

WHAT WE EAT IN AMERICA, NHANES 2005-2006

USUAL NUTRIENT INTAKES FROM FOOD AND WATER
COMPARED TO 1997 DIETARY REFERENCE INTAKES FOR
Vitamin D, Calcium, Phosphorus, and Magnesium



U.S. Department of Agriculture
Agricultural Research Service
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Food Surveys Research Group
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Abstract

This report presents national estimates of usual nutrient intake distributions from food and water for vitamin D, calcium, phosphorus, and magnesium and compares those estimates to the Dietary Reference Intakes published by the Institute of Medicine in 1997. Estimates are based on data from 8,437 individuals ages 1 year and over (excluding breast-fed children and pregnant or lactating females) and 327 pregnant females 19-50 years of age who completed a 24-hour dietary recall in *What We Eat in America*, the dietary interview component of the National Health and Nutrition Examination Survey, 2005-2006. Data include nutrient intake estimates from food (both naturally present and fortified) and water only and exclude nutrient intake estimates contributed by dietary supplements and medications or that obtained from sunlight. Statistics are reported for 22 gender/age/lifestage groups. The nutrient values for this report are from two sources. The vitamin D values are based on the Vitamin D Addendum to the USDA Food and Nutrient Database for Dietary Studies 3.0, and the values for the remaining nutrients are based on the USDA Food and Nutrient Database for Dietary Studies 3.0 (both derived from the USDA National Nutrient Database for Standard Reference).

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Methodology

Dietary Reference Intakes

The Food and Nutrition Board of the Institute of Medicine, the National Academies, established a set of reference values for nutrients called Dietary Reference Intakes (DRIs) for use in planning and assessing diets of apparently healthy people (1-7). The DRIs used in this report are those appropriate for assessing intakes of population groups, and include Adequate Intakes (AI) for vitamin D and calcium, Estimated Average Requirements (EAR) for phosphorus and magnesium, and Tolerable Upper Intake Levels (UL) for vitamin D, calcium, and phosphorus. **The assessments presented in this report cover nutrient intakes from foods and water only and therefore, are not total nutrient intakes.** They do not contain intakes from dietary supplements or medications or estimates of vitamin D obtained from sunlight. This report was provided to the Institute of Medicine Committee to Review Dietary Reference Intakes for Vitamin D and Calcium established in early 2009 to review the 1997 DRIs for vitamin D and calcium (8). While this Committee is specifically reviewing vitamin D and calcium, data on phosphorus and magnesium are also included because of their key roles in bone health.

Dietary Intake Data

The statistics in this report are estimated from 24-hour dietary recall interviews conducted in the *What We Eat in America* (WWEIA), NHANES 2005-2006 (9). Dietary recalls were conducted by trained interviewers using the U.S. Department of Agriculture (USDA) Automated Multiple Pass Method (10). The day 1 recalls were conducted in-person in the NHANES Mobile Examination Center. The day 2 recalls were conducted by telephone approximately 3-10 days after the day 1 recall. Food intake information was coded using the USDA Food and Nutrient Database for Dietary Studies 3.0 (FNDDS 3.0), and that database was used to produce nutrient intake values for calcium, phosphorus, and magnesium (11). Since FNDDS 3.0 does not include values for vitamin D, a special vitamin D database (an addendum to FNDDS 3.0) was developed for estimating usual intakes of this vitamin from food (12). All FNDDS 3.0 items used to code foods reported in WWEIA, NHANES 2005-2006 are included. The values in this vitamin D database, and used in this report, represent the sum of both ergocalciferol (vitamin D₂) and cholecalciferol (vitamin D₃) and were based on the USDA Nutrient Database for Standard Reference, Release 22 (13). Another form of the vitamin, 25-hydroxycholecalciferol, which may be present in some foods, was not included in this addendum to FNDDS 3.0, or in Standard Reference, Release 22, because adequate data from validated methods were not available.

Beginning with WWEIA, NHANES 2005-2006, consumption of plain drinking water was collected and reported with the 24-hour food recall data (9). Nutrient database values used for this report include small amounts of calcium and magnesium in water estimated by national sampling (14), and these values are reflected in the intake estimates reported here.

Tables

This report presents estimates of usual nutrient intakes (Tables 1-4), including the mean, standard error of the mean, and intakes at the 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles for gender/age/lifestage groups for which DRIs have been established: children ages 1-3 and 4-8 years, males and females ages 9-13, 14-18, 19-30, 31-50, 51-70, and 71 years and older, and pregnant females ages 19-50 years. Additionally, summary estimates are presented for males and for females 19-50 years, 19 and older, 51 and older, and for males and females 1 year and older. Infants (<12 months of age) and lactating females were excluded from all tabulations because the sample sizes for both groups were not large enough for comparison to their unique DRIs. Pregnant females were also excluded except where noted. Breast-fed children were excluded because breast milk was not quantified in dietary recall interviews. Percentile values and their standard errors are reported for each nutrient in Appendix A (Tables A1-A4). Statistical guidelines for identifying potentially less reliable estimates as presented in the Third Report on Nutrition Monitoring in the United States, Volume 1 have been applied to Tables 1-4 and Tables A1-A4 (15). The sample counts for all gender/age/lifestyle groups from WWEIA, NHANES 2005-2006, including those not analyzed for this report as well as the proportion of the national population they represent, are provided in Appendix B.

The data in Tables 1-4 include tabulations by the DRI reference values for each nutrient. Tables 1 and 2 present usual intake estimates from food and water for vitamin D and calcium including percentile values and the percentages of individuals with intakes **above the AI**. Mean usual intake greater than the AI implies a low prevalence of inadequate intakes, especially when the AI is based on the mean intake of a healthy group. Tables 3 and 4 present usual intake estimates from food and water for phosphorus and magnesium including the percentile values and the percentages of individuals with intakes **below the EAR**. The EAR is the average daily nutrient intake level estimated to meet the requirement of half of the healthy individuals in a particular life stage and gender group. It is used to estimate the prevalence of inadequate intakes in a population group.

Estimates of the proportion of the population with usual intakes from food and water above the UL for vitamin D, calcium, and phosphorus are presented in their respective tables. The UL is the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects may increase. For most nutrients, the UL is based on the contribution from food, dietary supplements, and water. However, the UL estimates in this report are based on intakes from food and water only. Estimates for individuals exceeding the UL for magnesium were excluded because the UL applies only to intake from dietary supplements and medications, but not intake from food (1). It is important to note that the proportions of the population with intakes greater than the ULs shown in Tables 1-3 may be underestimated because they do not include nutrient intakes from dietary supplements and medications.

