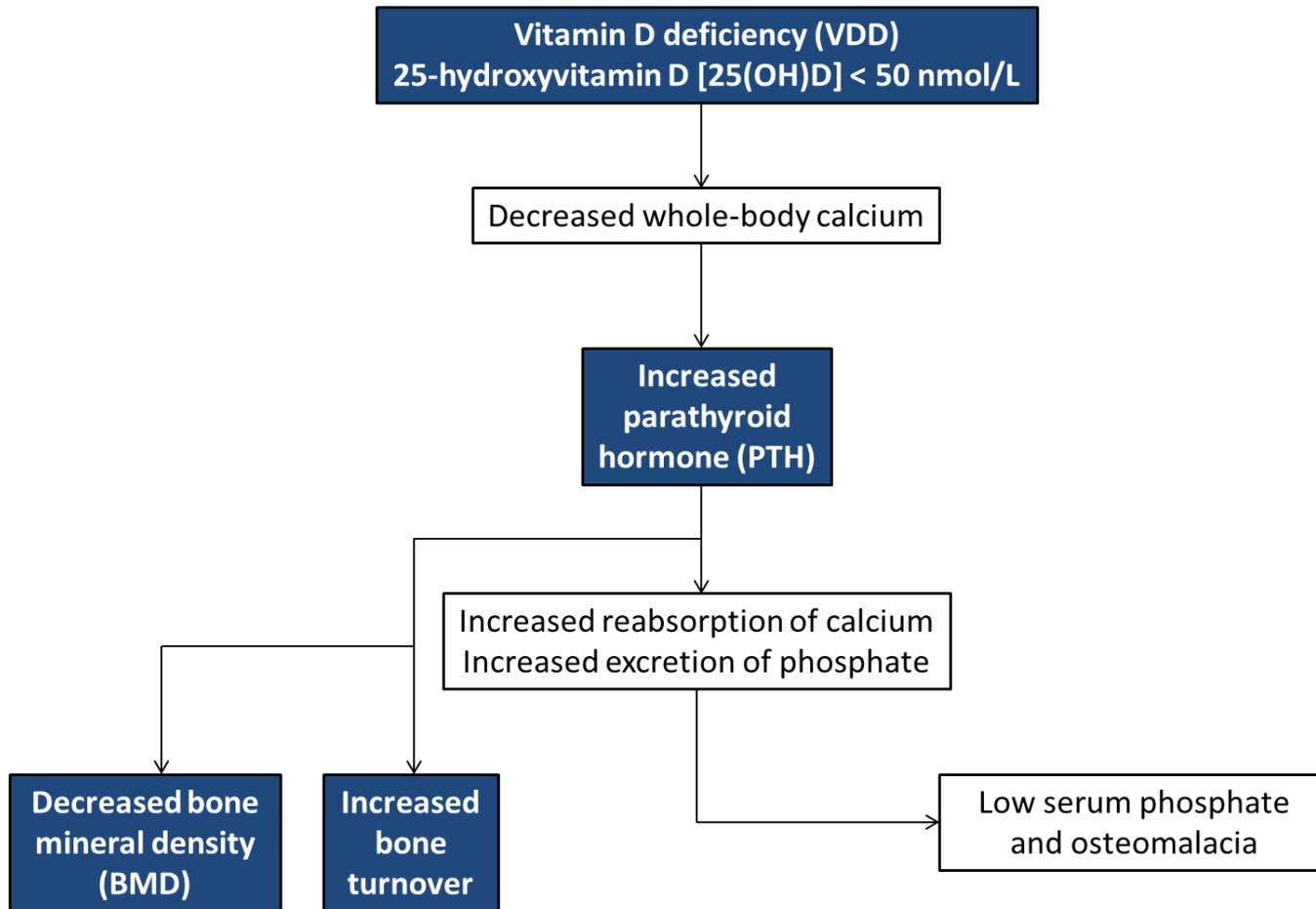


# No association between vitamin D deficiency and parathyroid hormone, bone density and bone turnover in a large cohort of HIV-infected men on tenofovir

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# Vitamin D deficiency (VDD)



