Vitamin D deficiency, Smoking, and Lung Function in the Normative Aging Study

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Online data supplement

For all tables, reference group for vitamin D deficiency (VDD) was the group of subjects without VDD, therefore negative effect estimates represent lower values in subjects with VDD compared to subjects without VDD.

Table E1: Baseline characteristics of subjects included and not included in current analysis

	Baseline (Time 1: 1984-89)		
	included (N=626)	not included (N=798)	
	Mean (SD) or N(%)	Mean (SD) or N(%)	p value*
Age	59.9 (6.9)	65.3	<.0001
BMI	27.2 (3.3)	26.9 (3.6)	0.15
FEV_1	3.21 (0.63)	2.93 (0.66)	<.0001
FEV_1 %pred	89.5 (14.8)	86.8 (16.7)	0.001
FVC	4.24 (0.74)	3.89 (0.74)	<.0001
FVC %pred	93.3 (12.8)	89.7 (14.3)	<.0001
FEV_1/FVC ratio	75.5 (6.8)	75.1 (7.7)	0.35
pack-years	19.2 (22.3)	25.5 (27.0)	<.0001
current smoking (N, % yes)	64 (10%)	120 (15%)	0.008
GOLD			
0	528 (84%)	634 (79%)	
1	36 (6%)	44 (5.5%)	
2	53 (8%)	90 (11.3%)	
3	5 (1%)	16 (2%)	
4	4 (0.5%)	14 (1.8%)	

* t-test or chi-sq

Table E2: Cross-sectional analysis, main effects of Vitamin D deficiency in relation to lung function, at each of three time points (Time 1: 1984-89, Time 2: 1992-1999, Time 3: 1995-2003)

Effect estimates (β) are for vitamin D deficiency. Multivariable analysis includes adjustment for age, height, pack-years of smoking, BMI and season of blood draw.

	Time 1		Time 2		Time 3	
	β	p value	β	p value	β	p value
FEV_1	-0.053	0.21	-0.012	0.84	-0.073	0.15
FVC	-0.029	0.53	-0.1	0.11	-0.045	0.42
ratio	-0.811	0.14	1.66	0.03	-1.34	0.083

Table E3: Bivariable and multivariable longitudinal models examining the main effect of vitamin D (both VDD and VDC) and lung function decline

There were no significant relationships between vitamin D and lung function decline with the exception of an inverse relationship between VDC and FVC decline

	Vitamin D Deficiency				Vitamin D Continuous			
	Bivariate		Multivariate		Bivariate		Multivariate	
	β	p value	β	p value	β	p value	β	p value
FEV1	-0.00039	0.88	0.0021	0.39	-0.00008	0.46	-0.00019	0.06
FVC	0.002	0.48	0.0044	0.11	-0.00025	0.023	-0.00035	0.0008
FEV1/FVC	-0.057	0.23	-0.046	0.37	0.0031	0.09	0.00216	0.25

Table E4: Cross-sectional analysis, vitamin D deficiency and smoking (pack-years) in relation to lung function (Times 1-3)

Effect estimates (β) are for the interaction between VDD and smoking as labeled at the top of the column, i.e. either VDD x pack-years or VDD x smoking status. Smoking status was analyzed as a dichotomous variable (current vs. ex- and never-smokers). Reference group is never & ex-smokers.

		Pack-years		Smoking Status	
		β	p value	β	p value
Time 1	FEV_1	-0.0019	0.3	-0.201	0.143
	FVC	-0.0017	0.53	-0.148	0.33
	FEV_1/FVC	-0.0225	0.35	-2.23	0.21
Time 2	FEV_1	-0.002	0.43	-0.525	0.016
	FVC	-0.0648	0.43	-0.584	0.016
	FEV_1/FVC	-0.021	0.53	-3.524	0.23
Time 3	FEV_1	-0.0072	0.0007	-0.888	0.0001
	FVC	-0.0055	0.0211	-0.64	0.013
	FEV_1/FVC	-0.0938	0.0039	-14.491	<.0001

Table E5: Cross-sectional analysis, vitamin D continuous and smoking (pack-years) in relation to lung function

Effect estimates (β) are for the interaction term between vitamin D as a continuous variable (VDC) and smoking (pack-years). Positive values imply incremental increase in lung function value for each 1ng/ml increase in vitamin D level.

