

## SUPPLEMENTAL MATERIAL

**Supplemental Table 1. Food categories considered for this study and variables included in each one.**

<b>Food Categories</b>	<b>Variables</b>
Poultry	grams043 fried chicken, g
	grams044 chicken not fried, g
	grams105 mixed dishes with chicken, g
	grams187 chicken stew, pot pie, g
	grams278 restaurant fried chicken, g
	grams287 fried chicken (w/o skin), g
	grams288 fried chicken (with skin), g
	grams289 other chick or turk w/o skin, g
	grams290 other chicken (with skin), g
	grams291 fr chicken w/o skin, light mt, g
	grams292 fr chicken w skin, light meat, g
	grams293 other chick w/o skin light mt, g
	grams294 oth chicken w skin light meat, g
Red meat	grams038 hamburger, cheeseburger, g
	grams039 beef (roast, steak, sandwiches), g
	grams042 pork chops, roasts, dinner ham, g
	grams072 bacon, g
	grams101 veal, lamb or deer meat, g
	grams104 mixed dishes with beef or pork, g
	grams143 ribs, spareribs, g
	grams279 restaurant burgers, g
	grams285 pork (fat trimmed off), g
	grams286 pork (fat not trimmed off), g
	grams295 beef (fat trimmed off), g
	grams296 beef (fat not trimmed off), g
	grams297 beef trimmed & extra lean, g
	grams298 hamburger, regular, g
grams299 hamburger, extra lean, g	
Organ meat	grams041 liver, liverwurst, g
	grams126 menudo, g
	grams144 gizzard, neckbones, chitlins, g
Processed meat	grams053 hot dogs or dinner sausage, g
	grams054 ham, boloney, lunch meats, g
	grams073 breakfast sausage, g
	grams110 polish or italian sausage, g
	grams125 spam, g
	grams148 low-fat hot dogs, g
	grams149 low-fat lunch meats, g
Fish	grams045 fried fish, g

	grams046 tuna casserole, tuna sandwich, g
	grams048 fish not fried, g
	grams283 restaurant fried fish, g
	grams284 tuna in water, g
Shellfish	grams047 shellfish (shrimp, crab, etc.), g
	grams114 oysters, g
Leafy vegetables	grams027 spinach (cooked), g
	grams028 greens like collards, g
	grams029 coleslaw, cabbage, g
	grams031 green salad, g
Root vegetables	grams030 carrots, g
	grams033 sweet potatoes, g
Other vegetables	grams016 green beans or peas, g
	grams022 raw tomatoes, g
	grams024 broccoli, g
	grams025 cactus, g
	grams036 other vegetables, g
	grams040 vegetable stew, g
	grams055 vegetable soup, g
	grams103 tofu, bean curd, g
	grams108 alfalfa sprouts, g
	grams138 peas, g
	grams142 summer squash, g
	grams146 bean sprouts (cooked), g
	grams150 okra, g
	grams152 tomato juice, v-8 juice, g
	grams154 soy milk, g
	grams193 cauliflower, brussel sprouts, g
Cereals	grams057 white bread, french, ital.,etc, g
	grams058 dark bread, whole wheat, rye, g
	grams066 high fiber cereals, g
	grams067 product 19, total, just right, g
	grams068 cereal excl. fiber or fortified, g
	grams069 cooked cereal or grits, g
	grams075 doughnuts, pastry, g
	grams112 crackers, g
	grams119 bagels, eng.muffins, buns, g
	grams120 biscuits, muffins, g
	grams121 pancakes, waffles, pop tarts, g
	grams124 breakfast bars, power bars, g
	grams130 flour tortillas, g
	grams133 cookies, regular, g
	grams134 cookies, low-fat, g