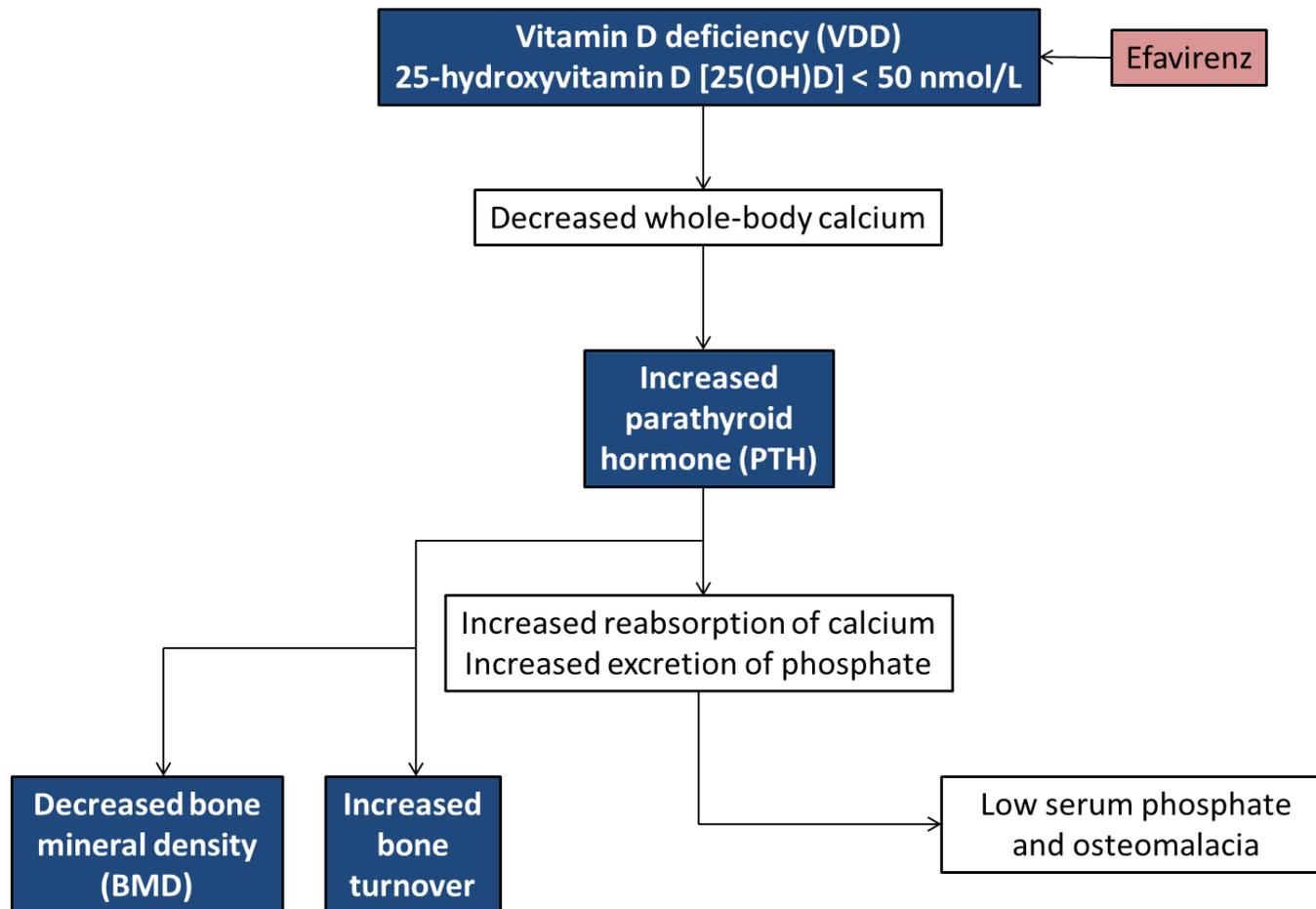
# VDD and HIV infection

- High rates of VDD have been reported in HIV-positive patients<sup>1</sup>
- Factors associated with VDD are similar to those in general population<sup>2</sup>
  - Black/Hispanic ethnicity
  - Reduced sunlight exposure
  - Increased body mass index (BMI)
  - Low exercise level