		β	p value
Time 1	FEV$_1$	0.00014	0.19
	FVC	0.000038	0.74
	FEV$_1$/FVC	0.0024	0.08
Time 2	FEV$_1$	0.00008	0.32
	FVC	0.0001	0.3
	FEV$_1$/FVC	0.0005	0.65
Time 3	FEV$_1$	0.00016	0.1
	FVC	0.00015	0.14
	FEV$_1$/FVC	0.00086	0.55

Table E6: Longitudinal Analysis showing effect of combination of vitamin D deficiency, smoking status, and change in lung function over time

Effect estimates and p values are for the interaction term with vitamin D deficiency, time (in years) and smoking status. Negative effect estimates imply that in current smokers with vitamin D deficiency, lung function decline was more rapid as compared to current smokers who were vitamin D sufficient.

	Smoking Status	
	β	p value
FEV1	-0.026	0.052
FVC	-0.009	0.54
FEV1/FVC	-0.76	0.023

Table E7: Longitudinal Analysis showing effect of combination of vitamin D as continuous variable, pack-years of smoking, and change in lung function over time.

Effect estimates and p values are for the interaction term with vitamin D as a continuous variable, time (in years), and pack-years of smoking. Positive effect estimates imply an incremental decrease in rate of decline (rate becomes less negative) per year per ng/ml increase in vitamin D level.

