Appendix A: Propensity score methods

Propensity-score methods were used to evaluate and improve covariate balance between food secure and food insecure children. The propensity scores were estimated using a logit model with the full set of covariates listed in Table s1 and child food security status as the dependent variable. All of these variables were included in estimating the propensity scores because models that include only a limited set of 'predictors of convenience' tend to perform poorly and there is little downside to including even up to 100 covariates,(Stuart, 2010) Conversely, failing to include important covariates can result in substantial bias. (Stuart, 2010) The Stata 12SE module PSMATCH2 (Leuven & Sianesi, 2012; StataCorp, 2011) was used to examine covariate imbalance pre- and post-matching; see Supplementary Figure s1. For all included covariates, bias was reduced to less than 20%, consistent with a rule of thumb suggesting that standardized bias not exceed 25%.(Harder, Stuart, Anthony, 2010; Stuart, 2010) The limited set of covariates that were also included in the outcome models (e.g., age group, sex and race/ethnicity) were consistent with prior work suggesting that such 'doubly robust' procedures can be advantageous in accounting for any small residual imbalances across food security groups.(Stuart, 2010) These methods were repeated for household food security status.

Table s1. Variables included in propensity score estimation.

Individual and Household Level Variables from NHANES 2007–2010:

Age

Race/ethnicity (non-Hispanic white, non-Hispanic black, Mexican-American, other)

Household Income-to-Poverty Ratio[1,2] (PIR)

Sex

Foreign born

Food assistance program participation in prior year (SNAP, WIC, free or reduced price school breakfast or lunch programs)

Caregiver education[1]: less than high school; high school degree; some college or higher

Caregiver marital status[1]: married or cohabitating; single/divorced/widowed

Survey year, strata, PSU, sample weight

Health insurance (private, public, uninsured)

Household smoking

Household size

Double jeopardy (household income below federal poverty threshold and reside in high-deprivation census tract)[3]

Census tract-level variables[4]	*County-level Variables*
% female-headed households with children	Urban/rural category[5]: large central metropolitan; large fringe (population ≥ 1 million); medium fringe (population 250,000–999,999); small fringe (population <250,000); micropolitan; rural.
% adults over 25 years with less than a high school education	
% families below the poverty threshold	Segregation indices[6]: Dissimilarity Index, Gini Index, Information Index, Relative Diversity Index, Normalized Exposure Index, Squared Coefficient of Variation, Exposure Index, Isolation Index
Population size	
% vacant housing units	
% county that is urban	Arrests per 1000 population[7]
Square miles	SNAP and WIC redemptions per store, 2007[8]
% urban	Households no car & > 1 mi to store, Low income & > 1 mi to store, 2006[8]
% males over 16 years who are unemployed	# Grocery Stores, convenience stores, fast-food restaurants, SNAP authorized stores, WIC authorized stores, 2007[8]
% households receiving public assistance	SNAP participation rate, WIC participation rate, Total SNAP benefits, 2007[8]
% vacant housing units	% students free-lunch eligible, 2006[8]
Median household income	Household food insecurity prevalence, 2007[8]

% owner-occupied housing units	Food prices, 2006[8]: low-fat milk; soda; green-leafy vegetables/starchy vegetables; fruit/sweet snacks; fruit/savory snacks; whole grains/refined grains; soda sales tax; general food tax
Median housing unit value	
Deprivation Index[3]	

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[1] Caregivers who did not report education level, marital status, or PIR were still included in models as these covariates included dummy-codes for missingness.

[2] Ratio of family income to poverty threshold.

[3] Tract-level deprivation index is constructed by first standardizing then averaging the following variables: proportion of adults over 25 years with less than a high school education; proportion of males over 16 years who are unemployed; proportion of families below the poverty threshold; proportion of households receiving public assistance; proportion of female-headed households with children; and median household income. These variables were transformed for normality and direction, and their Z-scores were averaged; higher values indicate worse SES profile.