grams137	stuffing, g
grams153	sweetened cereals like frosted, g
grams171	frybread, g
grams177	cake, low-fat, g
grams178	cake - regular, g
grams180	pasta salad, other pasta dish, g
grams181	tortillas - corn or flour, g
grams208	c01 all bran or bran buds cereal, g
grams209	alpha bits,sugar fr. oat cereal, g
grams210	apple jacks-apple/cinn.flavored, g
grams211	bran chex, g
grams212	bran, wheat, crude, g
grams213	bucweats, g
grams214	cap'n crunch, crunch berries, g
grams215	cheerios, g
grams220	cookie crisp chocolate chip cer, g
grams223	cracklin bran, cr oat bran, g
grams224	nutrific, g
grams225	froot loops-fruit flav.puffed, g
grams226	frosted mini-wheats, g
grams227	fruit squares, fruit wheats, g
grams228	c21 fruit-n-fiber cereal, or fiber1, g
grams229	fruitful bran, g
grams230	golden grahams;frosty o's;frank, g
grams231	graham crackos, g
grams232	granola-nature valley,heartland, g
grams233	grape nut flakes, g
grams234	grape nuts, g
grams235	honey nut cheerios, g
grams237	just right, g
grams238	king vitamin, kaboom, g
grams239	life, quaker, g
grams240	muesli, g
grams241	nutrigrain, g
grams242	oat product breakfast oat w soy, g
grams243	pop tarts, g
grams245	product 19-4 grain multi-vit.+f, g
grams248	puffed wheat, unsweetened, g
grams251	c44 raisin bran cereal, g
grams255	shredded wheat, sw & bran, g
grams256	special k-fort. high protein ce, g
grams259	sugar smacks-sugar coated puffe, g
grams260	super sugar crisp-sweetened whe, g

	grams261 team flakes, g
	grams262 total -- corn or wheat, g
	grams263 wheat chex, g
	grams264 wheat germ, (crude, commercial, g
	grams265 wheaties, kix, trix, g
	grams266 100% nat w/rais & da, cranbars, g
	grams267 40% bran flakes, g
Rice	grams035 rice or dishes with rice, g
	grams155 rice milk, g
	grams216 cocoa krispies-choc. flav. rice, g
	grams217 cocoa pebbles. fruity pebbles, g
	grams246 puffa-puffa rice-sugar coated p, g
	grams247 puffed rice, g
	grams253 rice chex, g
	grams254 rice krispies, crispix, g
Corn	grams019 corn, fresh, frozen or canned, g
	grams059 cornbread or hush puppies, g
	grams129 corn tortillas, g
	grams135 guysava, g
	grams184 popcorn plain, unbuttered, g
	grams218 cocoa puffs, g
	grams221 corn chex, g
	grams222 cornflakes, g
	grams236 honeycomb sweetened corn cereal, g
	grams244 post toasties corn flakes, g
	grams249 quaker oats corn bran cereal, g
	grams250 quisp -- (quaker oats co.), g
	grams257 sugar frosted flakes-corn cerea, g
	grams258 sugar pops, corn pops, g
Legumes	grams018 baked beans, blackeye p, pintos, g
	grams109 refried beans, bean burritos, g
	grams139 lentil, pea or bean soup, g
Nuts and seeds	grams061 peanut butter, g
	grams170 peanuts, other nuts & seeds, g
Baked and mashed potatoes	grams034 white potatoes baked, mashed, g
Fries and chips	grams032 french fries, fried potatoes, g
	grams060 salty snacks (chips, popcorn), g
Eggs	grams071 eggs or egg biscuits, g
Dairy products	grams062 butter, g
	grams074 ice cream, g
	grams080 cottage cheese, g
	grams081 cheese and cheese spreads, g
	grams082 yogurt, frozen yogurt, g

	grams083 whole milk, g
	grams084 reduced fat 2 % milk, g
	grams085 nonfat milk, g
	grams095 milk in coffee/tea (by program), g
	grams096 cream or half & half, g
	grams115 low-fat cheese & cheese spread, g
	grams117 low-fat ice cream, g
	grams118 low-fat yogurt, g
	grams123 pudding, g
	grams128 milk on cereal line item, g
	grams156 low-fat 1% milk, g
Fruits	grams001 apples or pears, g
	grams002 bananas, g
	grams003 canned/stewed peaches, apricots, g
	grams004 peaches, apricots, fresh, seas., g
	grams005 cantaloupe in season, g
	grams006 cantaloupe (year round), g
	grams007 watermelon in season, g
	grams008 canned fruit, applesauce, etc., g
	grams009 strawberries in season, g
	grams010 oranges, tangerines, g
	grams015 other fruits in season, g
	grams017 other fresh fruit (year round), g
	grams021 winter squash, g
	grams147 avocado, g
	grams161 pineapple, g
	grams162 prunes, prune juice, g
	grams165 grapes, g
	grams166 mangoes, g
	grams167 papayas, g
	grams168 honeydew, cassaba, g
	grams169 raisins, other dried fruit, g
Fruit juices	grams011 orange juice, crapefruit juice, g
	grams012 grapefruit, g
	grams013 drinks w. some juice, sunny d, g
	grams157 orange juice with calcium, g
	grams160 real frt juice excl orange,grft, g
Sauces and dressings	grams023 salsa, ketchup, taco sauce, g
	grams064 salad dressing, g
	grams065 gravy, g
	grams116 reduced fat mayonnaise, g
	grams131 sour cream, dips, cuacamole, g
	grams132 diet salad dressing, g

