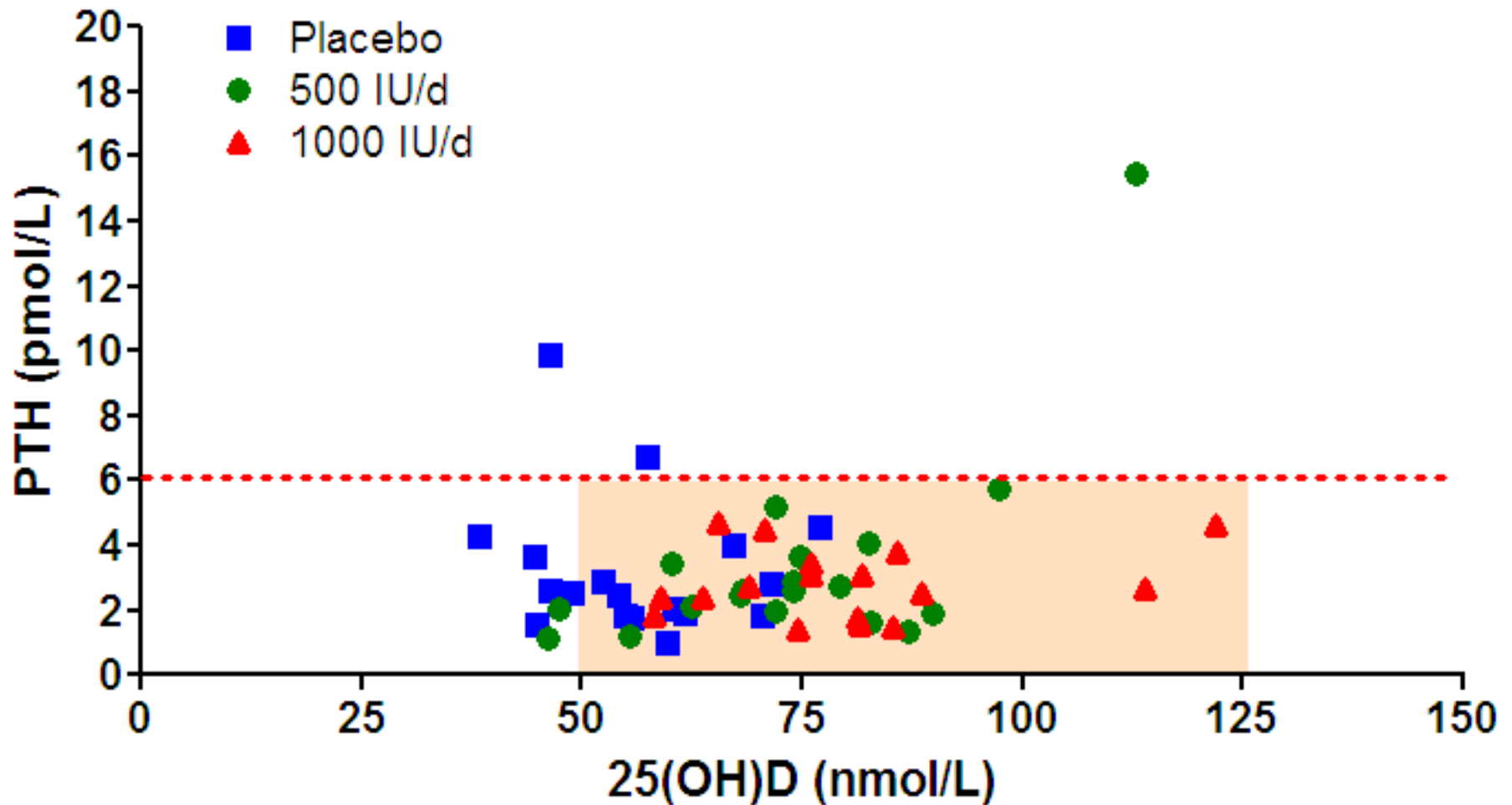
Means followed by different superscript **lowercase** letters differ for group by time interactions ($P < .05$)

Means followed by different superscript in **uppercase** letters within columns differ ($P < .05$)