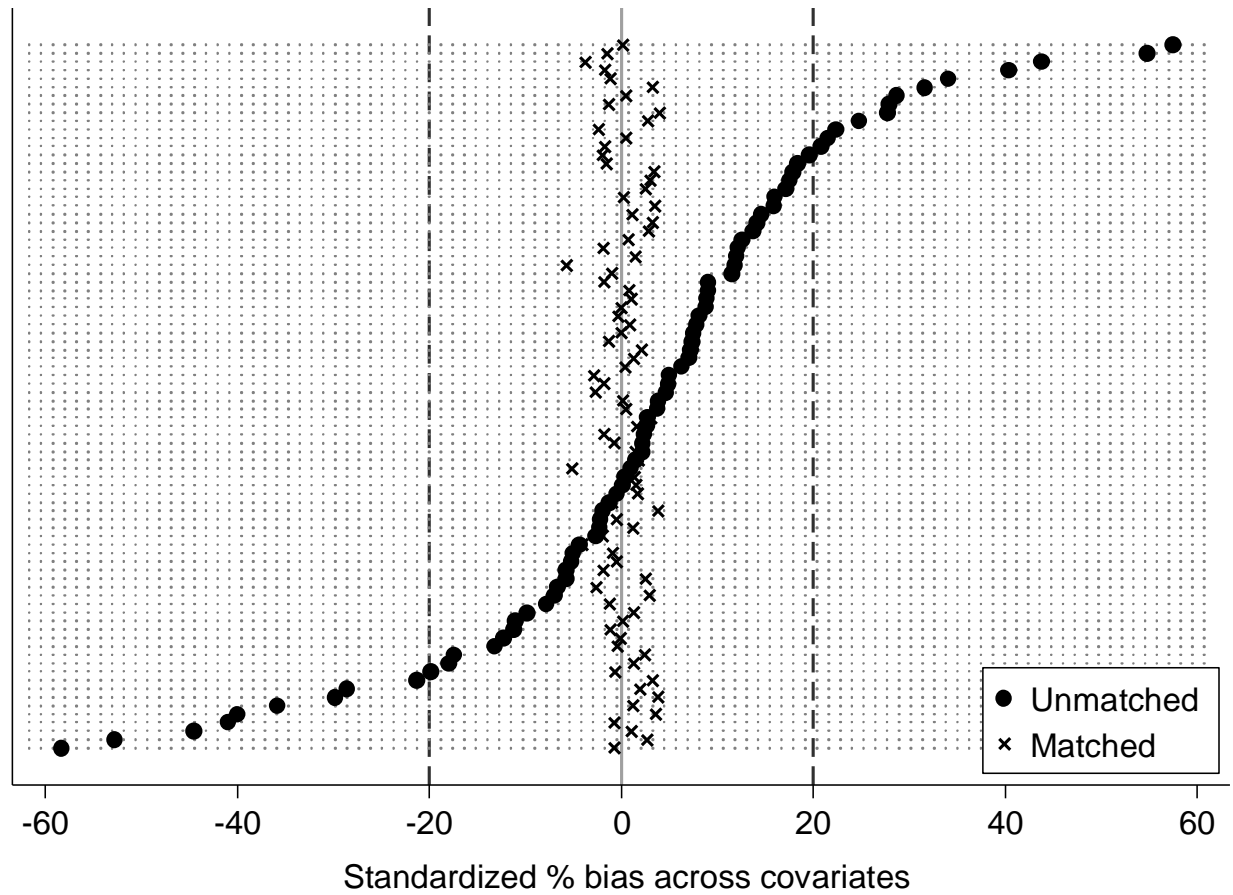[4] From the year 2000 decennial U.S. Census.

[5] From the National Center for Health Statistics Urban-Rural Classification Scheme.

[6] For further description of the segregation indices, see Reardon and Firebaugh (2002).

[7] From the U.S. Federal Bureau of Investigation Uniform Crime Reporting Program, 2000.

[8] From the USDA Food Environment Atlas.

Figure s1. Standardized percent bias in covariates comparing food insecure and food secure

children, pre- and post-propensity score weighting.

Note: Standardized bias is the mean difference between groups expressed as a percentage of the
average standard deviation.

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Appendix B: Socio-demographic characteristics.

Table s2. Socio-demographic characteristics of children ages 2 -15 years (n=5,136): NHANES,

2007-2010.