	grams145 mustard, bbq sauce, other sauce, g
	grams198 mayonnaise, sandwich spreads, g
Oil and fat	grams037 table fat added --by program, g
	grams063 margarine, g
	grams199 olive oil, canola oil, g
	grams200 vegetable oil, g
	grams201 half margarine, half butter, g
	grams202 soft margarine, g
	grams203 stick margarine, g
	grams204 lard, g
	grams205 crisco, g
	grams206 diet margarine, g
	grams207 whipped butter, g
Non-Alcoholic Drinks	grams014 koolaid, hi-c,vit.c-rich drinks, g
	grams086 soft drinks or snapple not diet, g
	grams087 diet soft drinks, g
	grams092 coffee, g
	grams093 tea or iced tea (not herbal), g
	grams094 nondairy creamer, g
	grams097 sugar or honey in coffee/tea, g
	grams098 non-alcoholic beer, g
	grams122 breakfast or diet shakes,ensure, g
	grams159 snapple, sweetnd bottled drinks, g
	grams163 hi-c, g
	grams164 cranberry juice cocktail, g
Alcoholic drinks	grams088 beer (regular), g
	grams089 wine or wine coolers, g
	grams090 liquor or mixed drinks, g
	grams091 light beer, g

**Supplemental Table 2. Cadmium concentrations (mg/kg) in the foods included in FDA Total Diet Study 2003 (1) grouped according to food categories considered for this study.**

Food Category	Foods included in the FDA sampling	No. Samples	Median (P27, P75) <sup>1</sup>
Poultry	Turkey breast, oven-roasted; Chicken potpie, frozen, heated; Chicken breast, oven-roasted (skin removed); Chicken nuggets, fast-food; Chicken breast, fried, fast-food (w/ skin); Chicken thigh, oven-roasted (skin removed); Chicken leg, fried, fast-food (w/ skin); Chicken w/ vegetables in sauce, from Chinese carry-out; Chicken filet (broiled) sandwich on bun, fast-food.	36	0.006 (0.005, 0.007)
Red meat	Beef, ground, regular, pan-cooked; Beef roast, chuck, oven-roasted; Ham, cured (not canned), baked; Pork chop, pan-cooked w/ oil; Pork bacon, oven-cooked; Pork roast, loin, oven-roasted; Lamb chop, pan-cooked w/ oil; Quarter-pound hamburger on bun, fast-food; Meatloaf, beef, homemade; Beef stroganoff w/ noodles, homemade; Quarter-pound cheeseburger on bun, fast-food; Beef steak, loin/sirloin, broiled; Stew, beef and vegetable, canned; Beef w/ vegetables in sauce, from Chinese carry-out.	56	0.004 (0.003, 0.005)
Organ meat	Liver (beef/calf), pan-cooked w/ oil.	4	0.033 (0.026, 0.038)
Processed meat	Pork sausage (link/patty), oven-cooked; Frankfurter (beef/pork), boiled; Bologna (beef/pork); Salami, luncheon-meat type (not hard); Luncheon meat, ham; Luncheon meat (chicken/turkey).	24	0.004 (0.002, 0.005)
Fish	Fish sticks or patty, frozen, oven-cooked; Tuna noodle casserole, homemade; Fish sandwich on bun, fast-food; Salmon, steaks/fillets, baked; Catfish, pan-cooked w/ oil; Tuna, canned in water, drained.	24	0.010 (0.009, 0.011)
Shellfish	Shrimp, boiled.	4	0.013 (0.007, 0.022)
Leafy vegetables	Spinach, fresh/frozen, boiled; Collards, fresh/frozen, boiled; Lettuce, iceberg, raw; Cabbage, fresh, boiled; Celery, raw; Coleslaw, mayonnaise-type, from grocery/deli; Lettuce, leaf, raw.	28	0.046 (0.031, 0.064)
Root vegetables	Beets, canned; Carrot, fresh, peeled, boiled; Turnip, fresh/frozen, boiled; Carrot, baby, raw; Sweet potatoes, canned.	20	0.014 (0.011, 0.022)
Other vegetables	Peas, green, fresh/frozen, boiled; Broccoli, fresh/frozen, boiled; Asparagus, fresh/frozen, boiled; Cauliflower, fresh/frozen, boiled; Tomato, raw; Green beans, fresh/frozen, boiled; Green beans, canned; Cucumber, peeled, raw; Summer squash, fresh/frozen, boiled; Pepper, sweet, green, raw; Onion, mature, raw; Soup, tomato, canned, cond, prep w/ water; Dill cucumber pickles; Tomato juice, bottled; Brussels sprouts, fresh/frozen, boiled; Mushrooms, raw; Eggplant, fresh, peeled, boiled; Okra, fresh/frozen, boiled; Mixed vegetables, frozen, boiled; Black olives.	80	0.008 (0.006, 0.009)

