# Association of Food Insecurity and Metabolic Syndrome among NHANES Participants 1999-2014

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## Abstract

## Introduction

Food Security is access at all times to enough food for an active, healthy life; food insecurity exists when ever the availability of nutritionally adequate and safe foods is limited or uncertain(1).

## Methods

## Results

Table 1: Charactersitcs of Study Participants by Food Security Status

| | Not Food Insecure | Food Insecure | Missing |
|---|---|---|---|
| | (n=8877) | (n=3594) | (n=240) |
| | N(%) | N(%) | N(%) |
| **Gender** | | | |
| **Female** | 4340(49) | 1869(52) | 118(49) |
| **Race** | | | |
| **Non-Hispanic White** | 4318(49) | 1101(31) | 81(34) |
| **Mexican American** | 1435(16) | 1002(28) | 66(28) |
| **Other Hispanic** | 649(7) | 403(11) | 16(7) |
| **Non-Hispanic Black** | 1655(19) | 893(25) | 58(24) |
| **Other (including multiracial)** | 298(3) | 82(2) | 12(5) |
| **Missing** | 522(6) | 113(3) | 7(3) |
| **Education** | | | |
| **Less than 9th Grade** | 601(7) | 606(17) | 26(11) |
| **9-11th Grade** | 1126(13) | 826(23) | 38(16) |
| **High School Grad** | 1944(22) | 891(25) | 71(30) |
| **Some College/AA** | 2705(30) | 998(28) | 68(28) |
| **College Graduate or above** | 2497(28) | 267(7) | 36(15) |
| **Missing** | 4(0) | 6(0) | 1(0) |
| **Income** | | | |
| **Under $20,000** | 1407(16) | 1595(44) | 7(3) |
| **$20,000 - $54,999** | 3100(35) | 1487(41) | 82(34) |
| **$55,000-$74,999** | 1149(13) | 185(5) | 27(11) |
| **$75,000 and Over** | 2709(31) | 130(4) | 18(8) |
| **Missing** | 512(6) | 197(5) | 106(44) |
| **Alcohol Use** | | | |
| **Never** | 993(11) | 467(13) | 29(12) |
| **Moderate** | 3297(37) | 930(26) | 73(30) |
| **Heavy** | 2854(32) | 1364(38) | 76(32) |
| **Missing** | 1733(20) | 833(23) | 62(26) |
| **Smoking Status** | | | |
| **Never** | 5047(57) | 1748(49) | 138(57) |
| **Former** | 1935(22) | 586(16) | 50(21) |
| **Current** | 1838(21) | 1198(33) | 50(21) |
| **Missing** | 57(1) | 62(2) | 2(1) |
| **Moderate Phys Act** | | | |
| **Yes** | 4642(52) | 1738(48) | 119(50) |
| **No** | 3265(37) | 1502(42) | 107(45) |
| **Missing** | 970(11) | 354(10) | 14(6) |
| | Mean(SD) | Mean(SD) | Mean(SD) |
| **Age** | 43(13) | 40(13) | 41(13) |

Table 2: Charactersitcs of Study Participants by Food Security Category

| | Fully Food Secure | Marginal Food Security | Low Food Security | Very Low Food Security | Missing |
|---|---|---|---|---|---|
| | (n=8877) | (n=1405) | (n=1370) | (n=819) | (n=240) |
| | N(%) | N(%) | N(%) | N(%) | N(%) |