Usual Intake Determination

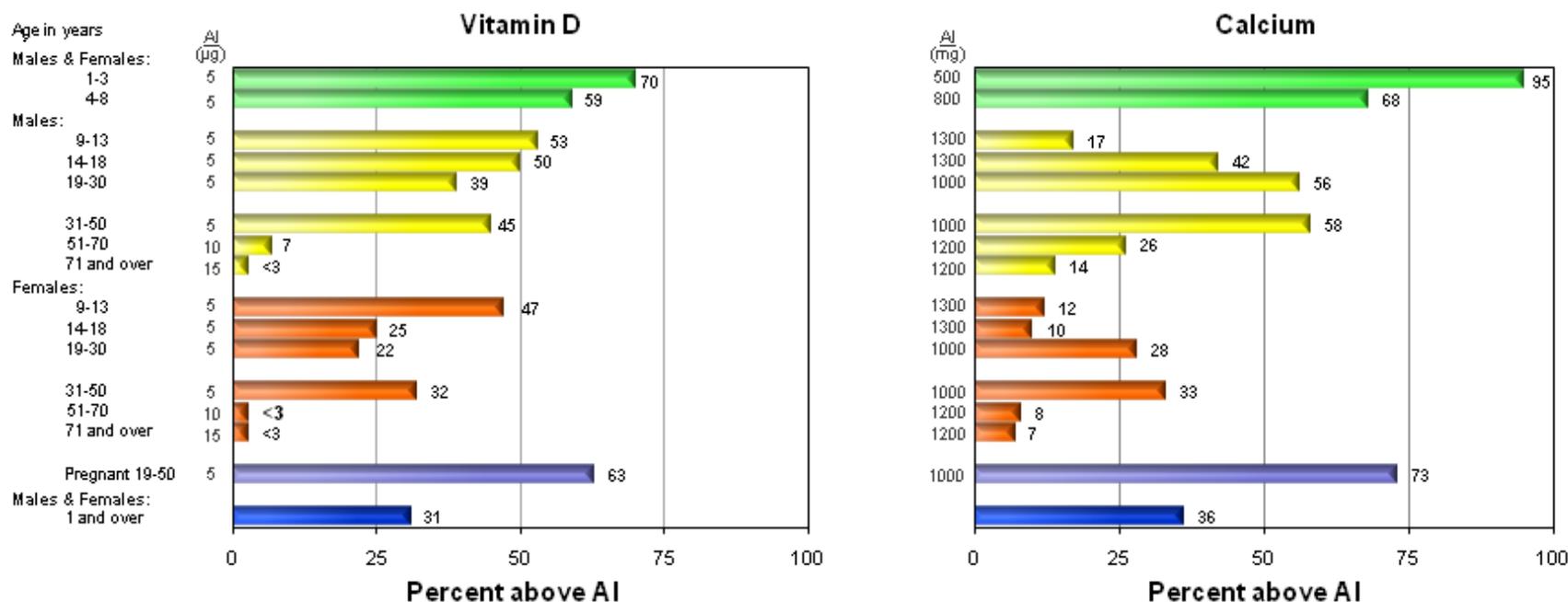
Usual intake estimates included in this report are based on the recommendation of the Institute of Medicine regarding the need to determine the distributions of usual nutrient intakes for assessing diets of population groups in relation to the DRIs (7). Nutrient intakes for an individual vary from day-to-day. This variation is referred to as within-individual variation. To determine usual nutrient intake for an individual, a large number of days of intake data is typically needed. It is seldom practical to collect long-term data for each person in a large group such as the sample from WWEIA, NHANES. Therefore, a statistical modeling method that accounts for within-individual variation in nutrient intakes while requiring relatively few days of intake per sampled individual was needed. A statistical method developed by the National Cancer Institute (NCI) was used to produce the usual intake distributions for this report (16). A brief description of the NCI method and its application for this report are provided in Appendix C.

Summarized Results

The graph below summarizes results on intake estimates from food and water reported in WWEIA, NHANES 2005-2006 for vitamin D and calcium, respectively, for which AIs have been established (1). The AI for a nutrient is the recommended average daily intake level that is assumed to be adequate. It is important to note that, unlike an EAR, an AI cannot be used to estimate the prevalence of inadequacy in a population. Further, the percentages of the population above the AI may underestimate the true percentage with adequate intakes due to additional intakes provided by supplements or medications. Percentages with intakes above the AI varied by gender/age/lifestage groups as reported in Tables 1 and 2 and summarized below.

- For both vitamin D and calcium, about one-third of individuals 1 year and over met their AI. Females 14-50 years were even less likely than their male counterparts to exceed their AI.
- For vitamin D, most individuals over 50 years regardless of gender did not meet their AI.

