**MCH Epi Training 2012 – Denver, CO  
Results from Model-Building Exercise**

**Research Question:** Using 2003 NSCH data,what factors are associated with overweight/obesity among African-American adolescents? (Note: Underweight adolescents have been excluded)

**SAS Code for initial model (based on results from bivariate and stratified analysis):**  
title 'Initial Model';  
**proc** **surveylogistic** data=analysis;  
strata state;  
cluster idnumr;  
domain adolblack; /\*domain subsets data appropriately; adolblack=1 for adolescent blacks\*/  
class phys3/param=ref ref=last; /\*Creates 2 dummy variables for physical activity 0 vs 5-7 days and 1-4 vs 5-7 days\*/   
weight weight\_i;/\*Note: if using newer versions of NSCH (2007) – nschwt is name of this variable\*/  
model ovwt(ref=last)= poor male agecat lesscol sedentry phys3 nosports   
male\*lesscol male\*nosports male\*phys3 poor\*sedentry; **run**;

**Selected output from the initial model:**

Domain Analysis for domain adolblack=1

Domain Summary

Number of Observations 102353

Number of Observations in Domain 3605

Number of Observations not in Domain 98748

Sum of Weights in Domain 3742104.9

...

Number of Observations Read 102353

Number of Observations Used 3272

Sum of Weights Read 44892913

Sum of Weights Used 3342218

Response Profile

Ordered Total Total

Value Ovwt Frequency Weight

1 Overweight or At Risk of Overweight 1361 1334276.3

2 Normal Weight 1911 2007941.3

Probability modeled is Ovwt='Overweight or Obese'.

Class Level Information

Design

Class Value Variables

phys3 0 1 0

1-4 0 1

5-7 0 0

Model Fit Statistics

Intercept

Intercept and

Criterion Only Covariates

AIC 4496579.3 4350136.7

SC 4496585.4 4350222.0

-2 Log L 4496577.3 4350108.7

Type 3 Analysis of Effects

Wald

Effect DF Chi-Square Pr > ChiSq

poor 1 12.7608 0.0004

male 1 10.4480 0.0012

agecat 1 12.7970 0.0003

lesscol 1 5.0594 0.0245

sedentry 1 14.5873 0.0001

phys3 2 7.2312 0.0269

Nosports 1 2.4520 0.1174

male\*lesscol 1 4.5405 0.0331

male\*Nosports 1 3.5050 0.0612

male\*phys3 2 1.2091 0.5463

poor\*sedentry 1 6.7747 0.0092

Analysis of Maximum Likelihood Estimates

Standard Wald

Parameter DF Estimate Error Chi-Square Pr > ChiSq

Intercept 1 -2.0618 0.2494 68.3226 <.0001

poor 1 0.7277 0.2037 12.7608 0.0004

male 1 0.7192 0.2225 10.4480 0.0012

agecat 1 0.4219 0.1179 12.7970 0.0003

lesscol 1 0.4151 0.1846 5.0594 0.0245

sedentry 1 0.7808 0.2044 14.5873 0.0001

phys3 1 1 0.6441 0.2440 6.9682 0.0083

phys3 2 1 0.3870 0.2072 3.4880 0.0618

Nosports 1 0.2808 0.1793 2.4520 0.1174

male\*lesscol 1 -0.5176 0.2429 4.5405 0.0331

male\*Nosports 1 -0.4551 0.2431 3.5050 0.0612

male\*phys3 1 1 -0.3717 0.3618 1.0554 0.3043

male\*phys3 2 1 -0.2063 0.2645 0.6081 0.4355

poor\*sedentry 1 -0.6547 0.2515 6.7747 0.0092

Odds Ratio Estimates

Point 95% Wald

Effect Estimate Confidence Limits

agecat 1.525 1.210 1.921

**SAS Code for final model** (stratifying by gender and using manual backward elimination to reduce factors):  
title 'Stratified Models';

