

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Cunningham SA, Kramer MR, Narayan KMV. Incidence of childhood obesity in the United States. *N Engl J Med* 2014;370:403-11. DOI: 10.1056/NEJMoa1309753

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Table S1. National prevalence of overweight among children ages 5 to 14years in 1998-2007 by age

| | N | Fall K (mean age 5.6) | | | Spring K (mean age 6.1) | | | Fall 1st ^a (mean age 6.6) | | | Spring 1st (mean age 7.1) | | | Spring 3rd (mean age 9.1) | | | Spring 5th (mean age 11.1) | | | Spring 8th (mean age 14.1) | | |
|--------------------------------------|------|--------------------------|--------|------|----------------------------|--------|------|---|--------|------|------------------------------|--------|------|------------------------------|--------|------|-------------------------------|--------|------|-------------------------------|--------|------|
| | | Prev | 95% CI | | Prev | 95% CI | | Prev | 95% CI | | Prev | 95% CI | | Prev | 95% CI | | Prev | 95% CI | | Prev | 95% CI | |
| TOTAL | 7738 | 14.9 | 13.6 | 16.4 | 14.3 | 12.8 | 15.8 | 12.9 | 10.8 | 15.3 | 13.3 | 12.1 | 14.7 | 15.9 | 14.5 | 17.4 | 19.0 | 17.1 | 20.9 | 17.0 | 15.6 | 18.5 |
| MALE | 3865 | 14.5 | 12.7 | 16.6 | 12.9 | 11.0 | 15.0 | 12.1 | 9.1 | 16.0 | 12.3 | 10.5 | 14.4 | 16.5 | 14.5 | 18.7 | 19.5 | 16.9 | 22.3 | 15.8 | 13.7 | 18.2 |
| FEMALE | 3873 | 15.3 | 13.4 | 17.5 | 15.8 | 13.9 | 17.9 | 13.6 | 11.0 | 16.7 | 14.5 | 12.6 | 16.5 | 15.3 | 13.5 | 17.3 | 18.4 | 16.1 | 20.9 | 18.4 | 16.5 | 20.4 |
| SES Q1 ^b | 1025 | 17.0 | 13.6 | 21.1 | 15.5 | 12.3 | 19.5 | 12.5 | 8.1 | 18.8 | 13.7 | 10.1 | 18.4 | 16.5 | 13.5 | 20.0 | 21.7 | 17.9 | 26.0 | 20.8 | 17.4 | 24.7 |
| SES Q2 | 1278 | 14.7 | 12.1 | 17.7 | 13.8 | 11.1 | 17.1 | 12.2 | 7.7 | 18.6 | 14.9 | 11.6 | 18.8 | 15.8 | 12.6 | 19.6 | 17.5 | 14.5 | 21.0 | 15.5 | 12.4 | 19.1 |
| SES Q3 | 1484 | 16.8 | 13.7 | 20.4 | 14.8 | 12.0 | 18.1 | 12.4 | 8.5 | 17.6 | 13.0 | 10.3 | 16.3 | 16.6 | 13.5 | 20.2 | 21.4 | 18.1 | 25.2 | 19.2 | 16.0 | 23.0 |
| SES Q4 | 1594 | 14.8 | 11.6 | 18.6 | 13.5 | 10.6 | 17.0 | 13.8 | 9.0 | 20.6 | 13.2 | 10.3 | 16.7 | 14.5 | 10.9 | 19.2 | 16.6 | 13.4 | 20.3 | 15.5 | 12.4 | 19.1 |
| SES Q5 | 2047 | 12.1 | 9.9 | 14.8 | 13.9 | 11.2 | 17.2 | 12.3 | 8.7 | 17.0 | 12.5 | 10.3 | 15.0 | 15.9 | 12.7 | 19.8 | 16.8 | 13.7 | 20.4 | 13.1 | 11.1 | 15.4 |
| Non-Hispanic White | 4822 | 13.6 | 11.9 | 15.5 | 13.5 | 11.7 | 15.5 | 11.1 | 8.7 | 14.0 | 12.6 | 10.9 | 14.6 | 15.6 | 13.7 | 17.7 | 17.8 | 15.5 | 20.3 | 15.4 | 13.9 | 17.1 |
| Non-Hispanic Black | 762 | 17.2 | 13.5 | 21.6 | 15.8 | 12.2 | 20.3 | 19.1 | 12.6 | 27.7 | 14.3 | 10.8 | 18.6 | 14.2 | 10.9 | 18.3 | 20.2 | 16.4 | 24.5 | 18.7 | 13.8 | 24.8 |
| Hispanic | 1301 | 17.2 | 14.3 | 20.4 | 14.9 | 12.1 | 18.2 | 11.6 | 8.8 | 15.2 | 15.7 | 13.0 | 18.8 | 17.2 | 14.7 | 19.9 | 22.1 | 18.6 | 26.1 | 20.9 | 18.1 | 24.0 |
| Other | 853 | 14.8 | 10.4 | 20.6 | 15.2 | 11.0 | 20.6 | 11.6 | 5.8 | 21.8 | 11.4 | 8.7 | 14.8 | 18.9 | 14.1 | 25.0 | 17.7 | 13.3 | 23.1 | 16.3 | 12.1 | 21.7 |
| <2500 grams birthweight ^c | 711 | 10.4 | 6.9 | 15.4 | 8.7 | 6.0 | 12.5 | 4.3 | 2.5 | 7.2 | 7.7 | 5.5 | 10.6 | 11.3 | 8.3 | 15.1 | 16.8 | 12.8 | 21.8 | 14.1 | 10.8 | 18.1 |
| 2500-3999 g birthweight | 6035 | 14.9 | 13.3 | 16.6 | 14.2 | 12.6 | 16.0 | 13.7 | 11.2 | 16.7 | 13.9 | 12.4 | 15.4 | 15.5 | 14.0 | 17.1 | 18.9 | 17.0 | 21.0 | 17.6 | 15.9 | 19.4 |
| 4000+ gram birthweight | 915 | 19.4 | 14.8 | 25.0 | 20.3 | 15.7 | 25.9 | 13.7 | 7.7 | 23.1 | 16.0 | 11.8 | 21.5 | 23.1 | 17.8 | 29.5 | 20.0 | 15.3 | 25.7 | 15.7 | 12.4 | 19.7 |