	β	p value
FEV1	7.5E-06	0.07
FVC	8E-06	0.15
FEV1/FVC	0.00002	0.85

Figure E1: Relationship between FEV$_1$ and pack-years of smoking

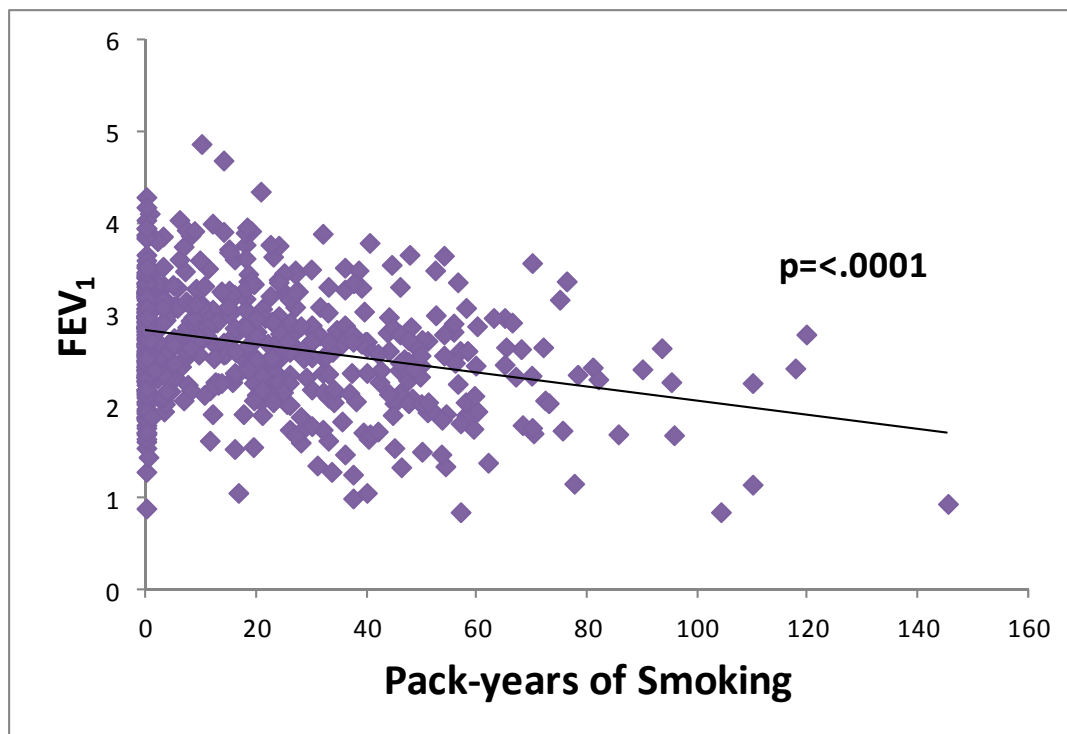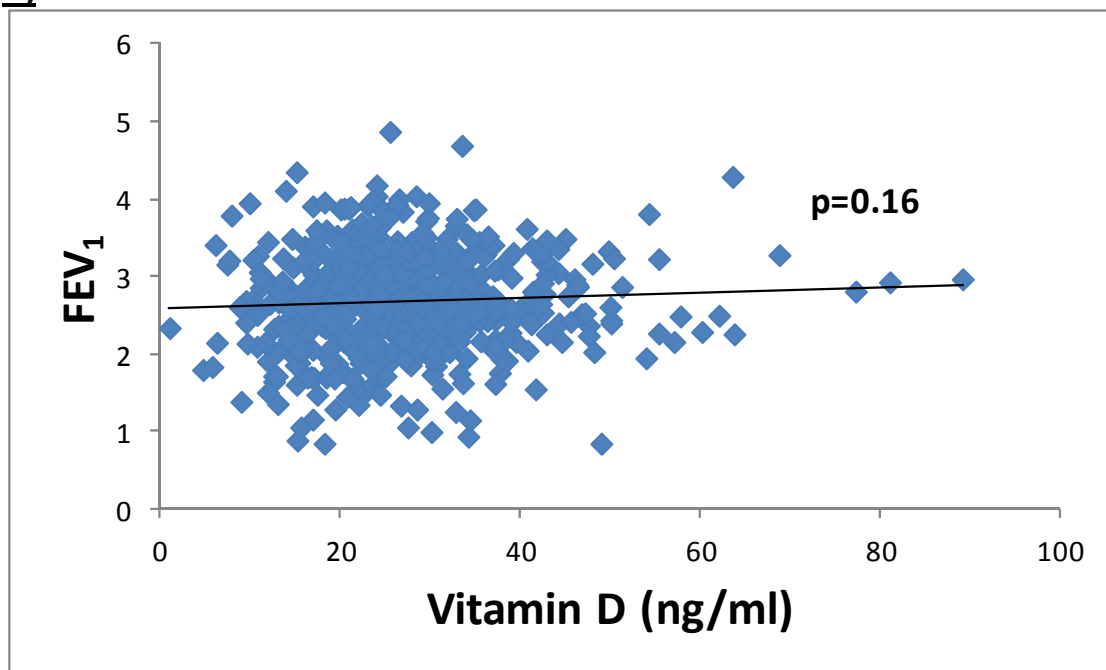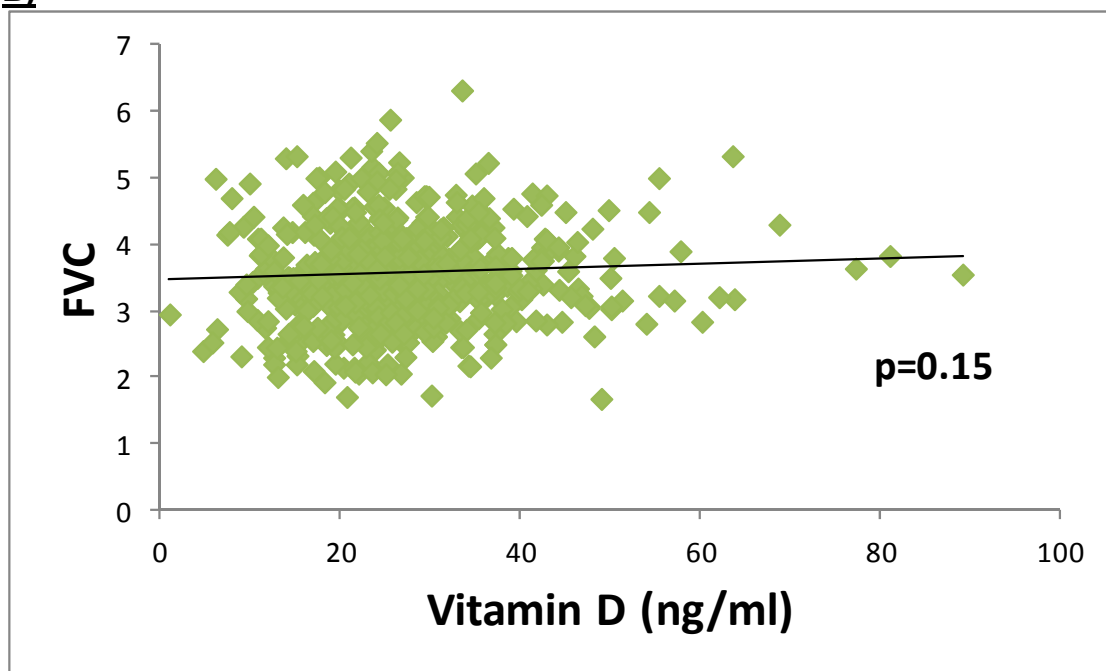There was a significant inverse relationship between FEV$_1$ and pack years of smoking