Usual Intakes from Food and Water
Percentage of Americans Above Adequate Intakes

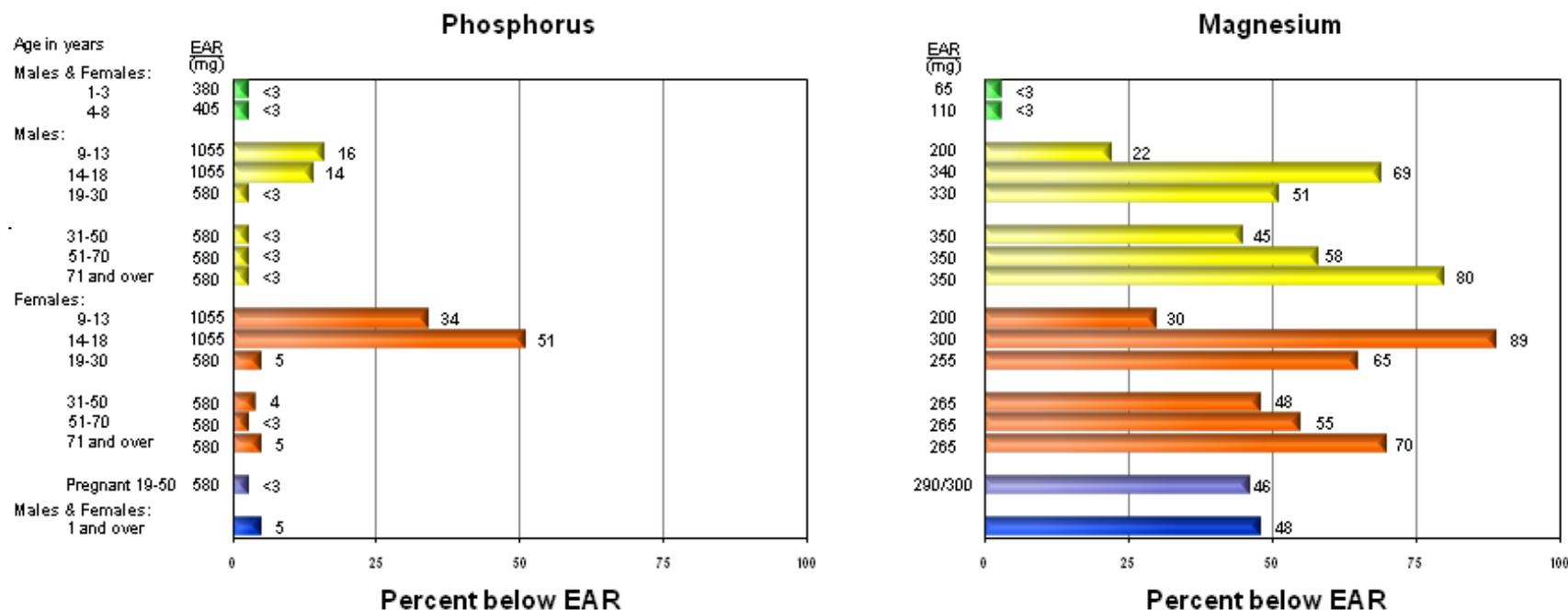


Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

The graph below summarizes results for adequacy of intake estimates reported in WWEIA, NHANES 2005-2006 for phosphorus and magnesium, respectively, nutrients for which EARs have been established (1). The EAR is the average daily nutrient intake level estimated to meet the requirement of half of the healthy individuals in a particular gender/age/lifestage group. It is used to estimate the prevalence of inadequate intakes in a population group. Percentages with inadequate intakes vary by gender/age/lifestage group as reported in Tables 3 and 4 and summarized below.

- With the exception of females 9-18 years of age, few individuals 1 year and over had inadequate intakes from food and water for phosphorus. About one-third of those ages 9-13 and one-half of those ages 14-18 had inadequate intakes of phosphorus.
- Overall, nearly one-half of all individuals 1 year and over had inadequate intakes of magnesium and the percentage of inadequacy was greater for some gender/age groups. More than two-thirds of 14-18 year olds and adults 71 years and over had inadequate intakes.

Usual Intakes from Food and Water Percentage of Americans Below Estimated Average Requirements



Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

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Table 1. Vitamin D[#] (µg): Usual Intakes from Food and Water, 2005-2006, Compared to Adequate Intakes and Tolerable Upper Intake Levels

Age in years	N	Day 1 Mean [†] (SE)	Percentiles of Usual Intake								AI ^{**}	Above AI		UL ^{**}	Above UL	
			5	10	25	50	75	90	95	%		(SE)	%			
Males and females:																
1-3.....	789	7.0 (0.23)	2.4	3.1	4.6	6.6	9.0	11.4	13.0	5	70	(2.6)	50	<3		
4-8.....	899	6.0 (0.24)	2.3	2.9	4.0	5.6	7.4	9.3	10.4	5	59	(3.6)	50	<3		
Males:																
9-13.....	522	5.5 (0.22)	2.1	2.6	3.7	5.2	7.2	9.3	10.7	5	53	(4.8)	50	<3		
14-18.....	654	6.2 (0.44)	1.3	1.8	3.0	5.0	8.1	11.7	14.3	5	50	(3.9)	50	<3		
19-30.....	549	5.1 (0.33)	1.3	1.7	2.6	4.2	6.5	9.5	11.7	5	39	(3.5)	50	<3		
31-50.....	758	5.5 (0.26)	1.5	1.9	2.9	4.6	7.0	10.0	12.1	5	45	(3.3)	50	<3		
19-50.....	1307	5.4 (0.20)	1.4	1.8	2.8	4.5	6.8	9.8	12.1	5	43	(2.6)	50	<3		
51-70.....	614	5.1 (0.27)	1.5	1.9	2.9	4.5	6.6	9.1	10.9	10	7	(1.8)	50	<3		
71 and over.....	368	5.6 (0.41)	2.1*	2.6	3.6	5.1	7.1	9.2	10.7*	15	<3		50	<3		
51 and over.....	982	5.2 (0.28)	1.6	2.1	3.1	4.6	6.7	9.2	10.9	-	5	(1.5)	50	<3		
19 and over.....	2289	5.3 (0.18)	1.5	1.9	2.9	4.5	6.8	9.6	11.6	-	29	(1.9)	50	<3		
Females:																
9-13.....	525	5.2 (0.59)	1.5	2.0	3.1	4.8	7.0	9.4	11.1	5	47	(7.9)	50	<3		
14-18.....	643	3.8 (0.23)	1.1	1.4	2.1	3.3	5.0	6.9	8.4	5	25	(3.4)	50	<3		
19-30.....	481	3.8 (0.33)	0.8	1.1	1.8	3.0	4.7	6.9	8.6	5	22	(3.0)	50	<3		
31-50.....	693	4.3 (0.23)	0.9	1.3	2.1	3.6	5.7	8.5	10.7	5	32	(2.8)	50	<3		
19-50.....	1174	4.1 (0.17)	0.9	1.2	2.0	3.4	5.4	8.1	10.1	5	29	(2.2)	50	<3		
51-70.....	610	4.0 (0.44)	1.3	1.6	2.3	3.4	4.9	6.7	8.0	10	<3		50	<3		
71 and over.....	332	4.5 (0.21)	1.3*	1.7	2.6	3.9	5.8	7.8	9.2*	15	<3		50	<3		
51 and over.....	942	4.1 (0.31)	1.2	1.6	2.4	3.5	5.2	7.1	8.5	-	<3		50	<3		
19 and over.....	2116	4.1 (0.19)	1.0	1.4	2.1	3.4	5.3	7.7	9.5	-	17	(1.7)	50	<3		
Pregnant 19-50.....	328	6.3 (0.37)	2.4*	3.0	4.2	6.0	8.1	10.3	12.0*	5	63	(5.1)	50	<3		
Males and females:																
1 and over.....	8437	5.0 (0.12)	1.3	1.7	2.7	4.2	6.5	9.2	11.2	-	31	(1.3)	50	<3		

† ** <3 * See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table 2. Calcium (mg): Usual Intakes from Food and Water, 2005-2006, Compared to Adequate Intakes and Tolerable Upper Intake Levels