|  | Fully Food Secure | Marginal Food Security | Low Food Security | Very Low Food Security | Missing |
|---|---|---|---|---|---|
| **Gender** | | | | | |
|   Female | 4340(49) | 741(53) | 697(51) | 431(53) | 118(49) |
| **Race** | | | | | |
|   Non-Hispanic White | 4318(49) | 391(28) | 372(27) | 338(41) | 81(34) |
|   Mexican American | 1435(16) | 405(29) | 442(32) | 155(19) | 66(28) |
|   Other Hispanic | 649(7) | 146(10) | 159(12) | 98(12) | 16(7) |
|   Non-Hispanic Black | 1655(19) | 381(27) | 320(23) | 192(23) | 58(24) |
|   Other (including multiracial) | 298(3) | 28(2) | 39(3) | 15(2) | 12(5) |
|   Missing | 522(6) | 54(4) | 38(3) | 21(3) | 7(3) |
| **Education** | | | | | |
|   Less than 9th Grade | 601(7) | 183(13) | 294(21) | 129(16) | 26(11) |
|   9-11th Grade | 1126(13) | 297(21) | 331(24) | 198(24) | 38(16) |
|   High School Grad | 1944(22) | 374(27) | 308(22) | 209(26) | 71(30) |
|   Some College/AA | 2705(30) | 415(30) | 336(25) | 247(30) | 68(28) |
|   College Graduate or above | 2497(28) | 132(9) | 100(7) | 35(4) | 36(15) |
|   Missing | 4(0) | 4(0) | 1(0) | 1(0) | 1(0) |
| **Income** | | | | | |
|   Under $20,000 | 1407(16) | 525(37) | 616(45) | 454(55) | 7(3) |
|   $20,000 - $54,999 | 3100(35) | 626(45) | 553(40) | 308(38) | 82(34) |
|   $55,000-$74,999 | 1149(13) | 108(8) | 58(4) | 19(2) | 27(11) |
|   $75,000 and Over | 2709(31) | 78(6) | 43(3) | 9(1) | 18(8) |
|   Missing | 512(6) | 68(5) | 100(7) | 29(4) | 106(44) |
| **Alcohol Use** | | | | | |
|   Never | 993(11) | 191(14) | 187(14) | 89(11) | 29(12) |
|   Moderate | 3297(37) | 361(26) | 342(25) | 227(28) | 73(30) |
|   Heavy | 2854(32) | 531(38) | 527(38) | 306(37) | 76(32) |
|   Missing | 1733(20) | 322(23) | 314(23) | 197(24) | 62(26) |
| **Smoking Status** | | | | | |
|   Never | 5047(57) | 729(52) | 678(49) | 341(42) | 138(57) |
|   Former | 1935(22) | 240(17) | 229(17) | 117(14) | 50(21) |
|   Current | 1838(21) | 407(29) | 440(32) | 351(43) | 50(21) |
|   Missing | 57(1) | 29(2) | 23(2) | 10(1) | 2(1) |
| **Moderate Phys Act** | | | | | |
|   Yes | 4642(52) | 671(48) | 651(48) | 416(51) | 119(50) |
|   No | 3265(37) | 581(41) | 580(42) | 341(42) | 107(45) |
|   Missing | 970(11) | 153(11) | 139(10) | 62(8) | 14(6) |
|  | Mean(SD) | Mean(SD) | Mean(SD) | Mean(SD) | Mean(SD) |
| **Age** | 43(13) | 40(14) | 41(13) | 40(13) | 41(13) |

Table 3: Weighted Charactersitcs of Study Participants by Food Security Status

|  | Not Food Insecure | Food Insecure | p-value |
|---|---|---|---|
|  | (n=88177828) N(%) | (n=22997275) N(%) |  |
| **Gender** |  |  | 1.00 |
| **Female** | 42872281(49) | 11179567(49) |  |
| **Moderate Phys Act** |  |  | <0.01 |
| **No** | 31515063(36) | 9824629(43) |  |
| **Race** |  |  | <0.01 |
| **Non-Hispanic White** | 67376239(76) | 11878482(52) |  |
| **Mexican American** | 5656507(6) | 3818366(17) |  |
| **Other Hispanic** | 3753298(4) | 2180826(9) |  |
| **Non-Hispanic Black** | 7963019(9) | 4482271(19) |  |
| **Other (including multiracial)** | 3428764(4) | 637329(3) |  |
| **Education** |  |  | <0.01 |
| **Less than 9th Grade** | 2359155(3) | 2249538(10) |  |
| **9-11th Grade** | 7787500(9) | 5147999(22) |  |
| **High School Grad** | 18563491(21) | 6102111(27) |  |
| **Some College/AA** | 28338608(32) | 7617569(33) |  |
| **College Graduate or above** | 31129074(35) | 1880058(8) |  |
| **Income** |  |  | <0.01 |
| **Under $20,000** | 10738495(12) | 10047850(44) |  |
| **$20,000 - $54,999** | 27895252(32) | 9972909(43) |  |
| **$55,000-$74,999** | 13673503(16) | 1710333(7) |  |
| **$75,000 and Over** | 35870577(41) | 1266183(6) |  |
| **Alcohol Use** |  |  | <0.01 |
| **Never** | 9328890(11) | 3048910(13) |  |
| **Moderate** | 42648439(48) | 7914297(34) |  |
| **Heavy** | 36200499(41) | 12034069(52) |  |
| **Smoking Status** |  |  | <0.01 |
| **Never** | 50532364(57) | 10343630(45) |  |
| **Former** | 19755416(22) | 3542494(15) |  |
| **Current** | 17890047(20) | 9111150(40) |  |
|  | Mean(SD) | Mean(SD) |  |
| **Age** | 42(0.3) | 37(0.4) | <0.01 |