Figure E2: Relationship between lung function and vitamin D levels

There was no significant relationship between vitamin D levels and A) FEV_1, B) FVC or C) FEV_1/FVC.
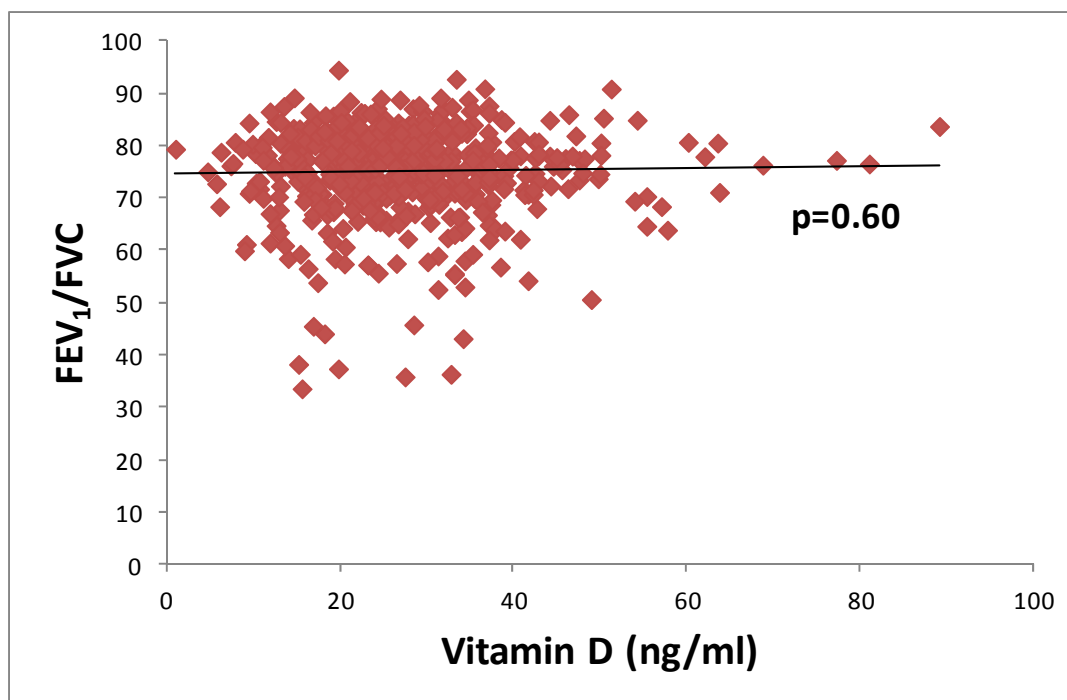
A)