Cereals	Oatmeal, plain, cooked; Cream of wheat (farina), enriched, cooked; Bread, white, enriched; Biscuits, refrigerated-type, baked; Bread, whole wheat; Tortilla, flour; Bread, rye; Muffin, fruit or plain; Crackers, saltine; Noodles, egg, enriched, boiled; Fruit-flavored cereal, presweetened; Shredded wheat cereal; Raisin bran cereal; Granola w/ raisins; Oat ring cereal; Cake, chocolate w/ icing; Sweet roll/Danish pastry; Chocolate chip cookies; Bread, cracked wheat; Bagel, plain, toasted; English muffin, plain, toasted; Crackers, graham; Crackers, butter-type; Doughnut, cake-type, any flavor, from donut store; Brownie; Sugar cookies; Pretzels, hard, salted; Pancakes, frozen, heated; Breakfast tart/toaster pastry; Macaroni salad, from grocery/deli; Spaghetti, enriched, boiled; Soup, Oriental noodles (ramen noodles), prep w/ water; Cake, yellow w/ icing; Granola bar, w/ raisins.	136	0.020 (0.018, 0.022)
Rice	Rice, white, enriched, cooked; Crisped rice cereal; Fried rice, meatless, from Chinese carry-out.	12	0.008 (0.006, 0.010)
Corn	Corn/hominy grits, enriched, cooked; Corn, fresh/frozen, boiled; Corn, canned; Cornbread, homemade; Corn/tortilla chips; Corn flakes cereal; Popcorn, microwave, butter-flavored.	28	0.004 (0.003, 0.005)
Legumes	Pinto beans, dry, boiled; Lima beans, immature, frozen, boiled; Refried beans, canned; White beans, dry, boiled.	16	0.004 (0.003, 0.006)
Nuts and seeds	Peanut butter, smooth/creamy; Peanuts, dry roasted, salted; Sunflower seeds (shelled), roasted, salted.	12	0.216 (0.179, 0.255)
Baked and mashed potatoes	Potato, boiled (w/out peel); Potato, baked (w/ peel); Potato salad, mayonnaise-type, from grocery/deli; Potatoes, mashed, prepared from fresh.	16	0.020 (0.017, 0.024)
Fries and chips	Potato chips; French fries, fast-food.	8	0.051 (0.043, 0.058)
Eggs	Eggs, scrambled w/ oil; Eggs, boiled.	8	0.000 (0.000, 0.000)
Dairy products	Milk, whole, fluid; Milk, lowfat (2%), fluid; Milk, chocolate, lowfat, fluid; Milk, skim, fluid; Milk shake, chocolate, fast-food; Cheese, American, processed; Cheese, cheddar, natural (sharp/mild); Butter, regular (not lowfat), salted; Cream, half & half; Ice cream, light, vanilla; Yogurt, lowfat, fruit-flavored; Cheese, Swiss, natural; Cream cheese; Ice cream, regular (not lowfat), vanilla; Sour cream; Cottage cheese, creamed, lowfat (2% milk fat); Sour cream dip, any flavor; Pudding, ready-to-eat, flavor other than chocolate.	72	0.001 (0.001, 0.002)
Fruits	Apple (red), raw (w/ peel); Orange (navel/Valencia), raw; Banana, raw; Watermelon, raw/frozen; Peach, raw/frozen; Applesauce, bottled; Pear, raw (w/ peel); Strawberries, raw/frozen; Fruit cocktail, canned in light syrup; Grapes (red/green), raw; Cantaloupe, raw/frozen; Grapefruit, raw; Pineapple, canned in juice; Raisins; Avocado, raw; Squash, winter (Hubbard or acorn), fresh/frozen, boiled; Peach, canned in light/medium syrup; Pear, canned in light syrup; Pineapple juice, frozen conc, reconstituted; Grape juice, frozen conc, reconstituted; Apricots, canned in heavy/light syrup.	84	0.004 (0.003, 0.006)