Table 4: Weighted Charactersitcs of Study Participants by Food Security Category

|  | Fully Food Secure | Marginal Food Security | Low Food Security | Very Low Food Security | p-value |
|---|---|---|---|---|---|
|  | (n=88177828) N(%) | (n=8934150) N(%) | (n=8276011) N(%) | (n=5787114) N(%) |  |
| **Gender** |  |  |  |  | 0.90 |
| **Female** | 42872281(49) | 4441789(50) | 3973027(48) | 2764751(48) |  |
| **Moderate Phys Act** |  |  |  |  | <0.01 |
| **No** | 31515063(36) | 3806635(43) | 3568694(43) | 2449300(42) |  |
| **Race** |  |  |  |  | <0.01 |

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|  | Fully Food Secure | Marginal Food Security | Low Food Security | Very Low Food Security | p-value |
|---|---|---|---|---|---|
| **Non-Hispanic White** | 67376239(76) | 4247902(48) | 4213178(51) | 3417402(59) | |
| **Mexican American** | 5656507(6) | 1633376(18) | 1617242(20) | 567748(10) | |
| **Other Hispanic** | 3753298(4) | 935038(10) | 685617(8) | 560171(10) | |
| **Non-Hispanic Black** | 7963019(9) | 1865360(21) | 1509963(18) | 1106949(19) | |
| **Other (including multiracial)** | 3428764(4) | 252474(3) | 250010(3) | 134845(2) | |
| **Education** | | | | | <0.01 |
| **Less than 9th Grade** | 2359155(3) | 814175(9) | 924848(11) | 510514(9) | |
| **9-11th Grade** | 7787500(9) | 1641976(18) | 2174825(26) | 1331199(23) | |
| **High School Grad** | 18563491(21) | 2464206(28) | 1926733(23) | 1711172(30) | |
| **Some College/AA** | 28338608(32) | 3032930(34) | 2566631(31) | 2018008(35) | |
| **College Graduate or above** | 31129074(35) | 980862(11) | 682974(8) | 216221(4) | |
| **Income** | | | | | <0.01 |
| **Under $20,000** | 10738495(12) | 3287677(37) | 3675740(44) | 3084433(53) | |
| **$20,000 - $54,999** | 27895252(32) | 4000244(45) | 3551965(43) | 2420701(42) | |
| **$55,000-$74,999** | 13673503(16) | 982134(11) | 565526(7) | 162673(3) | |
| **$75,000 and Over** | 35870577(41) | 664095(7) | 482780(6) | 119307(2) | |
| **Alcohol Use** | | | | | <0.01 |
| **Never** | 9328890(11) | 1222689(14) | 1088843(13) | 737377(13) | |
| **Moderate** | 42648439(48) | 3045107(34) | 2811894(34) | 2057296(36) | |
| **Heavy** | 36200499(41) | 4666354(52) | 4375274(53) | 2992441(52) | |
| **Smoking Status** | | | | | <0.01 |
| **Never** | 50532364(57) | 4352677(49) | 3892901(47) | 2098053(36) | |
| **Former** | 19755416(22) | 1547773(17) | 1204353(15) | 790368(14) | |
| **Current** | 17890047(20) | 3033700(34) | 3178757(38) | 2898693(50) | |
|  | Mean(SD) | Mean(SD) | Mean(SD) | Mean(SD) | |
| **Age** | 42(0.3) | 37(0.6) | 38(0.6) | 37(0.8) | <0.01 |