B)

C)

Figure E3: Relationship between vitamin D (continuous) and rates of change in lung function

There was no significant relationship between vitamin D levels and rate of change of FEV_1 or FEV_1/FVC, however there was a significant inverse relationship between vitamin D and rate of change of FVC (see **Table E3**) though the effect size was very small (β=-.00035, p=.0008 in adjusted model). Shown here are the bivariate relationships between vitamin D levels and lung function decline.
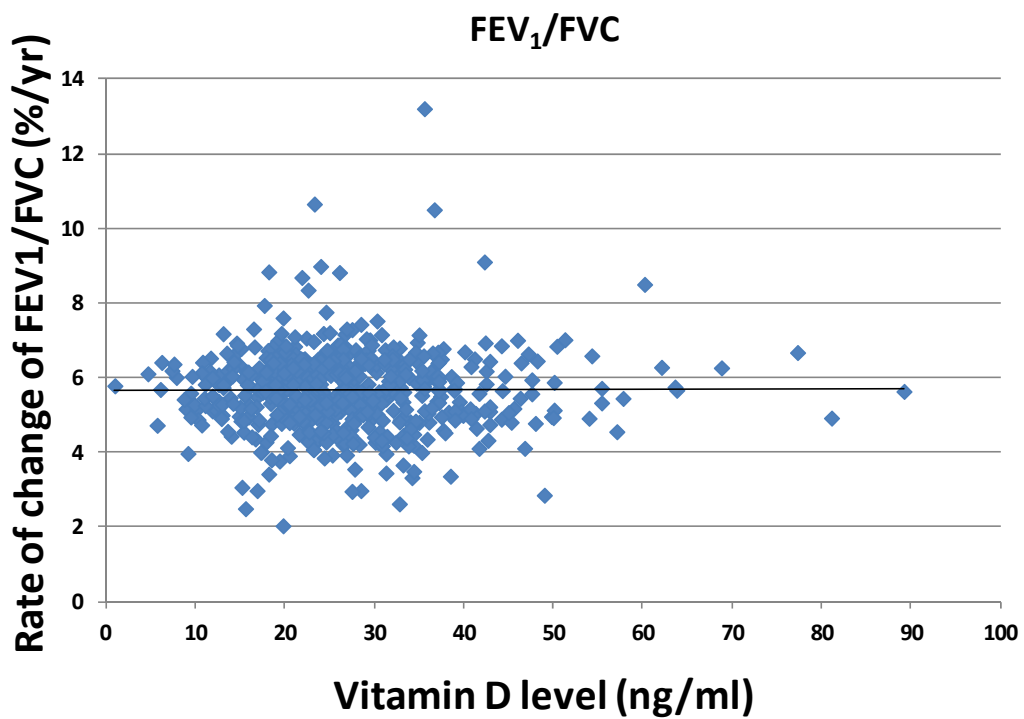
FEV$_1$