Fruit juices	Orange juice, frozen conc, reconstituted; Apple juice, bottled; Grapefruit juice, bottled; Prune juice, bottled; Lemonade, frozen conc, reconstituted; Fruit juice blend (100% juice), canned/bottled; Cranberry juice cocktail, canned/bottled; Orange juice, bottled/carton.	32	0.001 (0.000, 0.001)
Sauces and dressings	Tomato sauce, plain, bottled; Mayonnaise, regular, bottled; Tomato catsup; Mustard, yellow, plain; Tomato salsa, bottled; Sweet & sour sauce; Brown gravy, canned or bottled; Salad dressing, creamy/buttermilk type, regular; Salad dressing, creamy/buttermilk type, low-calorie; Salad dressing, Italian, regular.	40	0.010 (0.008, 0.012)
Oil and fat	Margarine, regular (not lowfat), salted; Olive oil; Vegetable oil.	12	0.001 (0.000, 0.002)
Non-alcoholic drinks	Carbonated beverage, cola, regular; Fruit drink, from powder; Carbonated beverage, cola, low-calorie; Tea, from tea bag; Coffee, from ground; Carbonated beverage, fruit-flavored, regular; Fruit drink (10% juice), canned or bottled; Meal replacement, liquid RTD, any flavor; Bottled drinking water (mineral/spring), not carbonated or flavored; Coffee, decaffeinated, from ground; Tea, decaffeinated, from tea bag.	44	0.000 (0.000, 0.001)
Alcoholic drinks	Beer; Wine, dry table, red/ white.	8	0.001 (0.000, 0.001)

P25: 25th percentile, P75: 75th percentile.

<sup>1</sup>P25, P75 and medians of each category reported are the average of the P25, P75 and medians of each food.

**Supplemental Table 3. Geometric Mean Ratios (95% confidence interval) of urine cadmium concentrations per interquartile range in daily food type intake.**

Food type	p75 vs. p25 (g/day)	Model 1	p-value	Model 2 <sup>a</sup>	p-value	Model 3 <sup>b</sup>	p-value	Model 4 <sup>c</sup>	p-value
Processed meat	48.8 vs 11.4	1.15 (1.03, 1.28)	0.01	1.23 (1.07, 1.40)	0.003	1.15 (1.04, 1.29)	0.01	1.15 (1.04, 1.28)	0.01
Dairy products	268.1 vs 38.3	0.88 (0.80, 0.97)	0.007	0.87 (0.76, 1.00)	0.04	0.88 (0.80, 0.97)	0.008	0.88 (0.80, 0.97)	0.008
Fruit juice	356 vs 46.6	0.91 (0.83, 0.99)	0.03	0.90 (0.80, 1.02)	0.09	0.90 (0.82, 0.99)	0.02	0.91 (0.83, 0.99)	0.03

Initial model (model 1) was adjusted for age at baseline, sex, smoking status, educational level, center, body mass index, total kcal, and dietary variables that may contribute to cadmium intake (organ meat, processed meat, leafy vegetables, root vegetables, baked and mashed potatoes, fries and chips, dairy products and fruit juice).