Prevalence of Metabolic Syndrome and Food Insecurity by Age and NHANES Cycle

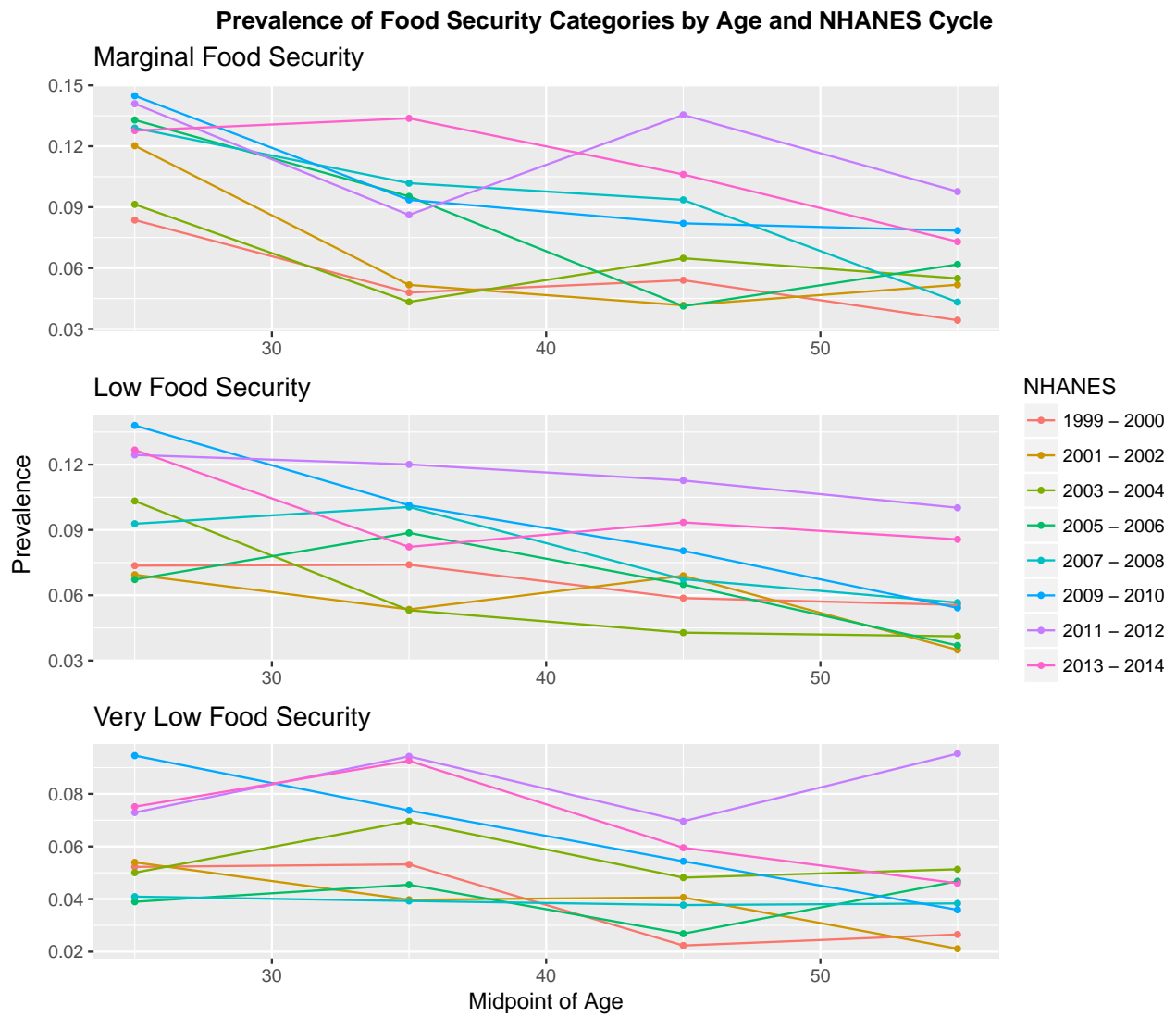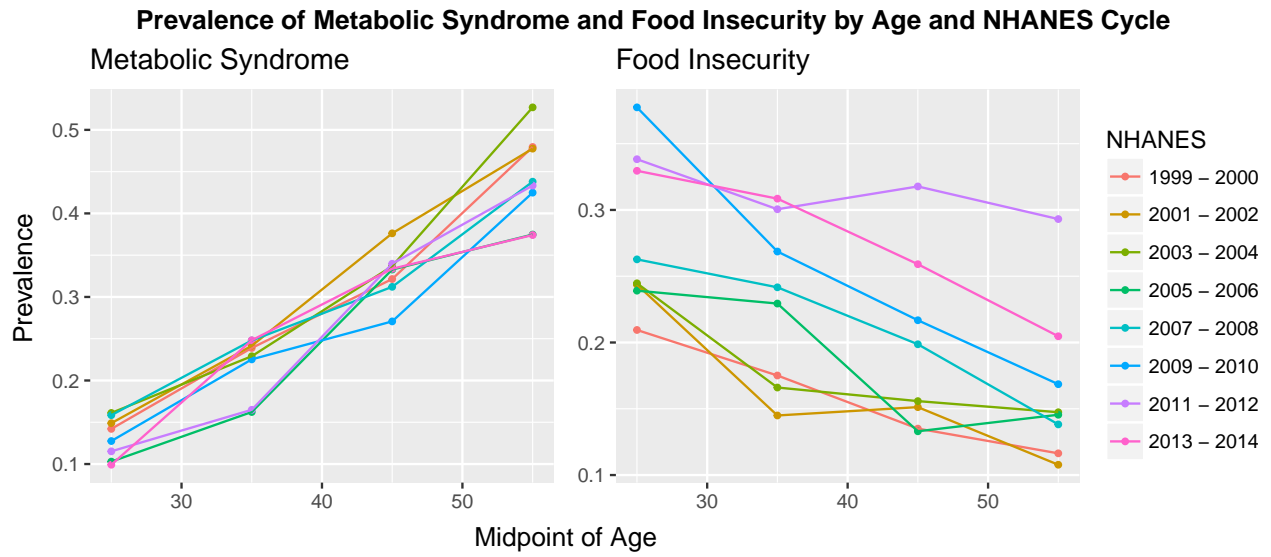Prevalence of Food Security Categories by Age and NHANES Cycle