FVC

FEV$_1$/FVC
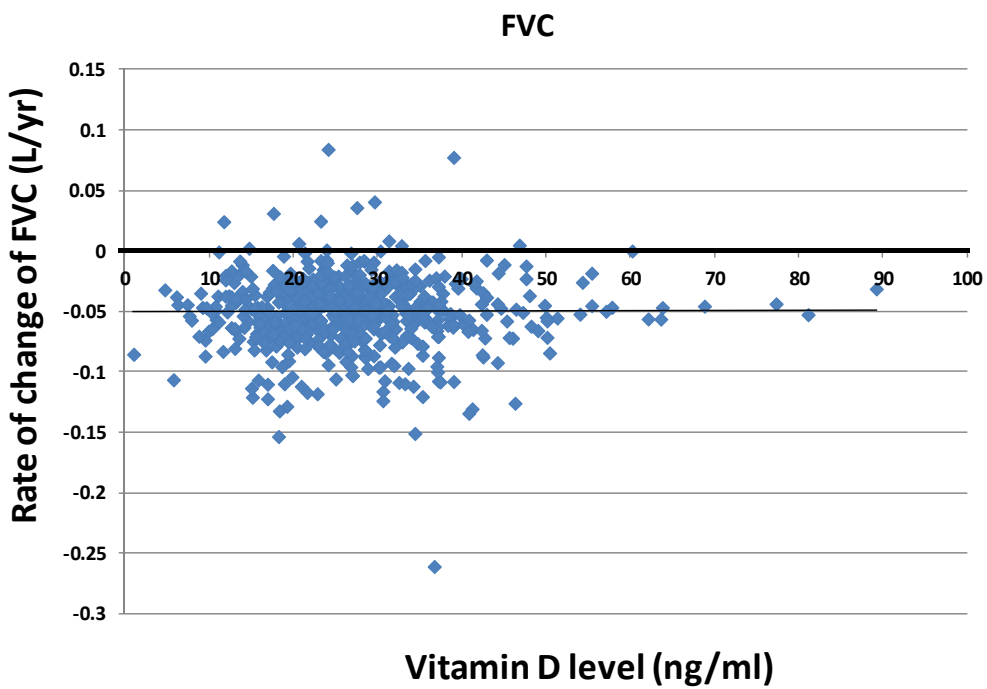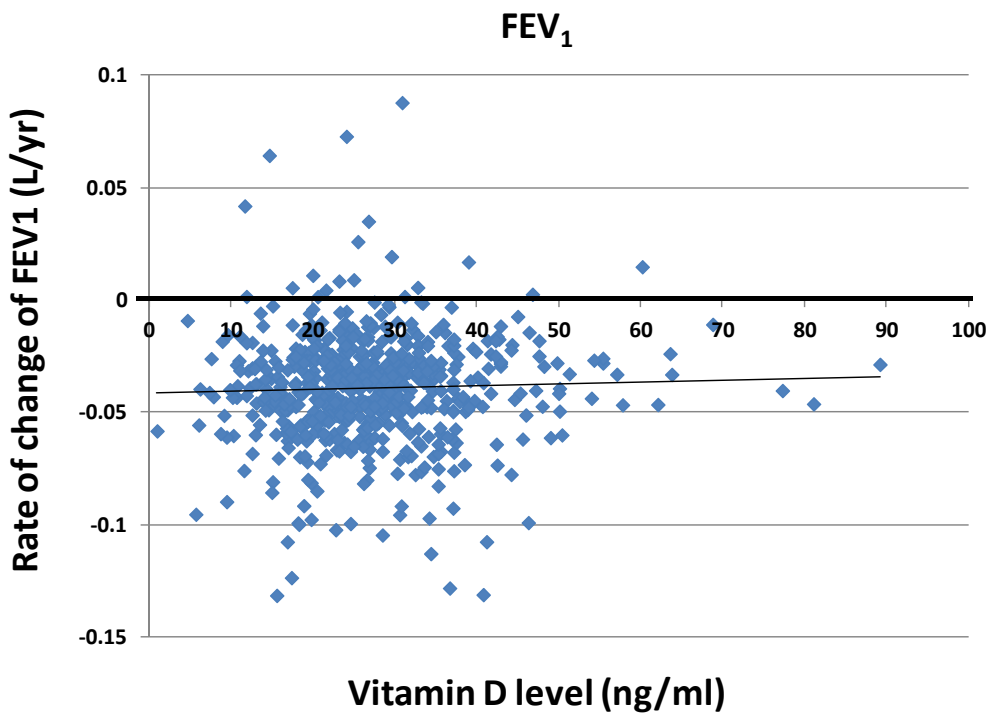
<u>Figure E4</u>: Relationship between Lung Function, Vitamin D deficiency, and Smoking Status

Shown here is the cross-sectional relationship between lung function (FEV_1% predicted) and smoking status.

In current smokers, the mean FEV_1% predicted was significantly lower in those who were vitamin D deficient, compared to those who were not. In ex and non-smokers, there was no significant difference between subjects with and without vitamin D deficiency.