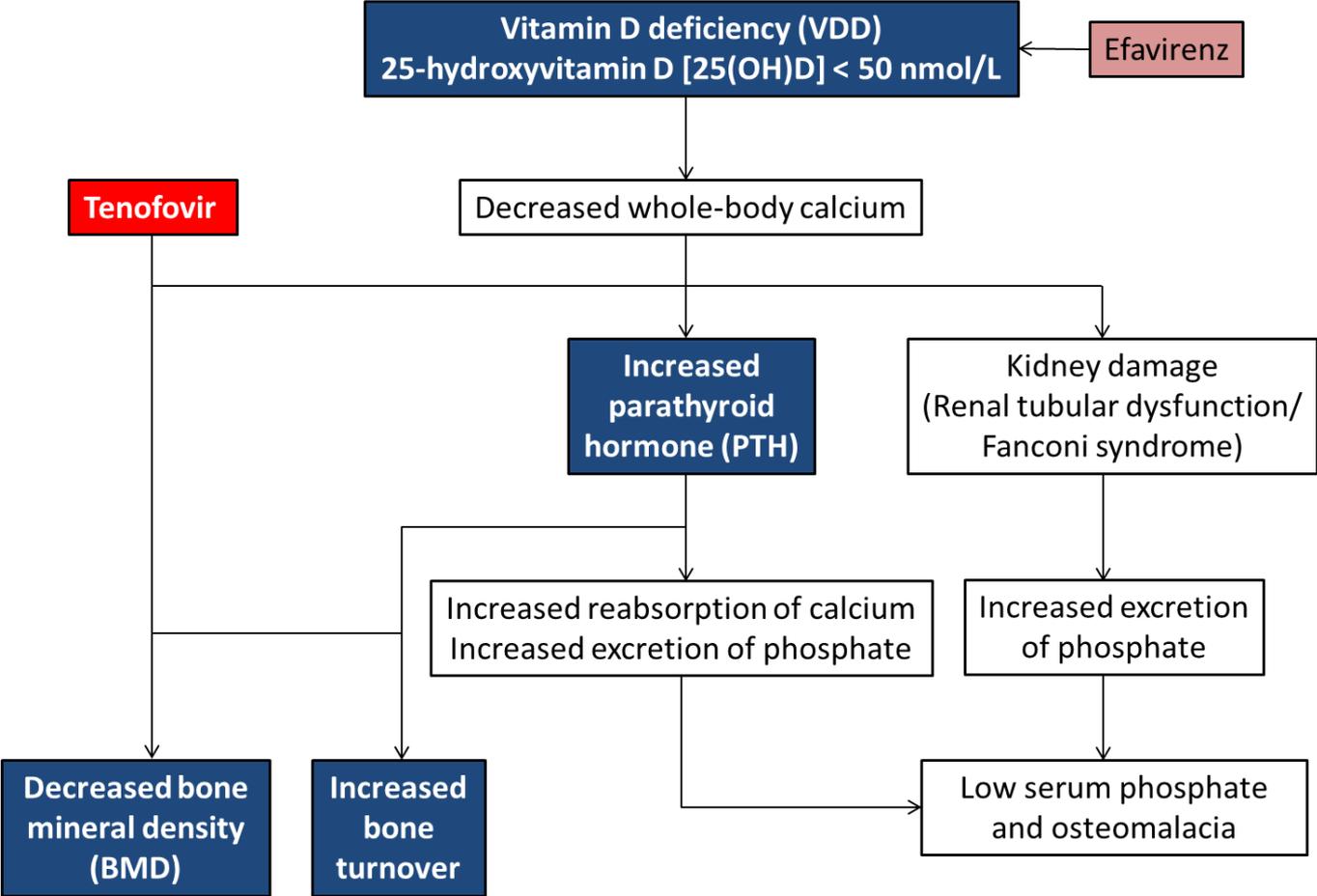
1. Childs K et al. *AIDS* 2012; 26:253–262

2. Dao CN et al. *Clin Infect Dis* 2011; 52:396–405

# VDD and antiretroviral therapy



# VDD and antiretroviral therapy



# Aims

- Prevalence of VDD
- Factors associated with VDD
- Associations of VDD and tenofovir with PTH, bone turnover and BMD