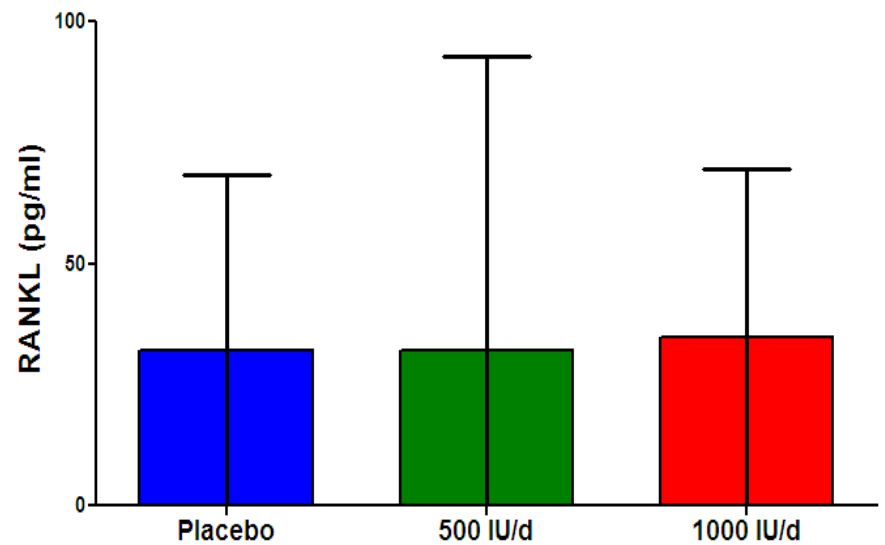
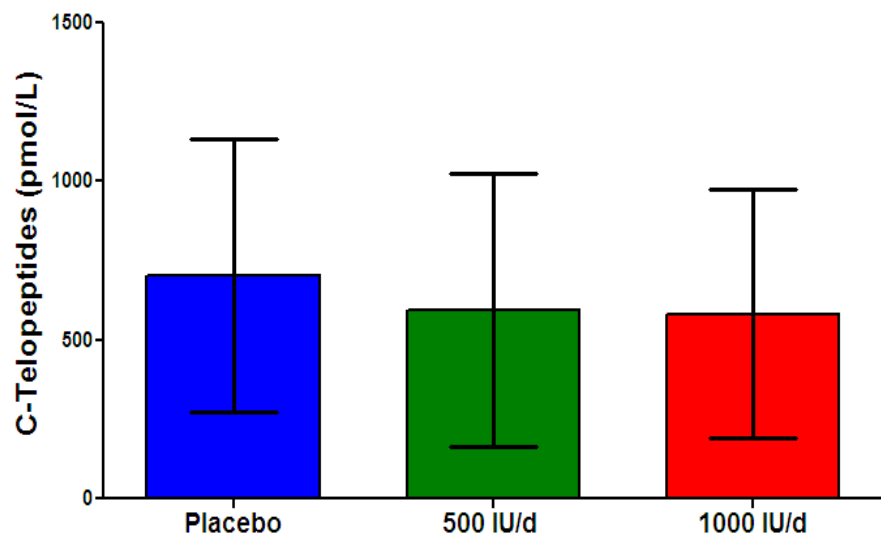
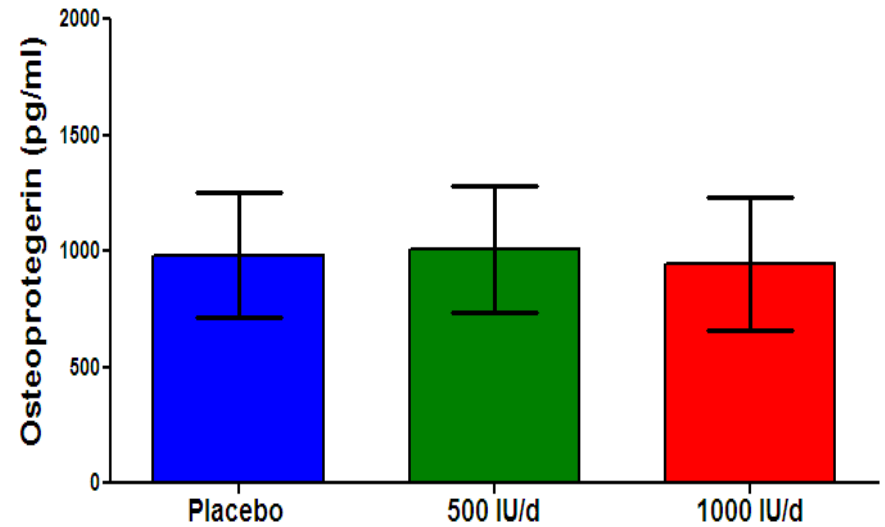