Age in years	N	Day 1 Mean [†] (SE)	Percentiles of Usual Intake							AI**	Above AI		UL**	Above UL	
			5	10	25	50	75	90	95		%	(SE)		%	<3
Males and females:															
1-3.....	789	947 (26.4)	494	576	728	923	1143	1364	1503	500	95	(1.2)	2500	<3	
4-8.....	899	961 (25.5)	529	607	748	930	1135	1340	1467	800	68	(2.7)	2500	<3	
Males:															
9-13.....	522	1023 (27.3)	611	688	828	1004	1211	1416	1545	1300	17	(5.1)	2500	<3	
14-18.....	654	1256 (57.0)	565	675	893	1191	1561	1943	2197	1300	42	(3.2)	2500	<3	
19-30.....	549	1141 (47.8)	532	626	805	1061	1388	1736	1971	1000	56	(3.5)	2500	<3	
31-50.....	758	1145 (27.5)	562	652	832	1083	1387	1718	1940	1000	58	(3.2)	2500	<3	
19-50.....	1307	1144 (27.5)	548	640	822	1076	1385	1726	1957	1000	57	(2.5)	2500	<3	
51-70.....	614	991 (21.5)	457	541	709	936	1220	1527	1732	1200	26	(2.1)	2500	<3	
71 and over.....	368	878 (27.8)	452*	523	660	838	1059	1286	1436*	1200	14	(3.6)	2500	<3	
51 and over.....	982	962 (20.7)	453	534	692	908	1178	1466	1670	1200	23	(2.2)	2500	<3	
19 and over.....	2289	1076 (22.1)	506	594	768	1008	1307	1638	1860	-	44	(2.1)	2500	<3	
Females:															
9-13.....	525	942 (72.1)	529	603	740	921	1131	1340	1472	1300	12	(7.7)	2500	<3	
14-18.....	643	843 (37.3)	404	481	622	810	1044	1288	1453	1300	10	(3.5)	2500	<3	
19-30.....	481	851 (39.1)	406	477	619	808	1034	1275	1433	1000	28	(3.9)	2500	<3	
31-50.....	693	886 (28.5)	394	472	625	834	1093	1371	1562	1000	33	(3.5)	2500	<3	
19-50.....	1174	875 (25.1)	396	471	620	824	1076	1347	1524	1000	31	(2.7)	2500	<3	
51-70.....	610	795 (34.0)	408	473	595	759	954	1159	1290	1200	8	(2.3)	2500	<3	
71 and over.....	332	759 (25.6)	375*	436	558	718	921	1136	1273*	1200	7	(1.4)	2500	<3	
51 and over.....	942	784 (22.0)	398	462	584	746	941	1151	1289	1200	8	(1.4)	2500	<3	
19 and over.....	2116	836 (19.9)	396	465	603	788	1017	1264	1427	-	21	(2.1)	2500	<3	
Pregnant 19-50.....	328	1237 (58.8)	684*	796	977	1217	1472	1713	1876*	1000	73	(7.0)	2500	<3	
Males and females:															
1 and over.....	8437	965 (17.9)	451	532	690	908	1178	1468	1664	-	36	(1.4)	2500	<3	

† ** <3 * See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table 3. Phosphorus (mg): Usual Intakes from Food and Water, 2005-2006, Compared to Estimated Average Requirements and Tolerable Upper Intake Levels

Age in years	N	Day 1 Mean [†] (SE)	Percentiles of Usual Intake							EAR**	Below EAR		UL**	Above UL %
			5	10	25	50	75	90	95		%	(SE)		
Males and females:														
1-3.....	789	1030 (26.3)	623	700	840	1013	1203	1389	1505	380	<3		3000	<3
4-8.....	899	1145 (27.4)	743	819	953	1122	1306	1487	1597	405	<3		3000	<3
Males:														
9-13.....	522	1321 (35.4)	910	989	1128	1297	1488	1673	1787	1055	16	(3.8)	4000	<3
14-18.....	654	1681 (61.5)	842	979	1246	1606	2043	2489	2785	1055	14	(3.5)	4000	<3
19-30.....	549	1656 (53.4)	996	1114	1326	1605	1930	2252	2457	580	<3		4000	<3
31-50.....	758	1727 (25.0)	1020	1147	1384	1686	2019	2351	2560	580	<3		4000	<3
19-50.....	1307	1701 (26.2)	1004	1129	1360	1657	1985	2319	2531	580	<3		4000	<3
51-70.....	614	1492 (30.0)	844	959	1179	1459	1787	2122	2336	580	<3		4000	<3
71 and over.....	368	1270 (27.6)	808*	894	1053	1248	1475	1697	1838*	580	<3		3000	<3
51 and over.....	982	1436 (27.9)	816	928	1135	1401	1710	2029	2244	580	<3		-	<3
19 and over.....	2289	1602 (24.3)	919	1042	1271	1557	1887	2222	2437	580	<3		-	<3
Females:														
9-13.....	525	1176 (57.5)	753	837	985	1167	1364	1548	1658	1055	34	(9.1)	4000	<3
14-18.....	643	1067 (29.8)	576	671	836	1046	1294	1540	1701	1055	51	(3.4)	4000	<3
19-30.....	481	1120 (40.8)	585	681	864	1090	1344	1596	1753	580	5	(2.0)	4000	<3
31-50.....	693	1197 (25.0)	623	729	924	1166	1438	1704	1876	580	4	(1.1)	4000	<3
19-50.....	1174	1172 (23.5)	609	711	901	1140	1410	1676	1838	580	4	(1.1)	4000	<3
51-70.....	610	1106 (34.0)	679	758	899	1079	1279	1480	1605	580	<3		4000	<3
71 and over.....	332	985 (28.8)	576*	648	785	956	1163	1372	1502*	580	5*	(2.0)	3000	<3
51 and over.....	942	1070 (20.6)	648	724	864	1041	1243	1446	1581	580	<3		-	<3
19 and over.....	2116	1128 (19.2)	620	713	885	1097	1340	1582	1732	580	3	(0.7)	-	<3
Pregnant 19-50.....	328	1484 (50.5)	858*	987	1199	1474	1764	2040	2224*	580	<3		3500	<3
Males and females:														
1 and over.....	8437	1328 (18.7)	697	802	1002	1271	1592	1919	2130	-	5	(0.5)	-	<3

† ** <3 * See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table 4. Magnesium (mg): Usual Intakes from Food and Water, 2005-2006, Compared to Estimated Average Requirements

