

**Supplemental Table 1.** Unadjusted weighted means and percentages (standard errors)<sup>1</sup>. All persons ages 20 years and older by serum 25-hydroxyvitamin D concentration (nmol/L). NHANES III baseline survey 1988-94 with follow-up through 2006.

Variables	Serum total 25-hydroxyvitamin D (nmol/L)								
	< 20	20-29	30-39	40-49	50-59	60-74	75-99	100-119	≥ 120
Age (yr) at Interview	46 (1.9)	46 (0.9)	47 (0.7)	47 (0.7)	47 (0.7)	45 (0.5)	43 (0.7)	41 (1.0)	37 (0.8)
Person-Years Follow-up (yr)	13.0 (0.4)	13 (0.3)	13 (.2)	14 (0.2)	14 (0.2)	14 (0.2)	14 (0.3)	14 (0.3)	14 (0.4)
Serum 25(OH)D (nmol/L) <sup>3</sup>	17 (0.2)	26 (0.1)	35 (0.1)	45 (0.1)	55 (0.1)	67 (0.1)	85 (0.2)	108 (0.3)	139 (1.4)
Calculated Glomerular Filtration Rate mL/(min*1.73m <sup>2</sup> ) <sup>4</sup>	99 (2.3)	100 (1.3)	95 (1.2)	92 (0.9)	92 (0.7)	91 (0.6)	90 (0.8)	91 (0.9)	92 (1.5)
Body Mass Index (kg/m <sup>2</sup> )	27.2 (0.6)	28.2 (0.4)	28.1 (0.2)	27.7 (0.3)	27.0 (0.2)	26.3 (0.2)	25.4 (0.2)	24.6 (0.2)	24.1 (0.4)
Systolic Blood Pressure (mm Hg)	129 (2.0)	124 (1.1)	125 (0.7)	125 (0.6)	123 (0.7)	122 (0.5)	121 (0.7)	120 (1.1)	119 (1.1)
Men (%)	29 (4.5)	31 (1.7)	35 (1.7)	43 (1.7)	48 (1.3)	52 (1.3)	58 (1.2)	55 (2.6)	52 (3.6)
Mexican-Americans (%)	5 (1.4)	7 (0.7)	7 (0.8)	7 (0.7)	6 (0.6)	5 (0.4)	3 (0.3)	2 (0.3)	1 (0.4)
non-Hispanic blacks (%)	48 (6.2)	44 (2.4)	27 (1.7)	15 (1.0)	8 (0.8)	4 (0.4)	2 (0.3)	1 (0.2)	1 (0.4)
non-Hispanic whites (%)	40 (6.7)	38 (2.6)	53 (2.9)	66 (1.9)	78 (1.6)	84 (1.2)	91 (1.0)	94 (1.2)	97 (0.7)
Other Race/Ethnic Group (%)	6 (3.3)	11 (2.5)	13 (1.6)	11(1.3)	8 (1.1)	7 (1.1)	4 (0.9)	3 (1.2)	1 (0.5)
Season (% Winter)	73 (5.5)	57 (5.4)	51 (4.8)	47 (4.4)	38 (4.4)	36 (3.6)	29 (3.9)	23 (3.4)	19 (4.8)
Current Smokers – Yes (%)	39 (4.9)	34 (2.9)	31 (1.6)	27 (1.5)	27 (1.7)	25 (1.2)	28 (1.8)	34 (3.3)	33 (5.0)
Leisure Time Physical Activity									
Low < 4.65 METS/week	65 (6.1)	62 (2.2)	53 (2.3)	49 (1.8)	39 (1.8)	35 (1.7)	28 (1.5)	26 (3.0)	20 (2.8)
Moderate 4.65-22.5 METS/week	23 (6.0)	22 (1.8)	28 (1.5)	29 (1.5)	34 (1.7)	37 (1.3)	36 (1.7)	35 (3.1)	31 (3.6)