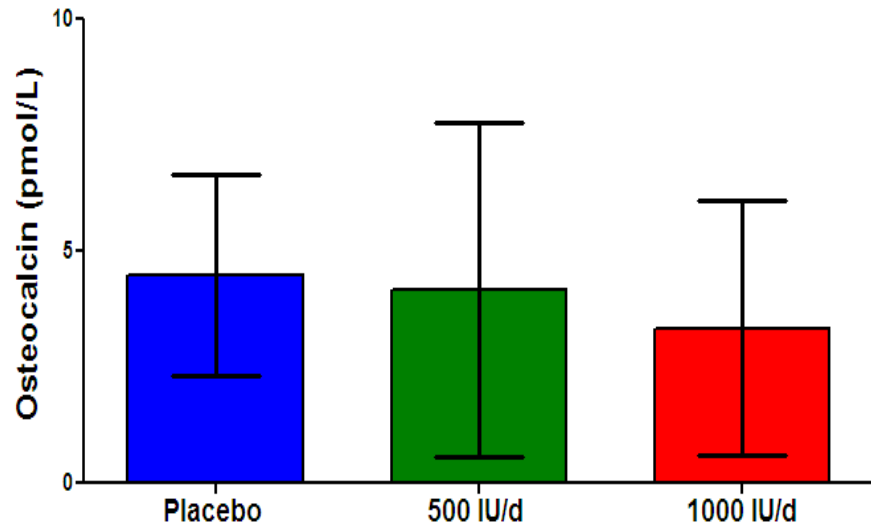
Means followed by an asterisk (*) differ from November values in same group ($P < .05$)