Age in years	N	Day 1 Mean [†] (SE)		Percentiles of Usual Intake							EAR**	Below EAR % (SE)	
				5	10	25	50	75	90	95			
Males and females:													
1-3.....	789	187	(4.0)	122	134	156	184	215	245	264	65	<3	
4-8.....	899	211	(5.2)	138	152	176	206	240	273	293	110	<3	
Males:													
9-13.....	522	239	(5.3)	164	179	205	236	273	309	331	200	22 (5.2)	
14-18.....	654	300	(11.1)	159	182	227	288	360	434	483	340	69 (3.3)	
19-30.....	549	339	(9.0)	197	221	266	326	399	472	519	330	51 (3.0)	
31-50.....	758	373	(5.6)	222	249	298	363	437	512	561	350	45 (2.1)	
19-50.....	1307	360	(5.6)	211	237	286	350	423	500	549	-	47 (2.1)	
51-70.....	614	338	(7.9)	181	207	259	328	413	505	566	350	58 (2.4)	
71 and over.....	368	288	(7.6)	179*	199	237	282	335	386	419*	350	80 (3.1)	
51 and over.....	982	326	(6.8)	176	202	250	315	393	478	537	350	62 (2.1)	
19 and over.....	2289	347	(5.2)	197	223	272	336	412	491	544	-	53 (1.6)	
Females:													
9-13.....	525	227	(11.0)	153	167	192	224	259	292	312	200	30 (6.5)	
14-18.....	643	211	(6.3)	116	134	165	206	255	305	339	300	89 (2.9)	
19-30.....	481	234	(9.9)	127	144	179	225	279	337	376	255	65 (4.7)	
31-50.....	693	282	(7.3)	145	169	213	270	337	405	451	265	48 (2.8)	
19-50.....	1174	266	(6.9)	136	158	199	254	319	387	431	-	54 (3.1)	
51-70.....	610	264	(7.2)	157	176	211	256	308	360	393	265	55 (3.9)	
71 and over.....	332	232	(7.5)	127*	144	178	222	277	333	368*	265	70 (3.5)	
51 and over.....	942	255	(5.0)	147	166	200	246	298	352	389	265	60 (2.2)	
19 and over.....	2116	261	(4.8)	141	161	200	250	310	373	414	-	56 (2.1)	
Pregnant 19-50.....	328	317	(11.4)	175*	203	250	312	381	448	493*	-	46 (2.8)	
Males and females:													
1 and over.....	8437	284	(3.7)	147	169	211	270	341	416	465	-	48 (1.3)	

† ** <3 * See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Appendix A. Usual Nutrient Intakes from Food and Water, 2005-2006, Percentiles and Standard Errors

Table A1. Vitamin D[#] (µg): Usual Intakes from Food and Water, 2005-2006, Percentiles and Standard Errors

Age in years	Percentiles (SE)							
	5th	10th	25th	50th	75th	90th	95th	
Males and females:								
1-3.....	2.4 (0.20)	3.1 (0.21)	4.6 (0.20)	6.6 (0.23)	9.0 (0.33)	11.4 (0.46)	13.0 (0.56)	
4-8.....	2.3 (0.20)	2.9 (0.21)	4.0 (0.22)	5.6 (0.23)	7.4 (0.29)	9.3 (0.39)	10.4 (0.46)	
Males:								
9-13.....	2.1 (0.42)	2.6 (0.42)	3.7 (0.37)	5.2 (0.27)	7.2 (0.30)	9.3 (0.58)	10.7 (0.81)	
14-18.....	1.3 (0.22)	1.8 (0.24)	3.0 (0.30)	5.0 (0.35)	8.1 (0.50)	11.7 (0.83)	14.3 (1.11)	
19-30.....	1.3 (0.25)	1.7 (0.28)	2.6 (0.30)	4.2 (0.31)	6.5 (0.36)	9.5 (0.67)	11.7 (1.03)	
31-50.....	1.5 (0.16)	1.9 (0.18)	2.9 (0.22)	4.6 (0.26)	7.0 (0.37)	10.0 (0.60)	12.1 (0.80)	
19-50.....	1.4 (0.16)	1.8 (0.18)	2.8 (0.20)	4.5 (0.20)	6.8 (0.25)	9.8 (0.46)	12.1 (0.67)	
51-70.....	1.5 (0.22)	1.9 (0.24)	2.9 (0.28)	4.5 (0.30)	6.6 (0.37)	9.1 (0.59)	10.9 (0.81)	
71 and over.....	2.1 (0.28)	2.6 (0.29)	3.6 (0.31)	5.1 (0.37)	7.1 (0.57)	9.2 (0.86)	10.7 (1.10)	
51 and over.....	1.6 (0.22)	2.1 (0.23)	3.1 (0.25)	4.6 (0.29)	6.7 (0.39)	9.2 (0.63)	10.9 (0.84)	
19 and over.....	1.5 (0.10)	1.9 (0.11)	2.9 (0.12)	4.5 (0.15)	6.8 (0.26)	9.6 (0.45)	11.6 (0.62)	
Females:								
9-13.....	1.5 (0.58)	2.0 (0.59)	3.1 (0.57)	4.8 (0.57)	7.0 (0.78)	9.4 (1.26)	11.1 (1.63)	
14-18.....	1.1 (0.25)	1.4 (0.26)	2.1 (0.26)	3.3 (0.23)	5.0 (0.30)	6.9 (0.58)	8.4 (0.86)	
19-30.....	0.8 (0.25)	1.1 (0.27)	1.8 (0.30)	3.0 (0.29)	4.7 (0.31)	6.9 (0.52)	8.6 (0.82)	
31-50.....	0.9 (0.12)	1.3 (0.13)	2.1 (0.15)	3.6 (0.19)	5.7 (0.34)	8.5 (0.59)	10.7 (0.86)	
19-50.....	0.9 (0.10)	1.2 (0.11)	2.0 (0.13)	3.4 (0.15)	5.4 (0.25)	8.1 (0.47)	10.1 (0.65)	
51-70.....	1.3 (0.16)	1.6 (0.16)	2.3 (0.17)	3.4 (0.26)	4.9 (0.51)	6.7 (0.89)	8.0 (1.20)	
71 and over.....	1.3 (0.16)	1.7 (0.18)	2.6 (0.19)	3.9 (0.20)	5.8 (0.26)	7.8 (0.37)	9.2 (0.52)	
51 and over.....	1.2 (0.10)	1.6 (0.10)	2.4 (0.12)	3.5 (0.19)	5.2 (0.37)	7.1 (0.65)	8.5 (0.89)	
19 and over.....	1.0 (0.06)	1.4 (0.07)	2.1 (0.08)	3.4 (0.13)	5.3 (0.26)	7.7 (0.48)	9.5 (0.66)	
Pregnant 19-50.....	2.4 (0.46)	3.0 (0.46)	4.2 (0.40)	6.0 (0.34)	8.1 (0.54)	10.3 (1.00)	12.0 (1.37)	
Males and females:								
1 and over.....	1.3 (0.06)	1.7 (0.06)	2.7 (0.07)	4.2 (0.10)	6.5 (0.15)	9.2 (0.26)	11.2 (0.34)	

See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table A2. Calcium (mg): Usual Intakes from Food and Water, 2005-2006, Percentiles and Standard Errors