Model 2 adjusted for model 1 variables plus cigarette packs per year. <sup>a</sup>n=977

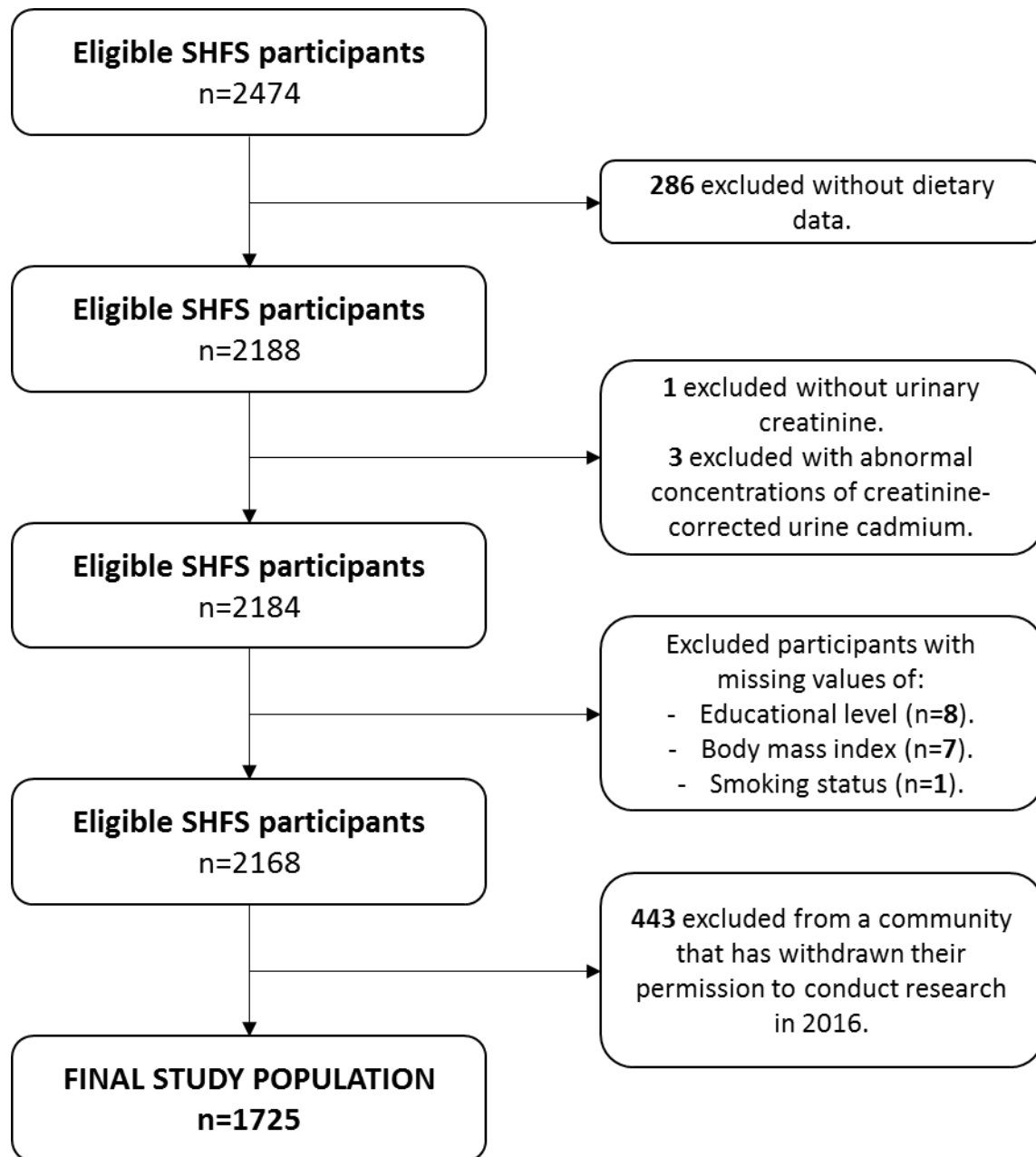
Model 3 adjusted for model 1 variables plus smokeless tobacco. <sup>b</sup>n=1703

Model 4 adjusted for model 1 variables plus hours/day exposed to secondhand smoking. <sup>c</sup>n=1722