	Food Secure (*n*=4033) Weighted %/Mean (SE)	Food Insecure (*n*= 1103) Weighted %/Mean (SE)
Age		
2-5 years	28.98 (1.02)	27.89 (2.00)
6-11 years	42.43 (0. 93)	40.41 (1.70)
12-15 years	28.59 (1.36)	31.69 (2.05)
Gender		
Male	50.26 (1.32)	51.73 (2.19)
Female	49.74 (1.32)	48.27 (2.19)
Race/Ethnicity†*		
Non-Hispanic White	61.83 (2.36)	36.99 (4.93)
Non-Hispanic Black	12.69 (1.27)	20.51 (2.34)
Mexican-American	12.26 (1.54)	25.40 (3.90)
PIR*	2.75 (0.08)	1.15 (0.07)
Poverty Status*		
≤100% FPT	17.88 (1.21)	51.09 (2.88)
101-<200% FPT	20.20 (1.39)	30.53 (2.42)
201-<300% FPT	14.44 (1.07)	10.34 (1.68)
301-<400% FPT	12.38 (0.96)	1.26 (0.66)
>400% FPT	28.34 (2.01)	1.89 (0.87)
HR education level*		
< High school	17.06 (1.48)	39.89 (2.51)
High school graduate	21.23 (1.37)	28.39 (2.41)
Some college	29.26 (1.21)	24.51 (2.40)
College graduate or higher	32.45 (2.55)	7.22 (1.72)
HR Marital Status*		
Single or never Married	7.70 (0.65)	13.89 (2.21)
Married or living with partner	78.53 (1.00)	56.07 (2.79)
Widowed/divorced/separated	13.77 (0.87)	30.04 (2.56)
Household smoking*	13.18 (1.58)	23.35 (2.93)
Household size*	4.44 (0.03)	4.80 (0.10)
Food assistance participation[¢]*	66.55 (1.95)	94.44 (1.18)
Insurance status*		
Private health insurance	61.56 (2.02)	25.79 (3.10)
Public health insurance	30.63 (1.78)	63.52 (3.02)
Uninsured	8.41 (1.06)	13.77 (1.68)

Census Tract Characteristics

Individual+Area Poverty‡ ***	10.98 (1.22)	32.44 (3.45)
Deprivation⌐ ***	-0.41 (0.06)	0.08 (0.07)
% families in poverty***	8.98 (0.69)	14.13 (1.17)
% owner occupied housing***	72.69 (1.13)	63.92 (1.40)
Median household income***	48420 (2023)	37684.94 (1272)
Median housing unit value**	140215 (7912)	108623(4869)
% households public assistance***	3.34 (0.27)	5.39(0.44)
% female headed households***	6.97 (0.28)	9.80 (0.46)
% males over 16 unemployed***	5.43 (0.31)	7.07 (0.44)

County Characteristics

Arrests/1000 population***	37.63 (2.24)	44.26 (2.35)
% urban***	71.83 (3.73)	84.74 (3.38)
Size (sq miles)*	46.06 (13.28	23.83 (5.95)
Mean SNAP redemption per store**	166186(7516)	185817(7874)

Note: Significant differences indicated by *$P<0.05$, **$P<0.01$, ***$P<0.001$

Abbreviations: FPT = Federal poverty threshold; HR= Household Reference person; HS= High school; PIR= Income-to-poverty ratio; SNAP = supplemental nutrition assistance program

†Columns do not sum to 100% as children of other Hispanic and other race groups are not included due to the limited sample sizes of these groups.

¢ Includes SNAP, WIC, free/reduced price school lunch and school breakfast programs at any point in the prior year.

‡ Individual+area poverty is the combination of individual PIR<100% FPT and living in a census tract with high levels of deprivation.

⌐ Deprivation is the mean of six standardized tract level variables including: percentage of adults over 25 years with less than a high school education, percentage of men over 16 years who are unemployed, percentage of families below FPT, percentage of households receiving public assistance, percentage of female-headed households with children and median household income. Higher values indicate higher levels of deprivation.