**proc** **surveylogistic** data=analysis;

strata state;

cluster idnumr;

domain adolblack\*male; /\*run stratified models by gender\*/

class phys3/param=ref;

weight weight\_i;

model ovwt(ref=last)= poor agecat lesscol sedentry phys3 poor\*sedentry ;

contrast 'Strat results: >2 hrs screen time, among <300% FPL' sedentry **1** poor\*sedentry **1**/estimate=exp;

contrast 'Strat results: >2 hrs screen time, among 300%+ FPL' sedentry **1**/estimate=exp;

contrast 'Joint effect: >2 hrs screen time and <300% FPL' sedentry **1** poor **1** poor\*sedentry **1**/estimate=exp;

contrast 'Sep effect scr time: >2 hrs screen time and 300%+ FPL' sedentry **1**/estimate=exp;

contrast 'Sep effect poverty: <=2 hrs screen time and <300% FPL' poor **1**/estimate=exp;

**run**;

**Domain Analysis for domain adolblack=1 male=Female**

Analysis of Maximum Likelihood Estimates

Standard Wald

Parameter DF Estimate Error Chi-Square Pr > ChiSq

Intercept 1 -1.9527 0.2872 46.2268 <.0001

poor 1 0.7051 0.2869 6.0408 0.0140

agecat 1 0.3427 0.1752 3.8280 0.0504

lesscol 1 0.4631 0.1849 6.2757 0.0122

sedentry 1 0.8296 0.2799 8.7839 0.0030

phys3 1 1 0.6795 0.2311 8.6434 0.0033

phys3 2 1 0.3844 0.2038 3.5582 0.0593

poor\*sedentry 1 -0.5536 0.3509 2.4893 0.1146

Odds Ratio Estimates

Point 95% Wald

Effect Estimate Confidence Limits

agecat 1.409 0.999 1.986

lesscol 1.589 1.106 2.283

phys3 1 vs 3 1.973 1.254 3.104

phys3 2 vs 3 1.469 0.985 2.190

Contrast Test Results

Wald

Contrast DF Chi-Square Pr > ChiSq

Strat results: >2 hrs screen time, among <300% FPL 1 1.6471 0.1994

Strat results: >2 hrs screen time, among 300%+ FPL 1 8.7839 0.0030

Joint effect: >2 hrs screen time and <300% FPL 1 13.2571 0.0003

Sep effect scr time: >2 hrs screen time and 300%+ FPL 1 8.7839 0.0030

Sep effect poverty: <=2 hrs screen time and <300% FPL 1 6.0408 0.0140

Contrast Rows Estimation and Testing Results

Standard

Contrast Type Row Estimate Error Alpha Confidence Limits

Strat results: >2 hrs screen time, among <300% FPL EXP 1 1.3179 0.2834 0.05 0.8646 2.0089

Strat results: >2 hrs screen time, among 300%+ FPL EXP 1 2.2924 0.6417 0.05 1.3244 3.9677

Joint effect: >2 hrs screen time and <300% FPL EXP 1 2.6675 0.7188 0.05 1.5730 4.5236

Sep effect scr time: >2 hrs screen time and 300%+ FPL EXP 1 2.2924 0.6417 0.05 1.3244 3.9677

Sep effect poverty: <=2 hrs screen time and <300% FPL EXP 1 2.0241 0.5807 0.05 1.1535 3.5517