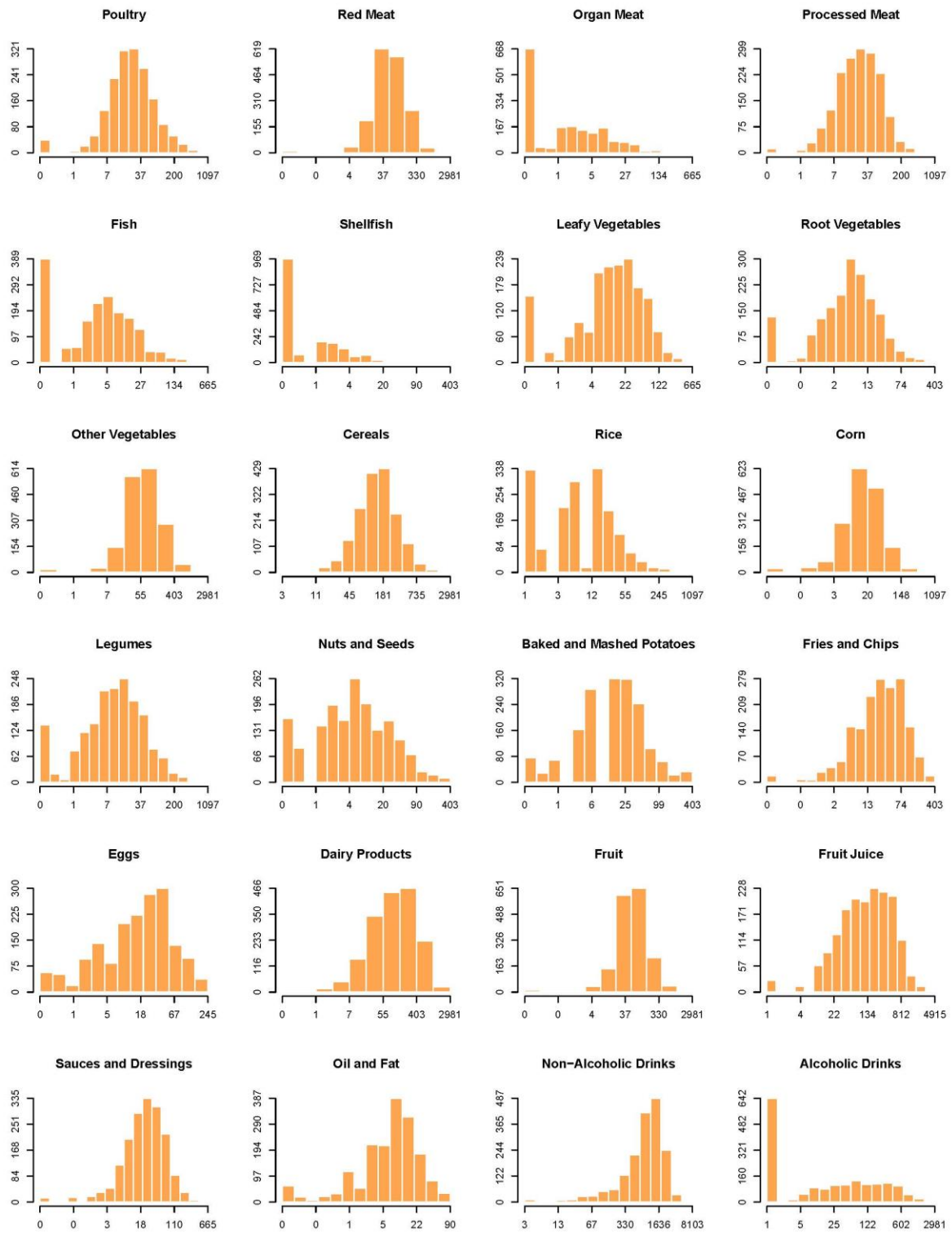
**Supplemental Table 4. Spearman correlations matrix of processed meat, fries and chips, dairy products and fruit juice variables.** Data are Spearman correlations (p values) of each pair of variables. Variables were corrected for total kilocalories before estimating the correlations.