High > 22.5 METS/Week	12 (2.2)	16 (1.5)	20 (1.9)	22 (1.3)	27 (1.3)	27 (1.7)	36 (1.9)	39 (3.3)	49 (4.4)
Education: < High School (%)	26 (3.9)	29 (1.7)	28 (1.7)	27 (1.6)	26 (1.3)	25 (1.3)	21 (1.9)	21 (2.9)	20 (3.8)
Education: High School (%)	37 (4.1)	38 (2.4)	37 (1.7)	33 (1.5)	33 (1.2)	31 (1.1)	34 (1.4)	36 (2.9)	26 (3.5)
Education: > High School (%)	37 (4.8)	33 (2.5)	35 (1.8)	40 (2.0)	41 (1.4)	44 (1.6)	44 (2.5)	43 (3.8)	54 (4.9)
Medicine Usage <sup>5</sup> – Yes (%)	20 (5.9)	16 (1.6)	16 (1.3)	16 (1.2)	17 (1.0)	14 (0.9)	13 (1.0)	19 (2.4)	24 (3.4)
Self-reported History of :									
Diabetes (%)	6 (1.7)	6 (0.8)	10 (0.9)	6 (0.7)	6 (0.7)	5 (0.5)	3 (0.3)	3 (1.1)	2 (1.3)
Congestive Heart Failure (%)	4 (1.6)	2 (0.5)	3 (0.5)	2 (0.5)	3 (0.4)	2 (0.3)	2 (0.3)	1 (0.4)	1 (0.5)
Stroke (%)	3 (1.8)	3 (0.8)	3 (0.6)	2 (0.4)	2 (0.3)	2 (0.3)	2 (0.2)	2.1 (0.8)	0 (0.2)
Heart Attack (%)	4 (1.7)	2 (0.6)	4 (0.6)	4 (0.6)	4 (0.6)	4 (0.5)	3 (0.4)	2 (0.8)	2 (0.9)
Cancer <sup>6</sup> (%)	6 (1.6)	3 (0.6)	3 (0.7)	5 (0.6)	4 (0.7)	4 (0.4)	4 (0.5)	4 (1.2)	2 (1.2)

Sources: Centers for Disease Control and Prevention, National Center for Health Statistics, Third National Health and Nutrition Examination Survey, 1988-1994 and the public use version of the NHANES III Linked Mortality File.

Sources: Centers for Disease Control and Prevention, National Center for Health Statistics, Third National Health and Nutrition Examination Survey, 1988-1994 and the public use version of the NHANES III Linked Mortality File.

<sup>1</sup>Standard error in parentheses.

<sup>2</sup>The t-test for the difference between those assumed alive and assumed deceased is significant with  $p < 0.01$ .

<sup>3</sup>Based on serum 25(OH)D values (nmol/L) calibrated to the DiaSorin assay kit available in 2004 using the following equation: NHANES III 25(OH)D<sub>Corrected to 2004 RIA</sub> = 0.8429 x NHANES III 25(OH)D<sub>1988-94 RIA</sub> + 2.5762 (mmol/L). [See Looker *et al.*, AJCN 2008;88:1519-1527 for more details.]

<sup>4</sup>Serum creatinine (mg/dL) was calibrated to the Cleveland Clinic Research Laboratory (CCRL) using the equation CCRL creatinine = 0.96 (NHANES III creatinine value) – 0.184 mg/dL (Please see Selvin *et al.* Am J Kidney Dis 2007;50:918-926) and glomerular filtration rate (GFR)

was calculated using the IDMS-Traceable Modification of Diet in Renal Disease (MDRD) Study equation (Please see Levy *et al.* Ann Intern Med 2006;145:247-254 for more details.)

<sup>5</sup>Self-reported usage any of the following prescription medications: anticonvulsants, glucocorticoids, estrogens, loop diuretics or thiazide diuretics during the 30 days prior to interview.

<sup>6</sup>Self-reported history of cancer other than skin cancer.

**Supplemental Table 2.** Unweighted raw numbers of deaths ( $N_{\text{Deaths}}$ ) by length of follow-up, demographic group, cause of death and by baseline serum concentration of total 25-hydroxyvitamin D (nmol/L). NHANES III baseline 1988-1994.

Category	Total	Serum total 25-hydroxyvitamin D (nmol/L)								
		< 20	20-29	30-39	40-49	50-59	60-74	75-99	100-119	≥ 120
<b>Follow-up</b>										
Follow-up to 2000 (9 years)	2,257	47	191	381	409	385	439	319	69	17
Follow-up to 2006 (15 years)	3,784	79	297	592	694	668	775	533	110	36
<b>Demographic Group<sup>1</sup></b>										
<b>Sex<sup>1</sup></b>										
Men	2,066	28	113	265	360	375	480	351	66	28
Women	1,718	51	184	327	334	293	295	182	44	8
<b>Age (yr) at interview<sup>1</sup></b>										
20-64	1,167	33	120	217	230	173	214	133	30	17
65+	2,617	46	177	375	464	495	561	400	80	19
<b>Race/Ethnicity<sup>1</sup></b>										
Mexican-American	687	15	67	125	170	109	113	73	9	6
non-Hispanic black	878	40	137	221	175	125	111	56	10	3
non-Hispanic white	2,134	22	89	230	335	417	535	392	87	27
Other <sup>2</sup>	85	2	4	16	14	17	16	12	4	.
<b>Causes of Death<sup>1</sup></b>										
Cancer	826	9	58	129	151	150	172	119	25	13
Cardiovascular Diseases	1,660	33	131	274	311	278	338	238	49	8
Other	1,106	31	90	165	201	206	220	150	31	12
Accidents	145	4	13	19	24	27	31	20	5	2
Unknown	47	2	5	5	7	7	14	6	.	1

Sources: Centers for Disease Control and Prevention, National Center for Health Statistics, Third National Health and Nutrition Examination Survey, 1988-1994 and the public use version of the NHANES III Linked Mortality File.