Wald

Contrast Type Row Chi-Square Pr > ChiSq

Strat results: >2 hrs screen time, among <300% FPL EXP 1 1.6471 0.1994

Strat results: >2 hrs screen time, among 300%+ FPL EXP 1 8.7839 0.0030

Joint effect: >2 hrs screen time and <300% FPL EXP 1 13.2571 0.0003

Sep effect scr time: >2 hrs screen time and 300%+ FPL EXP 1 8.7839 0.0030

Sep effect poverty: <=2 hrs screen time and <300% FPL EXP 1 6.0408 0.0140

**Domain Analysis for domain adolblack=1 male=Male**

Analysis of Maximum Likelihood Estimates

Standard Wald

Parameter DF Estimate Error Chi-Square Pr > ChiSq

Intercept 1 -1.4040 0.2595 29.2810 <.0001

poor 1 0.7551 0.2808 7.2321 0.0072

agecat 1 0.5054 0.1562 10.4728 0.0012

lesscol 1 -0.1162 0.1695 0.4704 0.4928

sedentry 1 0.7686 0.2866 7.1932 0.0073

phys3 1 1 0.2344 0.2669 0.7711 0.3799

phys3 2 1 0.1796 0.1642 1.1968 0.2740

poor\*sedentry 1 -0.7770 0.3463 5.0352 0.0248

Odds Ratio Estimates

Point 95% Wald

Effect Estimate Confidence Limits

agecat 1.658 1.221 2.251

lesscol 0.890 0.639 1.241

phys3 1 vs 3 1.264 0.749 2.133

phys3 2 vs 3 1.197 0.867 1.651

Contrast Test Results

Wald

Contrast DF Chi-Square Pr > ChiSq

Strat results: >2 hrs screen time, among <300% FPL 1 0.0018 0.9658

Strat results: >2 hrs screen time, among 300%+ FPL 1 7.1932 0.0073

Joint effect: >2 hrs screen time and <300% FPL 1 8.3101 0.0039

Sep effect scr time: >2 hrs screen time and 300%+ FPL 1 7.1932 0.0073

Sep effect poverty: <=2 hrs screen time and <300% FPL 1 7.2321 0.0072

Contrast Rows Estimation and Testing Results

Standard

Contrast Type Row Estimate Error Alpha Confidence Limits

Strat results: >2 hrs screen time, among <300% FPL EXP 1 0.9916 0.1945 0.05 0.6751 1.4565

Strat results: >2 hrs screen time, among 300%+ FPL EXP 1 2.1568 0.6181 0.05 1.2299 3.7822

Joint effect: >2 hrs screen time and <300% FPL EXP 1 2.1101 0.5466 0.05 1.2700 3.5058

Sep effect scr time: >2 hrs screen time and 300%+ FPL EXP 1 2.1568 0.6181 0.05 1.2299 3.7822

Sep effect poverty: <=2 hrs screen time and <300% FPL EXP 1 2.1279 0.5975 0.05 1.2273 3.6894

Wald

Contrast Type Row Chi-Square Pr > ChiSq

Strat results: >2 hrs screen time, among <300% FPL EXP 1 0.0018 0.9658

Strat results: >2 hrs screen time, among 300%+ FPL EXP 1 7.1932 0.0073

Joint effect: >2 hrs screen time and <300% FPL EXP 1 8.3101 0.0039

Sep effect scr time: >2 hrs screen time and 300%+ FPL EXP 1 7.1932 0.0073

Sep effect poverty: <=2 hrs screen time and <300% FPL EXP 1 7.2321 0.0072

**Results of Final Model:** Odds ratios (OR) and 95% confidence intervals (95% CIs) for the association between child characteristics and overweight/obesity among African-American adolescent girls and boys (age 12-17), 2003 National Survey of Children’s Health

|  |  |  |
| --- | --- | --- |
| Child Characteristic | Girls (n = 1,608)  OR (95% CI) | Boys (n = 1,669)  OR (95% CI) |
| Age |  |  |
| 12-14 | 1.4 (1.0, 2.0) | 1.7 (1.2, 2.3) |
| 15-17 | Ref | Ref |
| Highest Education of Parent(s) |  |  |
| High School or Less\* | 1.6 (1.1, 2.3) | 0.9 (0.6, 1.2) |
| Some College or More | Ref | Ref |
| Vigorous Physical Activity (days/week) |  |  |
| 0 | 2.0 (1.3, 3.1) | 1.3 (0.7, 2.1) |
| 1-4 | 1.5 (1.0, 2.2) | 1.2 (0.9, 1.7) |
| 5-7 | Ref | Ref |
| Screen Time for Children in Households at <300% FPL\*\* |  |  |
| > 2 hrs/day | 1.3 (0.9, 2.0) | 1.0 (0.7, 1.5) |
| ≤ 2 hrs/day | Ref | Ref |
| Screen Time for Children in Households at ≥300% FPL\*\* |  |  |
| > 2 hrs/day | 2.3 (1.3, 4.0) | 2.2 (1.2, 3.8) |
| ≤ 2 hrs/day | Ref | Ref |