Data source: Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K)

a. Fall 1st grade was a sub-sample of entire cohort

b. SES missing in N=310 cases so N stratified by SES does not sum to 7738

c. Birthweight missing N=77 so N stratified by birthweight does not sum to 7738

**Table S2. Inter-wave incidence proportion of obesity, 1998-2007, by weight in Kindergarten
All Children**

| Study Interval | n at risk | TOTAL | | | Normal weight at baseline | | | Overweight at baseline | | |
|-------------------------------------|-----------|--|--------|------|--|--------|------|--|--------|-------|
| | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | |
| Fall to Spring K | 6807 | 5.4% | 4.0% | 6.7% | 2.4% | 1.4% | 3.5% | 19.7% | 13.7% | 25.6% |
| Spring K to Fall 1st ^b | 1970 | 3.5% | 1.8% | 5.2% | 1.3% | 0.1% | 2.5% | 18.0% | 7.9% | 28.1% |
| Spring K to Spring 1st ^b | 4656 | 2.7% | 2.0% | 3.4% | 1.2% | 0.8% | 1.6% | 10.0% | 6.2% | 13.7% |
| Fall 1st to Spring 1st ^b | 1950 | 3.1% | 1.2% | 5.0% | 1.5% | 0.3% | 2.6% | 14.5% | 1.3% | 27.6% |
| Spring 1st to Spring 3rd | 6517 | 3.0% | 2.5% | 3.6% | 1.7% | 1.4% | 2.1% | 10.6% | 8.1% | 13.1% |
| Spring 3rd to Spring 5th | 6177 | 3.1% | 2.6% | 3.6% | 2.4% | 1.9% | 2.9% | 7.8% | 5.5% | 10.1% |
| Spring 5th to Spring 8th | 5957 | 1.7% | 1.4% | 2.0% | 1.4% | 1.1% | 1.7% | 3.7% | 2.4% | 5.0% |