<sup>1</sup>Follow-up through 2006 (15 years).

<sup>2</sup>Due to small sample size, no data analyses were conducted for the “Other” group.

**Supplemental Table 3.** Unweighted raw sample size (N) by length of follow-up, demographic group, cause of death and by baseline serum concentration of total 25-hydroxyvitamin D (nmol/L). NHANES III baseline 1988-1994.

Category	Total	Serum total 25-hydroxyvitamin D (nmol/L)								
		< 20	20-29	30-39	40-49	50-59	60-74	75-99	100-119	≥ 120
<b>Follow-up</b>										
Follow-up to 2000 (9 years)	15,099	251	1,270	2,340	2,790	2,526	3,046	2,156	518	202
Follow-up to 2006 (15 years)	15,099	251	1,270	2,340	2,790	2,526	3,046	2,156	518	202
<b>Demographic Group<sup>1</sup></b>										
<b>Sex<sup>1</sup></b>										
Men	7,216	68	394	896	1,243	1,285	1,680	1,260	285	105
Women	7,883	183	876	1,444	1,574	1,241	1,366	896	233	97
<b>Age (yr) at interview<sup>1</sup></b>										
20-64	11,359	200	1,034	1,831	2,104	1,826	2,233	1,562	397	172
65+	3,740	51	236	509	686	700	813	594	121	30
<b>Race/Ethnicity<sup>1</sup></b>										
Mexican-American	4,088	46	305	660	907	763	859	452	73	23
non-Hispanic black	4,052	164	754	1,067	879	536	419	197	25	11
non-Hispanic white	6,352	36	173	513	865	1,124	1,633	1,440	402	166
Other <sup>2</sup>	607	5	38	100	139	103	135	67	18	2
<b>Causes of Death<sup>1</sup></b>										
Denominator	15,099	251	1,270	2,340	2,790	2,526	3,046	2,156	518	202

Sources: Centers for Disease Control and Prevention, National Center for Health Statistics, Third National Health and Nutrition Examination Survey, 1988-1994 and the public use version of the NHANES III Linked Mortality File.

<sup>1</sup>Follow-up through 2006 (15 years)

<sup>2</sup>Due to small sample size, no data analyses were conducted for the “Other” group.

## Materials and Methods

*Measurements.* Serum 25(OH)D measurements in NHANES III were performed by the National Center for Environmental Health, CDC by using a radioimmunoassay (RIA) kit (DiaSorin, Stillwater, MN) (9,10). The manufacturer reformulated the kit in the late 1990s by introducing an antibody that improved binding. In a subsequent calibration study of 150 banked serum samples an equation to estimate NHANES III values using the more recent kit was developed (11). The equation is:

$$\text{NHANES III 25(OH)D}_{\text{Reformulated 2004 RIA}} = \\ [0.8429 \times \text{NHANES III 25(OH)D}_{1988-94 \text{ RIA}}] + 2.5762 \text{ nmol/L}$$

Reformulated values for serum 25(OH)D in nmol/L (ng/ml  $\approx$  nmol/L/2.5) are reported in this paper for all analyses.

Analytic Sample: A total of 23,258 participants ages 20 and older were selected to participate in NHANES III, 18, 825 were interviewed, and 16, 573 received the MEC examination including a blood draw. Excluded from that sample were those missing information on vital status (n=11), women who were pregnant at baseline (n=338), who were missing data for serum total 25(OH)D (n=765), serum creatinine (n=344), BMI (n=34), and SBP (n=25), and zero length of follow-up time from the date of examination (n=7) for a total analytic sample size of 15,099 participants. The analytic sample represents 80% of the interviewed sample, and 91% of the examined sample ages 20 years and older in NHANES III. In preliminary analyses it was found that while the NHANES III participants 20 years of age and older excluded from the analyses (n = 1,474) compared with those included in the analytic sample (n=15,099) were slightly younger (mean age 40 yr. vs. 45 yr.), and included proportionally more women (64% vs. 51%) and non-Hispanic blacks (20% vs. 10%), they were remarkably similar in mean BMI (26.0 vs. 26.6), systolic blood pressure (119 vs. 123 mmHg), the prevalence of current smokers (27% vs. 28%), the percent examined during the months November-April (38% vs. 38%) and the prevalence with a self-



reported history of diabetes (5% vs. 5%), congestive heart failure (2% vs. 2%), stroke (2% vs. 2%), heart attack (5% vs. 4%) and cancer (4% vs. 4%).