**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 LogisticOR (95% CI) | Level of Outcome (Generalized Logit) | Generalized LogitOR (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.