# Methods

- Cross-sectional cohort of randomly selected HIV-positive men
- Demographic and HIV factors
- Risk factors for low BMD (self-reported questionnaire)
- Fasting blood samples:
  - 25(OH)D
  - PTH
  - Bone resorption: C-terminal telopeptide crosslinks (CTX)
  - Bone formation: N-terminal propeptide of type I collagen (P1NP)
- Dual-energy x-ray absorptiometry (DXA): BMD ( $\text{g}/\text{cm}^2$ ) at lumbar spine, non-dominant total hip and femoral neck

# Demographics

		<b>Total N=422</b>
<b>Age</b>	years, mean (SD)	47 (10)
<b>White ethnicity</b>	n (%)	398 (94)
<b>MSM</b>	n (%)	392 (93)
<b>Years since HIV diagnosis</b>	median (IQR)	9.6 (5.0, 15.5)
<b>cART</b>		
On cART	n (%)	381 (90)
Duration on cART	median (IQR)	6.1 (2.2, 11.7)
VL < 40 copies/mL	n (%)	365 (87)
Current tenofovir	n (%)	292 (69)
Current efavirenz	n (%)	135 (32)

MSM: men who have sex with men, cART: combination antiretroviral therapy, VL: viral load

# Prevalence of VDD

	<b>Total (%) (n=421*)</b>	<b>Patients on tenofovir (%) (n=292)</b>
Normal (> 75 nmol/L)	60 (14)	37 (13)
Insufficiency (50 - 75 nmol/L)	127 (30)	89 (30)
<b>Deficiency (25 - 50 nmol/L)</b>	204 (49)	144 (49)
<b>Severe deficiency (&lt; 25 nmol/L)</b>	30 (7)	22 (8)

\* Data missing in 1 patient

- Overall prevalence of VDD was 56%
- Of 381 men on cART, VDD occurred in 215 (56%)
- Of 292 men on tenofovir, VDD occurred in 166 (57%)

# Associations with VDD

	<b>Crude OR (95% CI)</b>	<b>P</b>	<b>Adjusted OR (95% CI)</b>	<b>P</b>
<b>Sampling date*</b>	<b>1.27 (1.09, 1.47)</b>	<b>0.002</b>	<b>1.29 (1.10, 1.51)</b>	<b>0.001</b>
<b>Nadir CD4 count, cells/<math>\mu</math>L</b>	0.93 (0.86, 1.00)	0.06	0.92 (0.84, 1.00)	0.05
<b>Current tenofovir</b>	1.05 (0.65, 1.69)	0.85		
<b>Current efavirenz</b>	<b>1.71 (1.11, 2.63)</b>	<b>0.02</b>	<b>1.94 (1.21, 3.13)</b>	<b>0.01</b>

\*Sampling away from August, which was considered to be month with maximum sun exposure

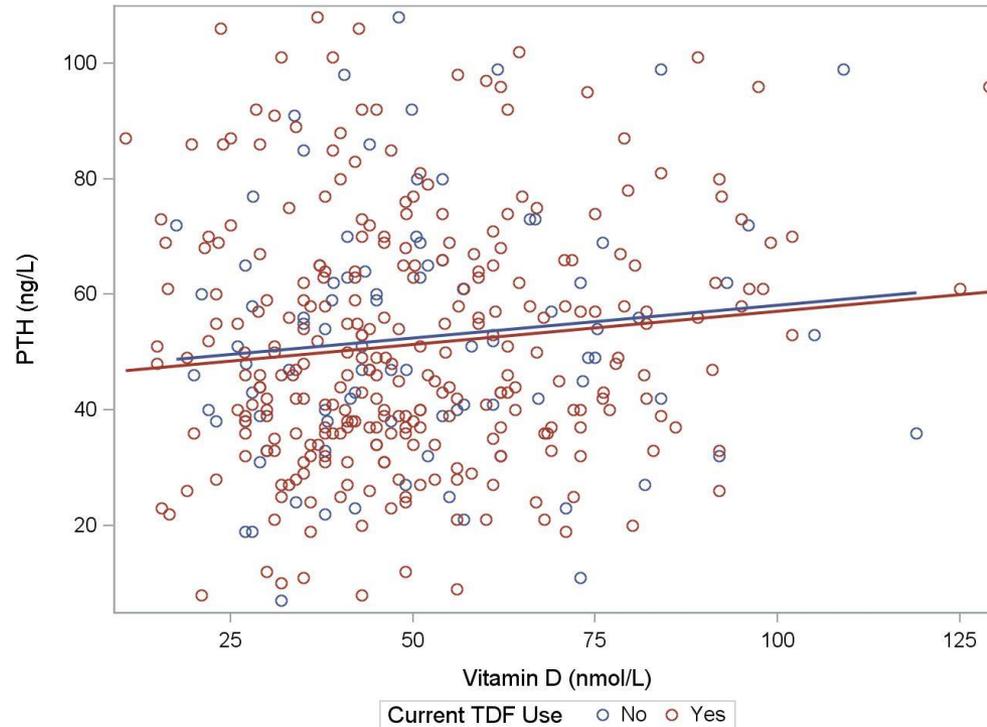
Other factors inserted into model: age, body mass index, skin colour, kidney disease, duration of HIV infection, HIV clinical stage, HIV RNA viral load, current protease inhibitor use, vitamin D supplementation