Means followed by 2 asterisks (**) differ from November, January and March values in same group ($P < .05$)

Parathyroid Hormone in July 2012



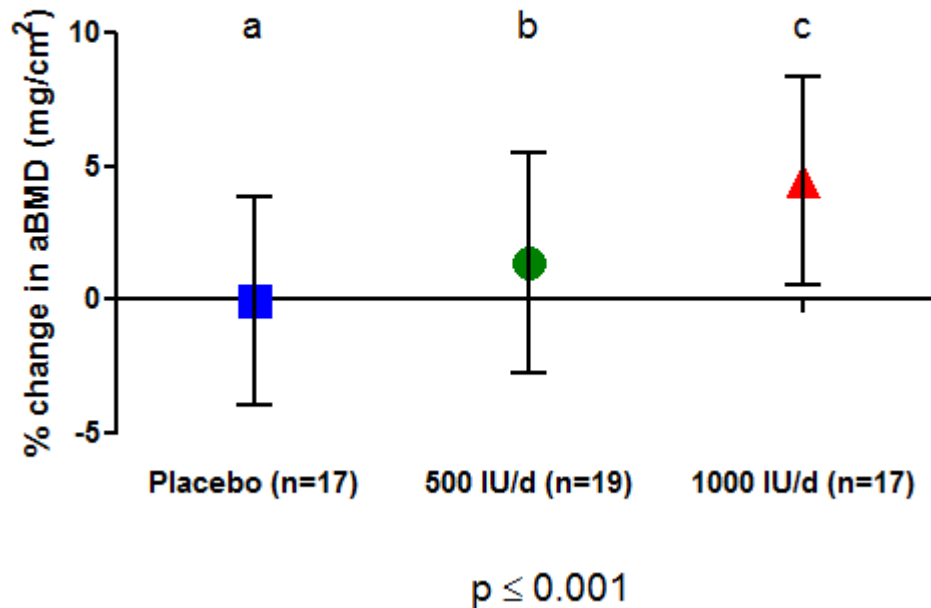
Bone Biomarkers in July 2012



Results – BMD Distal Forearm

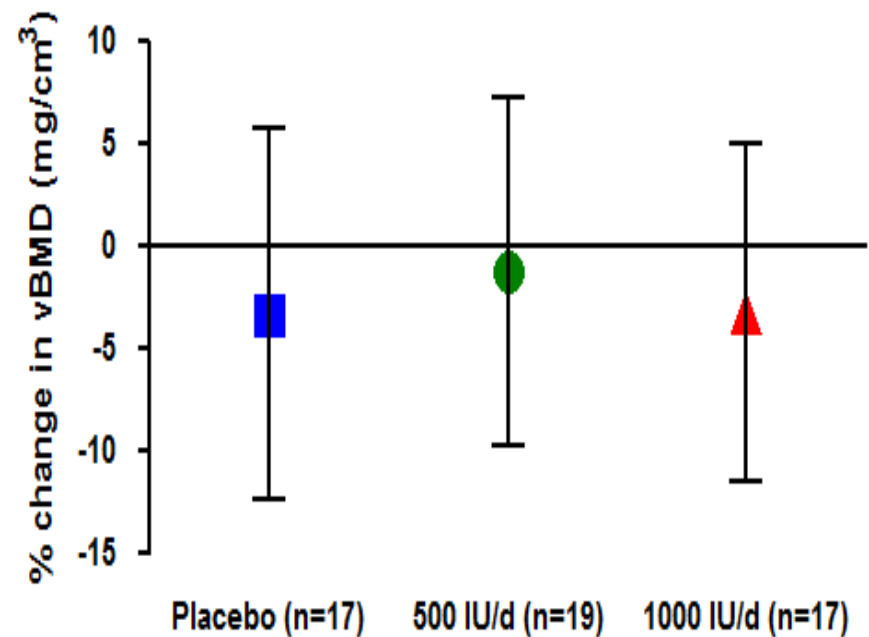
PIXI Evaluations

Percent change in aBMD
between January and July 2012



pQCT Evaluations

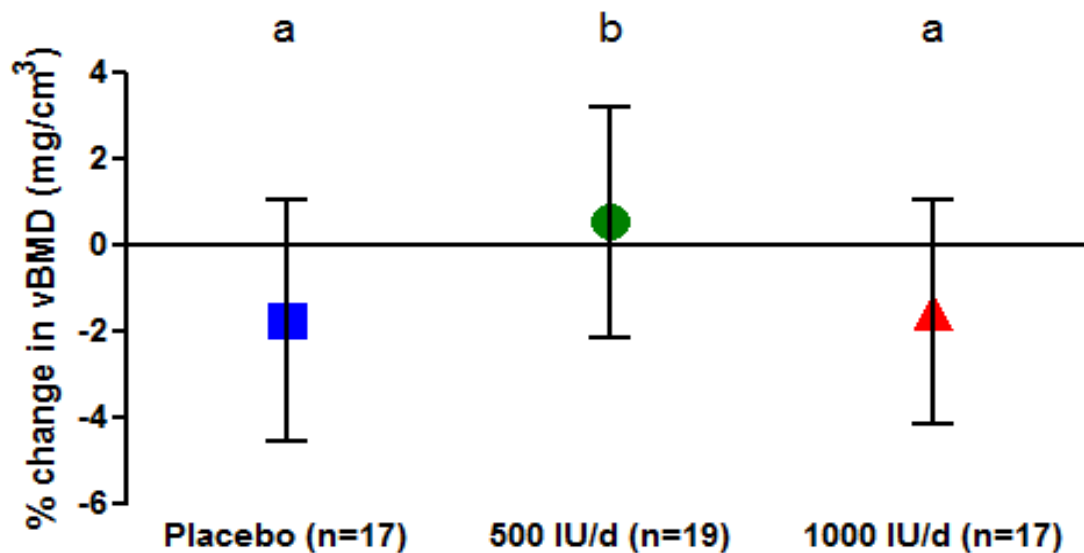
Percent change in vBMD - 4% radius
between January and July 2012