Age in years	Percentiles (SE)													
	5th		10th		25th		50th		75th		90th		95th	
Males and females:														
1-3.....	494	(22.8)	576	(20.3)	728	(17.9)	923	(24.3)	1143	(39.3)	1364	(58.2)	1503	(70.6)
4-8.....	529	(23.4)	607	(21.2)	748	(18.8)	930	(24.1)	1135	(36.6)	1340	(53.6)	1467	(64.7)
Males:														
9-13.....	611	(69.0)	688	(60.3)	828	(41.1)	1004	(25.3)	1211	(48.5)	1416	(89.7)	1545	(119.2)
14-18.....	565	(52.9)	675	(48.4)	893	(41.3)	1191	(39.1)	1561	(60.1)	1943	(98.5)	2197	(123.7)
19-30.....	532	(34.8)	626	(35.3)	805	(33.9)	1061	(38.2)	1388	(55.6)	1736	(88.2)	1971	(117.0)
31-50.....	562	(33.6)	652	(32.7)	832	(32.9)	1083	(30.0)	1387	(30.3)	1718	(39.6)	1940	(51.7)
19-50.....	548	(24.6)	640	(25.2)	822	(26.0)	1076	(26.6)	1385	(34.0)	1726	(50.3)	1957	(66.7)
51-70.....	457	(33.9)	541	(32.4)	709	(28.3)	936	(22.1)	1220	(32.0)	1527	(60.5)	1732	(86.2)
71 and over.....	452	(31.2)	523	(28.8)	660	(26.5)	838	(25.6)	1059	(42.4)	1286	(73.2)	1436	(96.7)
51 and over.....	453	(24.8)	534	(23.8)	692	(21.0)	908	(20.2)	1178	(29.8)	1466	(52.6)	1670	(73.6)
19 and over.....	506	(12.2)	594	(12.1)	768	(12.3)	1008	(17.1)	1307	(27.6)	1638	(42.1)	1860	(54.2)
Females:														
9-13.....	529	(120.0)	603	(108.4)	740	(85.9)	921	(70.0)	1131	(91.8)	1340	(145.7)	1472	(184.9)
14-18.....	404	(54.4)	481	(50.1)	622	(41.8)	810	(39.0)	1044	(52.8)	1288	(84.9)	1453	(110.6)
19-30.....	406	(43.8)	477	(41.8)	619	(37.8)	808	(33.4)	1034	(43.1)	1275	(67.7)	1433	(90.4)
31-50.....	394	(23.4)	472	(22.4)	625	(22.9)	834	(29.2)	1093	(44.9)	1371	(65.1)	1562	(83.6)
19-50.....	396	(26.3)	471	(25.0)	620	(23.6)	824	(23.4)	1076	(33.9)	1347	(54.5)	1524	(68.3)
51-70.....	408	(18.0)	473	(18.6)	595	(21.3)	759	(27.6)	954	(39.3)	1159	(54.0)	1290	(65.3)
71 and over.....	375	(24.6)	436	(24.3)	558	(23.8)	718	(23.6)	921	(27.4)	1136	(35.9)	1273	(44.2)
51 and over.....	398	(15.5)	462	(15.4)	584	(17.0)	746	(18.6)	941	(24.4)	1151	(34.1)	1289	(43.6)
19 and over.....	396	(16.0)	465	(15.6)	603	(15.0)	788	(16.8)	1017	(25.8)	1264	(42.0)	1427	(53.4)
Pregnant 19-50.....	684	(109.1)	796	(94.8)	977	(72.3)	1217	(58.8)	1472	(90.0)	1713	(149.7)	1876	(195.4)
Males and females:														
1 and over.....	451	(10.8)	532	(10.7)	690	(11.7)	908	(13.9)	1178	(18.3)	1468	(26.9)	1664	(32.8)

See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table A3. Phosphorus (mg): Usual Intakes from Food and Water, 2005-2006, Percentiles and Standard Errors

Age in years	Percentiles (SE)													
	5th		10th		25th		50th		75th		90th		95th	
Males and females:														
1-3.....	623	(19.7)	700	(16.9)	840	(15.8)	1013	(23.7)	1203	(38.0)	1389	(54.2)	1505	(64.5)
4-8.....	743	(32.2)	819	(30.2)	953	(27.7)	1122	(29.3)	1306	(36.6)	1487	(48.6)	1597	(57.3)
Males:														
9-13.....	910	(53.6)	989	(44.6)	1128	(29.3)	1297	(29.4)	1488	(58.2)	1673	(91.9)	1787	(114.5)
14-18.....	842	(77.9)	979	(70.8)	1246	(59.3)	1606	(46.6)	2043	(66.8)	2489	(121.5)	2785	(159.3)
19-30.....	996	(79.6)	1114	(72.9)	1326	(57.8)	1605	(47.8)	1930	(66.7)	2252	(111.9)	2457	(145.3)
31-50.....	1020	(37.9)	1147	(34.1)	1384	(28.4)	1686	(22.0)	2019	(26.1)	2351	(43.6)	2560	(58.3)
19-50.....	1004	(34.8)	1129	(33.1)	1360	(30.0)	1657	(24.8)	1985	(27.4)	2319	(41.1)	2531	(53.9)
51-70.....	844	(65.7)	959	(59.9)	1179	(47.6)	1459	(30.5)	1787	(30.4)	2122	(59.5)	2336	(86.3)
71 and over.....	808	(35.0)	894	(29.9)	1053	(23.8)	1248	(25.2)	1475	(43.6)	1697	(70.2)	1838	(88.1)
51 and over.....	816	(44.3)	928	(40.2)	1135	(34.3)	1401	(28.0)	1710	(31.2)	2029	(49.6)	2244	(67.8)
19 and over.....	919	(25.2)	1042	(23.8)	1271	(21.7)	1557	(20.9)	1887	(24.6)	2222	(35.5)	2437	(44.2)
Females:														
9-13.....	753	(102.4)	837	(90.2)	985	(70.3)	1167	(56.9)	1364	(66.5)	1548	(96.7)	1658	(118.0)
14-18.....	576	(42.6)	671	(36.7)	836	(27.7)	1046	(28.6)	1294	(47.5)	1540	(75.0)	1701	(95.0)
19-30.....	585	(49.3)	681	(45.8)	864	(43.9)	1090	(41.5)	1344	(45.5)	1596	(56.0)	1753	(65.2)
31-50.....	623	(36.6)	729	(31.8)	924	(23.5)	1166	(25.7)	1438	(44.9)	1704	(67.5)	1876	(85.2)
19-50.....	609	(33.4)	711	(30.3)	901	(25.2)	1140	(24.3)	1410	(35.0)	1676	(52.9)	1838	(63.2)
51-70.....	679	(19.4)	758	(18.3)	899	(20.7)	1079	(29.6)	1279	(43.0)	1480	(58.7)	1605	(68.6)
71 and over.....	576	(34.5)	648	(32.3)	785	(29.1)	956	(27.7)	1163	(35.2)	1372	(49.0)	1502	(60.4)
51 and over.....	648	(17.6)	724	(15.8)	864	(14.4)	1041	(15.7)	1243	(22.7)	1446	(33.6)	1581	(44.1)
19 and over.....	620	(22.2)	713	(19.1)	885	(15.3)	1097	(16.0)	1340	(26.3)	1582	(41.0)	1732	(50.8)
Pregnant 19-50.....	858	(55.2)	987	(47.2)	1199	(38.1)	1474	(51.2)	1764	(81.4)	2040	(121.8)	2224	(151.2)
Males and females:														
1 and over.....	697	(15.2)	802	(14.6)	1002	(14.0)	1271	(15.3)	1592	(18.2)	1919	(23.1)	2130	(27.8)