FPL = Federal poverty level   
\*p<0.05 for differences in ORs for boys and girls  
\*\*Modeled as an interaction term (screen time\*household income) with p=0.11 (girls) and p=0.02 (boys)

**Alternative version of presentation results for interaction (joint/separate effects):**

|  |  |  |
| --- | --- | --- |
| Screen Time and Household Income | Girls (n = 1,608)  OR (95% CI) | Boys (n = 1,669)  OR (95% CI) |
| > 2 hrs/day screen time and in a household at <300% FPL | 2.1 (1.3, 3.5) | 2.7 (1.6, 4.5) |
| > 2 hrs/day screen time and in a household at ≥300% FPL | 2.2 (1.2, 3.8) | 2.3 (1.3, 4.0) |
| In a household at <300% FPL and screen time ≤ 2 hrs/day | 2.1 (1.2, 3.7) | 2.0 (1.2, 3.6) |
| In a household at ≥300% FPL and screen time ≤ 2 hrs/day | Ref | Ref |

**SAS Code for final model, now using generalized logit to model overweight and obese separately:**

\*GENERALIZED LOGIT;

**proc** **surveylogistic** data=analysis;

strata state;

cluster idnumr;

domain adolblack\*male;

class phys3/param=ref;

weight weight\_i;

model bmi3(ref=first)= poor agecat lesscol sedentry phys3 poor\*sedentry/link=glogit;  
contrast '>2 hrs screen time, among <300% FPL' sedentry **1** poor\*sedentry **1**/estimate=exp;

contrast '>2 hrs screen time, among 300%+ FPL' sedentry **1**/estimate=exp;

**run**;

**Domain Analysis for domain adolblack=1 male=Female**

Response Profile

Ordered Total Total

Value bmi3 Frequency Weight

1 Normal Weight 955 1031631.6

2 Obese 305 339175.0

3 Overweight 348 346012.0

Logits modeled use bmi3='Normal Weight' as the reference category.