Table 5: Unadjusted Prevalence and Relative Risk Ratio of Metabolic Syndrome

|  | Metabolic Syndrome (missing alc excl) | Metabolic Syndrome (missing alc not excl) |
|---|---|---|
| **Unadjusted Prevalence** |  |  |
| **Food Secure** | 0.29(0.27-0.30) | 0.31(0.29-0.32) |
| **Food Insecure** | 0.31(0.28-0.34) | 0.33(0.30-0.36) |
| **Crude Risk Ratio** | 1.06(0.96-1.17) | 1.07(0.98-1.17) |

Table 6: Unadjusted Prevalence and Relative Risk Ratio of Metabolic Syndrome

|  | Metabolic Syndrome (missing alc excl) | Metabolic Syndrome (missing alc not excl) |
|---|---|---|
| **Unadjusted Prevalence** |  |  |
| **Full food security** | 0.29(0.27-0.30) | 0.31(0.29-0.32) |
| **Marginal food security** | 0.29(0.25-0.34) | 0.31(0.27-0.35) |
| **Low Food security** | 0.31(0.27-0.36) | 0.34(0.29-0.38) |
| **Very low Food security** | 0.32(0.27-0.37) | 0.34(0.29-0.39) |
| **Crude Risk Ratio (vs full food security)** |  |  |
| **Marginal food security** | 1.00(0.86-1.17) | 1.02(0.90-1.15) |
| **Low food security** | 1.08(0.94-1.24) | 1.10(0.98-1.24) |
| **Very low food security** | 1.10(0.93-1.31) | 1.11(0.95-1.31) |

Table 7: Adjusted Risk Ratio Metabolic Syndrome by Food Insecurity Status

|  | Adj RR | Adj RR not adj for alc |
|---|---|---|
| **Male** | 1.08(0.78-1.50) | 1.11(0.81-1.52) |
| **Female** | 1.36(0.95-1.93) | 1.37(1.01-1.85) |

Table 8: Adjusted Risk Ratio Metabolic Syndrome by Food Security Category

|  | Males | Females |
|---|---|---|
| **Adj RR (vs full food security)** |  |  |
| **Marginal food security** | 1.11(0.63-1.96) | 1.22(0.66-2.23) |
| **Low food security** | 1.28(0.80-2.05) | 2.14(1.35-3.38) |
| **Very low food security** | 0.86(0.53-1.41) | 1.36(0.77-2.39) |
| **Adj RR not adj for alc (vs full food security)** |  |  |
| **Marginal food security** | 1.11(0.65-1.89) | 1.17(0.69-1.99) |
| **Low food security** | 1.25(0.82-1.91) | 1.94(1.31-2.87) |
| **Very low food security** | 0.99(0.57-1.72) | 1.49(0.84-2.63) |

# Discussion

# Conculsions

# References

1. Core indicators of nutritional state for difficult-to-sample populations. J Nutr. 1990;120 Suppl 11:1559–600.