Boys

| Study Interval | n at risk | TOTAL | | | Normal weight at baseline | | | Overweight at baseline | | |
|-------------------------------------|-----------|--|--------|------|--|--------|------|--|--------|-------|
| | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | |
| Fall to Spring K | 3356 | 5.4% | 3.7% | 7.1% | 2.3% | 0.9% | 3.7% | 20.8% | 13.4% | 28.1% |
| Spring K to Fall 1st ^b | 952 | 4.8% | 1.7% | 7.8% | 2.2% | 0.1% | 4.5% | 21.3% | 3.2% | 39.3% |
| Spring K to Spring 1st ^b | 2307 | 2.8% | 1.8% | 3.8% | 1.6% | 0.8% | 2.5% | 8.8% | 3.7% | 13.9% |
| Fall 1st to Spring 1st ^b | 938 | 1.6% | 0.6% | 2.6% | 0.7% | 0.0% | 1.5% | 7.9% | 1.5% | 14.3% |
| Spring 1st to Spring 3rd | 3208 | 2.9% | 2.2% | 3.6% | 1.6% | 1.2% | 2.1% | 10.3% | 7.1% | 13.5% |
| Spring 3rd to Spring 5th | 3026 | 3.3% | 2.6% | 4.0% | 2.7% | 2.0% | 3.5% | 7.2% | 4.7% | 9.7% |
| Spring 5th to Spring 8th | 2862 | 1.9% | 1.5% | 2.3% | 1.5% | 1.1% | 1.9% | 4.8% | 2.5% | 7.1% |

Girls

| Study Interval | n at risk | TOTAL | | | Normal weight at baseline | | | Overweight at baseline | | |
|-------------------------------------|-----------|--|--------|------|--|--------|------|--|--------|-------|
| | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | | Annual incidence proportion ^a | 95% CI | |
| Fall to Spring K | 3451 | 5.4% | 3.2% | 7.5% | 2.6% | 0.9% | 4.3% | 18.6% | 10.1% | 27.0% |
| Spring K to Fall 1st ^b | 1018 | 2.2% | 1.0% | 3.5% | 0.4% | 0.0% | 0.9% | 14.6% | 5.5% | 23.7% |
| Spring K to Spring 1st ^b | 2349 | 2.6% | 1.8% | 3.4% | 0.8% | 0.3% | 1.2% | 11.1% | 6.1% | 16.1% |
| Fall 1st to Spring 1st ^b | 1012 | 4.6% | 0.9% | 8.2% | 2.2% | 0.1% | 4.3% | 20.7% | -3.2% | 44.5% |
| Spring 1st to Spring 3rd | 3309 | 3.2% | 2.4% | 4.0% | 1.8% | 1.3% | 2.4% | 10.9% | 7.2% | 14.5% |
| Spring 3rd to Spring 5th | 3151 | 2.9% | 2.1% | 3.8% | 2.1% | 1.4% | 2.8% | 8.5% | 4.8% | 12.1% |
| Spring 5th to Spring 8th | 3095 | 1.4% | 1.0% | 1.9% | 1.3% | 0.8% | 1.7% | 2.6% | 1.2% | 4.0% |

Data source: Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K)

a. Annual incidence proportion is calculated as the # incident obese cases/# at risk / length of interval in years

b. Because a representative sub-sample was followed-up in the Fall of 1st grade, results are reported for each possible interval: Spring K to Fall 1st, Spring K to Spring 1st, and Fall 1st to Spring 1st.

Supplemental Table S3. Incidence density of obesity between kindergarten and 8th grade, ages 5 to 14 years, by weight in kindergarten