Analysis of Maximum Likelihood Estimates

Standard Wald

Parameter bmi3 DF Estimate Error Chi-Square Pr > ChiSq

Intercept Obese 1 -3.0492 0.4018 57.5785 <.0001

Intercept Overweight 1 -2.3200 0.3459 44.9814 <.0001

poor Obese 1 1.0283 0.3706 7.6986 0.0055

poor Overweight 1 0.4248 0.3683 1.3299 0.2488

agecat Obese 1 0.3668 0.2344 2.4487 0.1176

agecat Overweight 1 0.3190 0.2071 2.3721 0.1235

lesscol Obese 1 0.6502 0.2399 7.3473 0.0067

lesscol Overweight 1 0.2824 0.2176 1.6837 0.1944

sedentry Obese 1 1.0855 0.3734 8.4502 0.0036

sedentry Overweight 1 0.6354 0.3494 3.3071 0.0690

phys3 1 Obese 1 0.8878 0.3002 8.7473 0.0031

phys3 1 Overweight 1 0.4611 0.2829 2.6554 0.1032

phys3 2 Obese 1 0.4203 0.2717 2.3922 0.1219

phys3 2 Overweight 1 0.3504 0.2399 2.1333 0.1441

poor\*sedentry Obese 1 -1.0146 0.4530 5.0169 0.0251

poor\*sedentry Overweight 1 -0.1441 0.4389 0.1077 0.7427

Odds Ratio Estimates

Point 95% Wald

Effect bmi3 Estimate Confidence Limits

agecat Obese 1.443 0.912 2.285

agecat Overweight 1.376 0.917 2.064

lesscol Obese 1.916 1.197 3.066

lesscol Overweight 1.326 0.866 2.032

phys3 1 vs 3 Obese 2.430 1.349 4.376

phys3 1 vs 3 Overweight 1.586 0.911 2.761

phys3 2 vs 3 Obese 1.522 0.894 2.593

phys3 2 vs 3 Overweight 1.420 0.887 2.272

Contrast Test Results

Wald

Contrast DF Chi-Square Pr > ChiSq

>2 hrs screen time, among <300% FPL 2 3.6691 0.1597

>2 hrs screen time, among 300%+ FPL 2 10.1703 0.0062

Contrast Rows Estimation and Testing Results

Standard Wald

Contrast Row Estimate Error Alpha Confidence Limits Chi-Square Pr > ChiSq

>2 hrs screen time, among <300% FPL 1 1.0735 0.2850 0.05 0.6381 1.8062 0.0715 0.7892

>2 hrs screen time, among <300% FPL 2 1.6345 0.4278 0.05 0.9786 2.7301 3.5245 0.0605

>2 hrs screen time, among 300%+ FPL 1 2.9610 1.1057 0.05 1.4242 6.1562 8.4502 0.0036

>2 hrs screen time, among 300%+ FPL 2 1.8878 0.6596 0.05 0.9518 3.7445 3.3071 0.0690

Comparison of odds ratios (OR) and 95% confidence intervals (95% CIs) from a binary logistic regression model (outcome=overweight/obese vs normal weight) and generalized logit model (outcome=overweight vs normal weight and obese vs normal weight) for the association between child characteristics and overweight/obesity among African-American adolescent girls, 2003 National Survey of Children’s Health

|  |  |  |  |
| --- | --- | --- | --- |
| Child Characteristic | Binary Logistic  OR (95% CI) | Level of Outcome (Generalized Logit) | Generalized Logit  OR (95% CI) |
| Age |  |  |  |
| 12-14 vs 15-17 | 1.4 (1.0, 2.0) | Obese vs Normal | 1.4 (0.9, 2.2) |
|  |  | Ovwt vs Normal | 1.4 (0.9, 2.0) |
| Highest Education of Parent(s) |  |  |  |
| HS or Less vs College+ | 1.6 (1.1, 2.3) | Obese vs Normal | 1.9 (1.2, 3.1) |
|  |  | Ovwt vs Normal | 1.3 (0.9, 2.0) |
| Vigorous Physical Activity (days/week) |  |  |  |
| 0 vs 5-7 | 2.0 (1.3, 3.1) | Obese vs Normal | 2.4 (1.3, 4.4) |
|  |  | Ovwt vs Normal | 1.6 (0.9, 2.8) |
| 1-4 vs 5-7 | 1.5 (1.0, 2.2) | Obese vs Normal | 1.5 (0.9, 2.6) |
|  |  | Ovwt vs Normal | 1.4 (0.9, 2.3) |
| Screen Time for Children in Households at <300% FPL\* |  |  |  |
| > 2 vs ≤ 2 hrs/day | 1.3 (0.9, 2.0) | Obese vs Normal | 1.1 (0.6, 1.8) |
|  |  | Ovwt vs Normal | 1.6 (1.0, 2.7) |
| Screen Time for Children in Households at ≥300% FPL\*\* |  |  |  |
| > 2 vs ≤ 2 hrs/day | 2.3 (1.3, 4.0) | Obese vs Normal | 3.0 (1.4, 6.2) |
|  |  | Ovwt vs Normal | 1.9 (1.0, 3.7) |

FPL = Federal poverty level   
\*Modeled as an interaction term (screen time\*household income) with p=0.11 from binary logistic model and p=0.03 for obese vs normal weight and p=0.75 for overweight vs normal weight from generalized logit model

***Example interpretation:***Compared to African-American adolescent girls in non-poor households who are exposed to two hours or less of screen time per day, those exposed to greater than 2 hours are at three times increased odds of being obese versus normal weight.