See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Table A4. Magnesium (mg): Usual Intakes from Food and Water, 2005-2006, Percentiles and Standard Errors

Age in years	Percentiles (SE)													
	5th		10th		25th		50th		75th		90th		95th	
Males and females:														
1-3.....	122	(3.6)	134	(3.4)	156	(3.1)	184	(3.6)	215	(5.3)	245	(7.7)	264	(9.2)
4-8.....	138	(5.4)	152	(4.9)	176	(4.4)	206	(5.1)	240	(7.0)	273	(9.7)	293	(11.6)
Males:														
9-13.....	164	(12.1)	179	(10.5)	205	(7.4)	236	(5.2)	273	(8.5)	309	(14.4)	331	(18.3)
14-18.....	159	(14.1)	182	(13.0)	227	(11.1)	288	(9.4)	360	(11.8)	434	(18.2)	483	(24.2)
19-30.....	197	(9.9)	221	(9.4)	266	(8.0)	326	(7.6)	399	(10.4)	472	(18.3)	519	(24.4)
31-50.....	222	(9.6)	249	(8.6)	298	(6.6)	363	(5.5)	437	(8.5)	512	(15.0)	561	(20.2)
19-50.....	211	(7.6)	237	(6.9)	286	(6.0)	350	(5.1)	423	(6.7)	500	(10.9)	549	(14.6)
51-70.....	181	(9.4)	207	(8.8)	259	(7.9)	328	(6.8)	413	(8.2)	505	(13.3)	566	(19.3)
71 and over.....	179	(6.8)	199	(6.4)	237	(6.7)	282	(7.4)	335	(9.1)	386	(11.7)	419	(13.5)
51 and over.....	176	(6.9)	202	(6.3)	250	(5.9)	315	(5.9)	393	(7.5)	478	(11.5)	537	(16.1)
19 and over.....	197	(5.2)	223	(4.8)	272	(4.3)	336	(4.4)	412	(6.0)	491	(9.6)	544	(12.8)
Females:														
9-13.....	153	(11.2)	167	(10.2)	192	(8.9)	224	(9.4)	259	(12.8)	292	(18.1)	312	(21.4)
14-18.....	116	(8.5)	134	(7.8)	165	(6.5)	206	(6.2)	255	(8.8)	305	(13.7)	339	(17.6)
19-30.....	127	(7.8)	144	(7.9)	179	(8.4)	225	(9.1)	279	(11.2)	337	(15.5)	376	(19.2)
31-50.....	145	(8.5)	169	(7.3)	213	(5.4)	270	(6.8)	337	(12.8)	405	(19.6)	451	(24.8)
19-50.....	136	(7.3)	158	(6.6)	199	(5.8)	254	(6.4)	319	(9.9)	387	(15.1)	431	(19.0)
51-70.....	157	(6.4)	176	(6.3)	211	(6.4)	256	(6.8)	308	(8.0)	360	(10.0)	393	(11.8)
71 and over.....	127	(5.8)	144	(5.7)	178	(5.8)	222	(6.4)	277	(9.0)	333	(12.8)	368	(15.9)
51 and over.....	147	(4.7)	166	(4.4)	200	(4.2)	246	(4.1)	298	(4.7)	352	(6.3)	389	(7.8)
19 and over.....	141	(4.9)	161	(4.5)	200	(3.9)	250	(4.1)	310	(6.2)	373	(9.3)	414	(11.8)
Pregnant 19-50.....	175	(16.1)	203	(12.4)	250	(9.2)	312	(11.1)	381	(19.4)	448	(29.8)	493	(39.0)
Males and females:														
1 and over.....	147	(2.7)	169	(2.8)	211	(2.9)	270	(3.2)	341	(3.8)	416	(5.1)	465	(6.6)

See Appendix D for table notes.

Source: What We Eat in America, NHANES 2005-2006. Excludes breast-fed children and lactating females. Pregnant females excluded except where noted.

Appendix B. Sample Sizes and Weighted Population Estimates, What We Eat in America, NHANES 2005-2006

Age in years	Sample count	Population Estimate (%)
Males and females:		
<i>Under 1, breastfeeding.....</i>	<i>166</i>	<i>0.6</i>
<i>Under 1, not breastfeeding.....</i>	<i>324</i>	<i>0.9</i>
<i>1-3, breastfeeding.....</i>	<i>18</i>	<i>0.1</i>
1-3.....	789	4.1
4-8.....	899	6.8
Males:		
9-13.....	522	3.5
14-18.....	654	3.9
19-30.....	549	8.0
31-50.....	758	13.9
19-50.....	1307	22.0
51-70.....	614	9.9
71 and over.....	368	3.3
51 and over.....	982	13.2
19 and over.....	2289	35.2
Females, not pregnant or lactating:		
9-13.....	525	3.3
14-18.....	643	3.4
19-30.....	481	6.7
31-50.....	693	13.7
19-50.....	1174	20.5
51-70.....	610	10.9
71 and over.....	332	4.6
51 and over.....	942	15.5
19 and over.....	2116	36.0
Females, pregnant or lactating:		
19-50, pregnant [†]	328	1.6
<i>18 and under, pregnant or lactating.....</i>	<i>38</i>	<i>0.1</i>
<i>19-50, lactating, not pregnant.....</i>	<i>38</i>	<i>0.5</i>
<i>51 and older, pregnant or lactating.....</i>	<i>0</i>	<i>0.0</i>
Males and females:		
1 and over, excluding pregnant or lactating females...	8437	96.2
<i>Total sample (all ages) with complete dietary intake data.....</i>	<i>9349</i>	<i>100.0</i>

Numbers and text in *italics* refer to groups excluded from the analyses presented in this report.

[†] Includes 4 pregnant females who are also lactating.

Appendix C. Procedure for Usual Intake Estimation

Overview of the General Method for Usual Intake Estimation

The method used to estimate the usual nutrient intake distributions presented in this report was developed at NCI (17). The NCI method permits the estimation of nutrients consumed by nearly all persons on nearly every day. This is referred to as the amount-only method and is applicable to the nutrient analyses presented in this report. The NCI method also permits the more complex estimation of the usual intake of episodically consumed foods or nutrients which requires a two-part approach that both estimates the probability of consuming a food or nutrient and estimates the amount consumed on a day when the food or nutrient is consumed. The software developed to implement the NCI method is in the form of SAS[®] macro programs (16). The subsequent discussion describes only the application of the amount-only aspect of the NCI method for usual intake estimation.

The following is a general summary of the amount-only usual intake estimation method.