| | All children non-obese at baseline | | | | Children normal weight at baseline | | | | Children overweight at baseline | | | | Overweight: Normal weight at baseline incidence ratio | | |
|--------------------|---|--------|------|------------|--|--------|------|------------|--|--------|-------|------------|---|--------|------|
| | (n=6807 at risk followed for 50,396 PY) | | | | n=5675 at risk followed for 44,364 PY) | | | | (n=1132 at risk followed for 6,032 PY) | | | | IDR | 95% CI | |
| | Rate (cases per 1,000 PY) | 95% CI | | p-value | Rate (cases per 1,000 PY) | 95% CI | | p-value | Rate (cases per 1,000 PY) | 95% CI | | p-value | | | |
| Total Cohort | 26.5 | 23.9 | 29.0 | | 17.2 | 15.0 | 19.3 | | 91.5 | 75.8 | 107.2 | | 5.3 | 4.3 | 6.6 |
| BOYS | 27.5 | 24.3 | 30.8 | <i>ref</i> | 18.6 | 15.8 | 21.4 | <i>ref</i> | 89.9 | 68.7 | 111.1 | <i>ref</i> | 4.8 | 3.7 | 6.4 |
| GIRLS | 25.3 | 21.6 | 29.1 | 0.363 | 15.6 | 12.4 | 18.9 | 0.160 | 93.1 | 71.8 | 114.5 | 0.826 | 6.0 | 4.4 | 8.1 |
| SES Quintile 1 | 30.1 | 23.2 | 36.9 | 0.000 | 20.6 | 15.0 | 26.3 | 0.001 | 80.0 | 52.0 | 108.1 | 0.674 | 3.9 | 2.5 | 6.0 |
| SES Quintile 2 | 31.6 | 25.1 | 38.1 | 0.000 | 23.1 | 17.0 | 29.3 | 0.002 | 86.7 | 48.0 | 125.4 | 0.545 | 3.8 | 2.2 | 6.4 |
| SES Quintile 3 | 34.5 | 27.6 | 41.4 | <0.001 | 22.5 | 16.9 | 28.1 | 0.000 | 114.4 | 70.3 | 158.5 | 0.122 | 5.1 | 3.3 | 7.9 |
| SES Quintile 4 | 23.6 | 18.1 | 29.1 | 0.020 | 12.3 | 8.3 | 16.3 | 0.389 | 109.7 | 71.9 | 147.6 | 0.128 | 8.9 | 5.7 | 14.0 |
| SES Quintile 5 | 16.1 | 12.1 | 20.0 | <i>ref</i> | 10.0 | 6.3 | 13.7 | <i>ref</i> | 71.7 | 44.6 | 98.9 | <i>ref</i> | 7.2 | 4.2 | 12.2 |
| Non-Hispanic White | 22.2 | 19.3 | 25.0 | <i>ref</i> | 14.7 | 12.2 | 17.2 | <i>ref</i> | 80.4 | 61.9 | 98.9 | <i>ref</i> | 5.5 | 4.0 | 7.4 |
| Non-Hispanic Black | 34.9 | 23.9 | 45.8 | 0.034 | 21.4 | 13.3 | 29.5 | 0.118 | 122.3 | 66.6 | 177.9 | 0.166 | 5.7 | 3.6 | 9.0 |
| Hispanic | 34.2 | 27.2 | 41.2 | 0.002 | 22.7 | 17.2 | 28.3 | 0.012 | 95.8 | 63.6 | 127.9 | 0.385 | 4.2 | 3.0 | 5.9 |
| Other | 25.4 | 17.6 | 33.2 | 0.464 | 16.2 | 10.6 | 21.7 | 0.632 | 88.2 | 33.5 | 142.8 | 0.800 | 5.5 | 2.9 | 10.2 |
| Birth weight | | | | | | | | | | | | | | | |
| <2500 grams | 22.8 | 16.8 | 28.8 | 0.362 | 17.9 | 12.3 | 23.5 | 0.850 | 74.6 | 28.3 | 120.9 | 0.565 | 3.6 | 1.8 | 7.2 |
| 2500-3999 grams | 26.2 | 23.0 | 29.5 | <i>ref</i> | 17.3 | 14.6 | 20.0 | <i>ref</i> | 89.0 | 72.0 | 105.9 | <i>ref</i> | 5.1 | 4.1 | 6.5 |
| 4000+ grams | 34.3 | 23.7 | 45.0 | 0.168 | 15.4 | 9.3 | 21.6 | 0.601 | 129.8 | 75.8 | 183.9 | 0.148 | 8.4 | 4.8 | 14.9 |

Data source: Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K)

Incidence density calculated as the incident cases between 2 waves/ Person-years lived between the 2 waves (PY)

IDR: Incidence density ratio

Table S4: Proportion of incident obese 8th graders by weight in kindergarten

| Kindergarten weight | n at risk of obesity in kindergarten | % of obese 8th graders | 95% CI | |
|----------------------------|--------------------------------------|------------------------|--------|-------|
| Total | 6807 | | | |
| Normal | 5675 | 54.68 | 48.67 | 60.55 |
| Overweight | 1132 | 45.32 | 39.45 | 51.33 |

Data source: Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999 (ECLS-K)