Note: Tract and county-level variables where standardized bias between food secure and insecure children was less than 20% are not included in this table, but were included in propensity score models and are listed in Appendix A. *P*-values are based on χ^2 for proportions and Wald tests for continuous covariates. Some columns may not sum to 100% due to missing data on select covariates.

Appendix C: Differences in dietary intake by child food security status and age group

Table s3. Dietary intake among children ages 2-5 years (n=1,676) in NHANES 2007-2010, comparing children in food secure households (unweighted n=1,333) to those in food insecure households (unweighted n=343). Significant differences shown in bold-type (*P*<0.05).

	Regular Survey Weights		IPTW+Survey Weights	
	Food Secure Mean (S.E.)	Food-Insecure Mean (S.E.)	Food Secure Mean (S.E.)	Food-Insecure Mean (S.E.)
Fruit juice (cups)	0.64 (0.04)	0.62 (0.05)	0.66 (0.05)	0.61 (0.32)
Whole fruit‡	0.87 (0.05)	0.70 (0.06)	0.75 (0.15)	0.74 (0.20)
Vegetables excl white potatoes‡	**0.49 (0.03)** [a]	**0.44 (0.03)** [b]	0.47 (0.03)	0.46 (0.13)
Starchy vegetables‡	**0.18 (0.01)** [a]	**0.24 (0.03)** [b]	0.23 (0.07)	0.24 (0.06)
Whole grains	0.63 (0.03)	0.61 (0.06)	0.52 (0.14)	0.57 (0.16)
Refined grains	4.11 (0.11)	4.19 (0.20)	4.23 (0.17)	4.27 (0.45)
Solid fats (g)	28.04 (0.71)	29.30 (1.12)	28.44 (0.69)	30.14 (3.03)
Added sugars (tsp)	11.59 (0.34)	12.01 (0.58)	12.04 (0.57)	12.30 (1.98)
SoFAS (kcal)	437.71 (10.61)	455.91 (16.47)	448.55 (13.70)	468.14 (58.25)
Kcal	1512.04 (20.74)	1534.55 (37.24)	1524.18 (23.81)	1544.93 (59.44)
Protein (g)	55.57 (0.99)	56.13 (1.47)	55.50 (0.93)	56.84 (6.15)
Carbohydrate (g)	206.36 (2.91)	206.81 (5.15)	205.97 (2.70)	207.68 (7.59)
Fiber (g)	11.59 (0.29)	11.44 (0.39)	11.26 (0.42)	11.56 (0.58)
Caloric density (kcal/food item)	96.49 (1.09)	100.51 (2.61)	103.00 (7.98)	100.52 (4.08)
Sodium (mg)	2280.28 (38.69)	2340.10 (69.03)	2309.44 (45.37)	2359.26 (227.41)
Dietary variety (# foods)	16.46 (0.19)	16.10 (0.39)	15.59 (1.08)	16.17 (0.76)

‡ cup equivalent

[a,b] indicate significantly different, *P*<0.05

Note: Regular models used only the first day dietary recall survey weights, while IPTW models used propensity-score weights.

Table s4. Dietary intake among children ages 6 -11 years (n=2,254) in NHANES 2007-2010, comparing children in food secure households (unweighted n=1,779) to those in food insecure households (unweighted n=475). There were no significant differences for any dietary component.