Results – BMD Distal Forearm

pQCT Evaluations

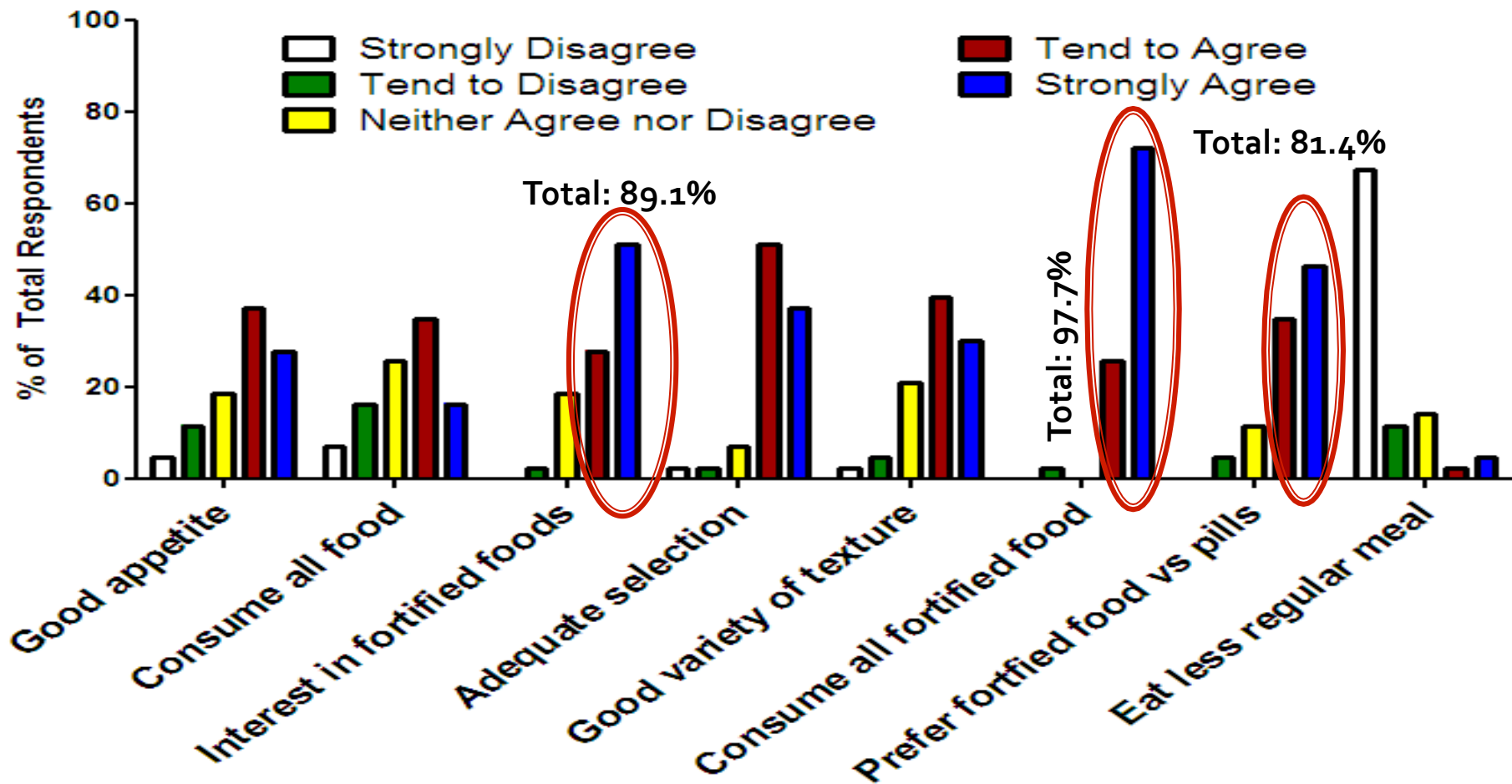
Percent change in vBMD - 66% radius
between January and July 2012



$p \leq 0.05$

Appreciation of Foods

Food Preference Survey assessing
Vitamin D₃ Fortified Foods



Strengths and Limitations

Strengths:

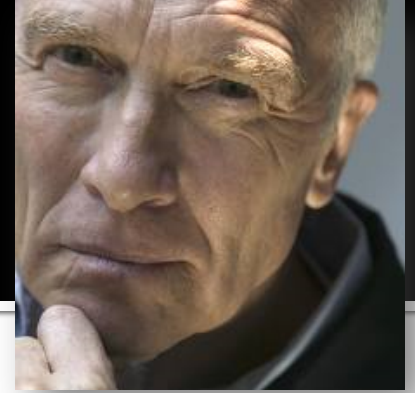
In this very old population, first RCT:

- to look at maintenance of vitamin D status and its impact of dosage on BMD for 24 wks
- to study the food-delivery formulations
- in a tightly controlled environment

Limitations:

- Men living in LTC facility, which is a tightly controlled environment
- Sample size

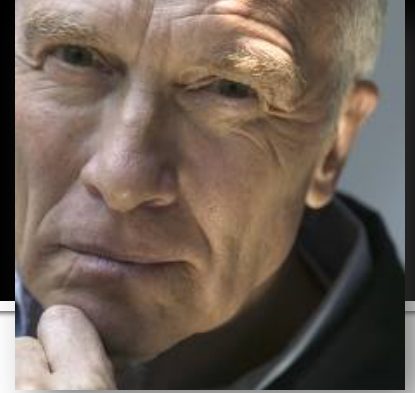
Conclusion



This research has provided *new insight on potential impact of optimized vitamin D status on bone health in elderly men:*

Providing 500 IU to 1000 IU of vitamin D₃ maintained 25(OH)D > 65 nmol/L and prevented seasonal declines in radial BMD.

Conclusion



The use of fortified foods was well accepted and created *new alternatives to the elderly population in long-term care facilities* and perhaps for community dwelling elders.



Acknowledgments



Supervisor

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Committee Members

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Canada
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McGill



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