	Processed Meat	Fries & Chips	Dairy Products	Fruit Juice
Processed Meat	1			
Fries & Chips	0.20 (<0.001)	1		
Dairy Products	0.04 (0.08)	-0.09 (<0.001)	1	
Fruit Juice	0.04 (0.107)	-0.07 (0.003)	0.24 (<0.001)	1

**Supplemental Figure 1. Participant flow chart.**



**Supplemental Figure 2. Distribution of dietary variables in log scale. (N=1725)**

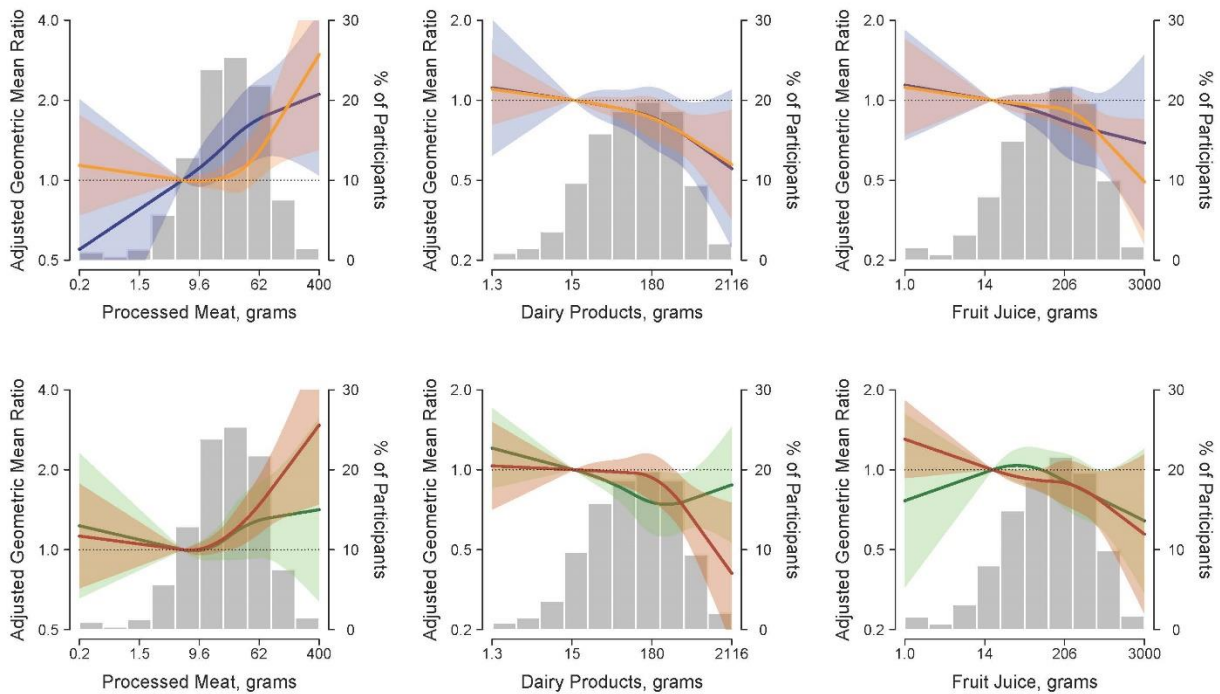


**Supplemental Figure 3. Geometric mean ratio (95% confidence interval) of urine cadmium by processed meat, dairy products and fruit juice consumption stratified by gender and by smoking status.** Lines represent the geometric mean ratio of urinary cadmium concentrations based on restricted quadratic spline models with knots at the 10<sup>th</sup>, 50<sup>th</sup>, and the 10<sup>th</sup>, 50<sup>th</sup>, and 90<sup>th</sup> percentiles of each log-transformed dietary variable intake.

Upper panel: stratified by gender. Blue line: Males; Orange line: Females.

Lower panel: stratified by smoking status. Green line: Never smokers; Brown line: Ever smokers.

Solid lines represent the cadmium geometric mean ratios of cadmium for each dietary variable by adjusting for age (continuous), center (Arizona/Oklahoma/North and South Dakota), educational level (<12 years/≥12 years), body mass index (continuous), total kilocalories and dietary variables considered risk factors (organ meat, processed meat, leafy vegetables, root vegetables, potatoes, fries and chips, dairy products, fruit juice and alcoholic drinks). Polygons surrounding the lines represent 95% confidence intervals. The reference was set at the 10<sup>th</sup> percentile of each dietary variable distribution. Bars represent the distribution of processed meat, dairy products and fruit juice intake, respectively.



## **SUPPLEMENTAL MATERIAL REFERENCES**

1. FDA. U.S. Food and Drug Administration. Total Diet Study, Analytical Results. Elements:

Individual Year Analytical Results: 2003. Available from:

<http://www.fda.gov/Food/FoodScienceResearch/TotalDietStudy/ucm184293.htm>