# Vitamin D and PTH

	25(OH)D > 50 nmol/L (n=166)	VDD (< 50 nmol/L) (n=215)	P
High PTH (> 65 ng/L), n (%)	45 (27)	46 (21)	0.18
PTH, median (IQR)	53 (39, 66)	47 (36, 63)	0.07

- Significant but weak correlation between vitamin D and PTH ( $r=0.11$ ,  $p=0.03$ )
- Proportion of patients with high PTH did not differ with vitamin D status ( $p=0.18$ )

# Vitamin D, PTH and tenofovir



- No association between vitamin D and PTH according to tenofovir ( $r=0.11$ ,  $p=0.06$ ) or non-tenofovir ( $r=0.12$ ,  $p=0.29$ ) cART
- No interaction effect between vitamin D and tenofovir use ( $p=0.94$ )

# Bone turnover and tenofovir

Median (IQR)	All patients (n=381)			VDD (n=215)		
	Tenofovir (n=293)	Non-tenofovir (n=88)	P	Tenofovir (n=166)	Non-tenofovir (n=49)	P
<b>CTX</b>	1.94 (0.85, 4.84)	2.39 (1.02, 5.33)	0.29	2.02 (1.03, 4.84)	2.48 (1.17, 5.65)	0.32
<b>P1NP</b>	13.6 (5.6, 32.4)	11.0 (5.5, 24.8)	0.52	14.5 (5.8, 40.7)	12.7 (6.5, 24.0)	0.60

VDD: vitamin D deficiency; CTX: C-terminal telopeptide crosslinks, ng/mL; P1NP: N-terminal propeptide of type I collagen, ng/mL

# BMD and tenofovir

Mean (SD)	All patients (n=381)			VDD (n=215)		
	Tenofovir (n=293)	Non-tenofovir (n=88)	P	Tenofovir (n=166)	Non-tenofovir (n=49)	P
<b>Lumbar spine BMD</b>	1.13 (0.15)	1.15 (0.17)	0.41	1.13 (0.15)	1.16 (0.18)	0.32
<b>Total hip BMD</b>	1.00 (0.13)	0.99 (0.14)	0.61	0.99 (0.14)	1.00 (0.15)	0.76
<b>Femoral neck BMD</b>	0.94 (0.12)	0.94 (0.18)	0.96	0.94 (0.13)	0.94 (0.14)	0.83

VDD: vitamin D deficiency; BMD: bone mineral density, g/cm<sup>2</sup>

# Summary

- Majority of patients were vitamin D-deficient
- Factors associated with VDD similar to reports in other studies in HIV-positive patients
- No association between vitamin D and PTH, bone turnover or BMD
- Results did not alter with tenofovir use

# Discussion

- No evidence to support additional monitoring of bone status in patients on tenofovir, regardless of vitamin D status
- No association between VDD and tenofovir use
- No association between tenofovir use and BMD
- Longitudinal data are required

# Acknowledgements

- Professor Martin Fisher
- Patients in Brighton who participated in the study