1. Preliminary data adjustments

Preliminary data adjustments include shifting observed intake data by a small amount away from zero, incorporating survey weights, and correcting for the effect of the sample day (Day 1 versus Day 2) on the mean and the variance of the distribution of observed intakes. Adjustment may also be made for differences in diet due to non-person specific effects such as seasonality or weekend-versus-weekday eating patterns.

2. Transformation to normality

Observed intake data (whether adjusted or not) generally have nonnormal distributions. For certain nutrients skewness is quite extreme. Most statistical procedures rely on an assumption of normality. At this step the adjusted dietary intake data are transformed into normality by applying a Box-Cox power transformation.

3. Estimation of usual intake model parameters

A measurement error model is used, under the assumption of normality, to obtain estimates for the components of within- and between-individual variances for the amount model from the transformed intake data. The variance components are used to estimate the distribution of usual intakes in the normal scale, which is assumed to exhibit only between-individual variation. This model is fit by the maximum likelihood method. The parameter for the Box-Cox transformation described in step 2 is also estimated at the same time as part of the maximum likelihood procedure.

4. *Estimation of usual intake distribution for the population*

The model parameters estimated in step 3 are used to simulate an appropriate population. The within-person component of variance is not included because, by definition, it does not contribute to long-term, or usual intake. A back transformation into the original scale is also performed. The mean and percentiles are then estimated empirically from this simulated population.

Sampling Weights

The use of sampling weights is suggested when estimating usual intakes from WWEIA, NHANES 2005-2006 just as their use is suggested for other analyses of NHANES data (18). As with other large-scale surveys with a complex sample design, sampling weights may compensate for variable probabilities of selection, differential nonresponse rates, and possible deficiencies in the sampling frame. The NCI method allows for the use of sampling weights in estimating usual intake statistics. It is required, however, that the sampling weights used by the SAS[®] implementation be integers whereas the sampling weights disseminated as part of the WWEIA, NHANES 2005-2006 release are not integers. For this project it was necessary to convert the original full-sample set of day 1 dietary sampling weights to integers. As the Balanced Repeated Replicate (BRR) method was used to estimate standard errors for the percentiles and percentages presented in this report it was also necessary to generate sets of integer BRR weights. For this analysis, sixteen sets of BRR weights were generated. These are Fay-adjusted BRR weights with a perturbation factor of 70%, that is, $k = 0.3$.

Application of the NCI method

The NCI method implementation is comprised of two SAS[®] macros (16). The first macro, %MIXTRAN, transforms the data and fits the model. The second macro, %DISTRIB, uses the parameters estimated by %MIXTRAN to estimate the usual intake statistics through simulation. %DISTRIB can also provide the estimated percentage of the population whose usual intake falls below a given value. This feature provides the estimated percentages below EARs or above AIs and ULs.

%MIXTRAN permits the use of covariates in the model fitting procedure. All of the calls to %MIXTRAN included two covariates: 1) a variable indicating the sequence of an individual's intakes, that is, day 1 vs. day 2 and 2) a variable differentiating between weekday (M-Th) and weekend (F-Su) intakes. In addition, variables identifying gender/age groups were used when the estimation was of a broad age group such as males 19+ or all individuals 1+ years of age.

Standard errors of the estimated usual intake statistics were estimated with the BRR method. The actual estimates were produced by using the integerized full-sample weights. The estimations were then repeated sixteen additional times using the BRR weights as

described above. The results were used to generate estimated standard errors as the square root of: $c \sum_{g=1}^G (\hat{\theta}_g - \hat{\theta})^2$ where $\hat{\theta}$ is the full-sample statistic, $\hat{\theta}_g$ is the statistic from the g^{th} replicate, G is the number of replicates, k is the Fay adjustment factor, and $c = 1/G(1 - k)^2$. As there are $G = 16$ replicates and $k = 0.3$, $c = 0.127551$.

Computer and Programming Environment

All programs were run on personal computers running Windows XP. SAS[®] version 9.2 was used in making use of the NCI SAS[®] macros and for other SAS[®] programming. The sampling weights were calibrated and replicate weights were generated using WesVar[®] version 5.1.

Appendix D. Table Notes

- # The vitamin D intake estimates in this report reflect the sum of ergocalciferol (vitamin D₂) and cholecalciferol (vitamin D₃) content of foods reported by survey participants. The contribution of another form of vitamin D, 25-hydroxycholecalciferol, which may be present in certain foods, was not included because adequate data from validated methods for this form of vitamin D were not available (13). Caution is advised when comparing the intake estimates in this report to earlier estimates. Numerous factors including changes in the food supply and improvements in dietary interview, food composition analysis, and food sampling methodologies have occurred.
- † Daily mean and standard error of the mean for nutrients are estimated directly from day 1 intake data and do not reflect the NCI usual intake estimation approach used to estimate the distribution statistics. The conventional mean estimates are provided to be comparable to other tables produced by the Food Surveys Research Group. While the NCI method and the conventional method are both estimating the mean, the actual results may differ slightly.
- ** Percentile of usual intake as well as the estimates of percentages less than or greater than the DRI and the standard error of the percentage are the direct result of an estimation of the usual nutrient intake distribution for that specific gender/age/lifestage group. Exceptions were necessary for composite groups where the DRI value differs across the component groups including 19 and over, 51 and over, and 71 and over for males and for females, 19-50 pregnant females, and for males and females 1 and over. For these composite groups, the estimated percentage less than or greater than the DRI value was computed as an average of the percentages for the gender/age/lifestage subgroups comprising the composite group weighted proportionally by population size. Because a single DRI value for these composite groups does not exist, a hyphen is displayed.
- <3 Percentages less than 3 percent are represented by <3. Standard errors are not displayed in these cases.
- * Indicates an estimate that may be less statistically reliable than estimates that are not flagged. The rules for flagging estimated means, percentages, and percentiles are as follows:

Means An estimated mean is flagged when it is based on a sample size of less than 30 times the variance inflation factor (VIF) or when the relative standard error is greater than 30 percent. The VIF used in this report is 2.51. No such estimates are flagged in this report.

Percentages An estimated percentage that falls above 25 percent and below 75 percent is flagged following the same rule as estimated means. Also, an estimated percentage of 25 percent or lower or 75 percent or higher is flagged when the smaller of np and $n(1-p)$ is less than 8 times the VIF, where n is the sample size and p is the percentage expressed as a fraction. In this report, estimated percentages between 0 and 3% are displayed as <3 and the flagging rule is not applied to these estimates.

Percentiles Estimated percentiles are flagged following the sample size rules that direct flagging for percentages. Thus, values at the 5th or 95th percentiles are flagged when the sample size is less than 8 times the VIF (20.08) divided by 0.05 or 402. In this report, the 5th and 95th percentile estimates are flagged for three groups: males ages 71 years and over, females ages 71 years and over, and pregnant females ages 19-50 years.

Appendix E. References

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