	Regular Survey Weights		IPTW+Survey Weights	
	Food Secure Mean (S.E.)	Food-Insecure Mean (S.E.)	Food Secure Mean (S.E.)	Food-Insecure Mean (S.E.)
Fruit juice (cups)	0.37 (0.03)	0.46 (0.04)	0.44 (0.08)	0.43 (0.14)
Whole fruit‡	0.73 (0.05)	0.63 (0.07)	0.70 (0.05)	0.66 (0.18)
Vegetables excl white potatoes‡	0.59 (0.03)	0.67 (0.05)	0.55 (0.06)	0.68 (0.07)
Starchy vegetables‡	0.26 (0.02)	0.32 (0.03)	0.27 (0.02)	0.33 (0.16)
Whole grains	0.59 (0.03)	0.56 (0.06)	0.55 (0.06)	0.54 (0.19)
Refined grains	5.84 (0.13)	5.84 (0.19)	5.66 (0.24)	5.93 (0.24)
Solid fats (g)	36.37 (0.89)	36.28 (1.66)	36.45 (0.88)	36.01 (3.79)
Added sugars (tsp)	17.04 (0.39)	17.96 (0.76)	16.64 (0.53)	18.00 (2.34)
SoFAS (kcal)	599.94 (13.23)	613.93 (22.39)	594.33 (12.60)	612.02 (55.10)
Kcal	1862.83 (24.24)	1904.37 (38.98)	1826.64 (44.35)	1913.84 (71.93)
Protein (g)	68.58 (1.99)	68.27 (1.59)	67.48 (1.54)	68.95 (2.57)
Carbohydrate (g)	248.20 (2.86)	257.21 (5.14)	242.46 (6.64)	258.54 (13.95)
Fiber (g)	13.51 (0.25)	13.71 (0.41)	13.19 (0.42)	13.97 (1.01)
Caloric density (kcal/food item)	125.54 (1.56)	129.43 (2.77)	127.94 (3.31)	127.76 (13.34)
Sodium (mg)	2991.86 (53.98)	2997.18 (72.47)	2893.16 (125.33)	3004.22 (141.62)
Dietary variety (# foods)	15.54 (0.16)	15.40 (0.32)	14.90 (0.74)	15.63 (1.31)

‡ cup equivalent

Note: Regular models used only the first day dietary recall survey weights, while IPTW models used propensity-score weights.

Table s5. Dietary intake among children ages 12 -15 years (n=1,206) in NHANES 2007-2010, comparing children in food secure households (unweighted n=921) to those in food insecure households (unweighted n=285). There were no significant differences for any dietary component.

| | Regular Survey Weights | | IPTW+Survey Weights | |
| | Food Secure | Food-Insecure | Food Secure | Food-Insecure |
	Mean (S.E.)	Mean (S.E.)	Mean (S.E.)	Mean (S.E.)
Fruit juice (cups)	0.31 (0.03)	0.48 (0.11)	0.40 (0.13)	0.48 (0.22)
Whole fruit‡	0.58 (0.06)	0.46 (0.06)	0.57 (0.06)	0.47 (0.10)
Vegetables excl white potatoes‡	0.68 (0.04)	0.72 (0.09)	0.66 (0.04)	0.66 (0.26)
Starchy vegetables‡	0.28 (0.03)	0.34 (0.06)	0.27 (0.03)	0.26 (0.46)
Whole grains	0.66 (0.06)	0.58 (0.06)	0.73 (0.11)	0.58 (0.36)
Refined grains	6.09 (0.16)	6.17 (0.26)	6.10 (0.16)	6.38 (0.73)
Solid fats (g)	36.75 (1.58)	38.26 (2.24)	36.02 (1.68)	38.40 (6.80)
Added sugars (tsp)	18.20 (0.68)	19.11 (1.55)	18.03 (0.70)	18.79 (1.84)
SoFAS (kcal)	621.88 (20.89)	650.11 (38.66)	612.57 (22.45)	646.27 (78.60)
Kcal	1937.18 (46.75)	1953.40 (54.97)	1877.64 (71.20)	1944.65 (257.28)
Protein (g)	75.45 (1.97)	71.75 (1.87)	70.77 (4.98)	71.69 (10.19)
Carbohydrate (g)	249.95 (6.82)	256.63 (9.41)	248.08 (6.23)	255.83 (16.69)
Fiber (g)	13.43 (0.51)	13.32 (0.43)	13.33 (0.44)	13.27 (2.69)
Caloric density (kcal/food item)	158.63 (2.90)	165.72 (7.85)	155.38 (4.43)	164.79 (12.80)
Sodium (mg)	3199.78 (76.59)	3253.67 (89.96)	3037.17 (173.47)	3262.92 (337.20)
Dietary variety (# foods)	12.81 (0.26)	12.53 (0.36)	12.64 (0.27)	12.49 (1.00)

‡ cup equivalent

Note: Regular models used only the first day dietary recall survey weights, while IPTW models used propensity-score weights.