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# Examining the changing role of risky behaviors in the association between food insecurity & obesity

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## 1. Abstract

About 49 million Americans – roughly 15% of entire America - live in households that lack the means to get enough nutritious food on a regular basis. Past experiences and fear of food accessibility could affect the quality of diet and eating behavior in many ways. In this study we examine long-term trends in food insecurity and obesity over a 20-year period. We specifically examine the changing role of health behaviors in the association between food insecurity and obesity. Most studies on this topic have conducted cross-sectional analysis. Examining this association over time would help us make more careful considerations in making policies. Until recently, it was assumed that the only reason for being overweight was excessive eating. Food insecurity could also cause weight gain due to adverse social and physical environments with identifiable risk factors. It is imperative to know that food security and poverty are both forms of material deficit which bring about a range of detrimental results such as excess weight gain. Food insecurity is a continuum of experiences ranging from the most extreme form, starvation, to complete food security and changes in food security status can be temporary, cyclical, medium or long term.

## 2. Introduction

Food insecurity is a global problem which has been around for centuries but has not been able to gather the appropriate concern from the policy makers nor the general population. For those who do intend to work on this challenge, they are faced with multiple issues, such as social customs, behavior of individuals and stages in the human life cycle, food availability and quality. A big concern that we face today is bringing a consensus to the understanding of the problem to come up with an effective response.

Leading a healthy lifestyle is a choice but having access to it is a basic human right. There are many who just don't have access to it whereas others who choose to follow an unhealthy routine. Living a "healthy" lifestyle takes time and energy. It requires giving extra in everything, be it the time one spends in the grocery store – aisle to aisle looking up the organic products, cooking/preparing the meals instead of ordering in, saying no to that extra drink, and being careful when eating out. The world today is more globalized than ever and almost every community has people from different backgrounds, lifestyle, access to resources and level of education. Hence, the problem which I will discuss in this paper is 'Examining the changing role of risky behaviors in the association between food insecurity & obesity'. We will explore the association between food insecurity and obesity over time and adding the element of time would help us make more careful considerations in making policies.

The concept of 'food security' first began to draw attention in the 1940s and is now commonly used in planning, implementing and assessing philanthropic emergency and development policies and programs. The universal definition of 'food security', acknowledged by the highest

level of global governance on food security, the Committee on World Food Security (CFS), describes it as a situation where 'all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active healthy life' (CFS 2012 as per the FAO 1996 definition). Until recently, it was assumed that the only reason for being overweight was excessive eating. Food insecurity could also cause weight gain and obesity due to adverse social and physical environments with identifiable risk factors.

Obesity is often linked with unhealthy behavior and laziness; however, it is not only health but also an economic phenomenon. Because of the high costs of obesity, and the fact that majority of these costs are financed by taxpayers, there is a clear motivation for government to try to reduce these costs. However, because obesity may result from poor information, lack of education, addictive behavior and/or as a result of being a part of an increasingly unhealthy lifestyle, interventions will need to be multifaceted to ensure the best chance of success. At the same time, people who have access to food, but not healthy food would fall under a tight spot since they would not be able to afford healthier options. It is also to be noted that eating healthy comes at a cost. In a world where an entire meal with unlimited soda refills is for $4.00 on average, a mere bowl of salad might cost about $7.00 or more. Hence, eating healthy is also much more expensive.

There are economic, social, environmental and political systems related to food (in)security and these are all inter-connected: eliminating one cause of food insecurity may bring to light a more deeply rooted cause of which the original insecurity may have been a symptom. An example of this case would be, we might give cash to a poor family to buy food, only to find that lack of cash was a stemmed from another problem, such as a lack of work opportunities. But theoretical

disagreements may distract from the problem. One such disagreement from Pangaribowo et al. (2013) offers the argument: that food security is an aim in itself, not just a prerequisite for adequate nutrition. So here it is assumed that food security is a bigger issue than just the availability of adequate nutrition and such differences in opinions of experts cause difficulty in effective policy related decisions. (Hendriks and Drimie 2011; Coates2013; Candel 2014) claim that how we understand and define food security determines how we measure it. Our knowledge on the subject has increased incrementally but more research needs to be done be able to dissect and solve the problem for good. This paper aims to provide better understanding of food (in)security and the various dimensions that incorporate it.

## 3. Review of Literature

The literature reviewed for this project is majorly selective rather than exhaustive and various scientific, government and industry sources of information have been studied. French et al. (2001) states that obesity is on the rise in USA and currently about 50% of US adults and 25% of US children are overweight. There is a certain percentage among these people who are food insecure and still in the obese category. It is hard to fathom how one can be food insecure and obese at the same time, but this is a real epidemic. Better understanding of food (in)security leads to better measurement and reforms and the measurement can consider quantitative, qualitative, psychological and social or normative paradigms of the experience of food insecurity (Campbell 1991, p410). There are various other approaches which have emerged over time and there is not set formula that exists to base the measurement.

Roughly 3 decades ago, food insecurity was based on the belief that it is just caused by insufficient food supply. The solution was therefore, to produce more food. This was not the actual problem as different studies led to the understanding that food insecurity is also when people experience food deprivation because they have difficulty in accessing it and not necessarily because it is not available in the marketplace (Sen 1981). This understanding led to a shift the focus to identifying subjective experiences of hunger and 'coping' tactics as determinants of food security. This is an ever evolving topic and Renzaho and Mellor (2010) claim that coping strategies based on the perspective of availability as a whole is misrepresentative and we should consider social, political and cultural aspects when looking at food insecurity. When we talk about the measurement of food security, it is important to know its linkage with utilization which is based either on dietary quality i.e. food consumption and dietary diversity, or on biological analysis on the effects of food

consumption. Nutrient requirements however, vary from person to person and depend on things like age and sex of each individual. Therefore, it is not easy to generalize utilization and nutrition data among populations and the data cannot be aggregated at household or national levels as it has been done in the past (Coates 2013). An example does exhibit this scenario would be that stunting levels of young children can be aggregated on household level and across populations. However, nutrition can only be measured at an individual level. Thus, it cannot be claimed that a said household is well nourished unless all members meet the criteria for sound nutrition as per their age, sex, weight, activity levels and height.

The first three food security dimensions are availability, access and utilization and these are hierarchical in order. Food availability is necessary but not sufficient for access, and access is necessary but not sufficient for utilization (Webb et al. 2006). However, these factors depend on constant availability, access to food supplies and the means to obtain adequate food for all household members throughout the life cycle. Until now, very little importance has been given to the stability dimension of the food security challenge. Some reports may show individuals to having enough the be placed in the food secure category, but that might be their temporary state and could very easily change in matter of months. So, it is critical to study how households have progressed over time as that would give a better picture of their scenario.

An instrument developed by the USDA has been administered since the mid-1990s as a part of the CPS (Current Population Survey) and it has been used in many surveys (such as NHANES, Panel Study of Income Dynamics, the Los Angeles Family and Neighborhood Survey) and it has become the foundation for official approximations of the number of hungry people in the United

States (Bhattacharya et al. 2004). The CPS is a source that is updated relatively consistently and frequently and subsequently helps in building data sets like the NHANES.

## 4. Data Description and Variables

### 4.1 Variables & Data Source

The data used for this research is from the National Health and Nutrition Examination Survey (NHANES) and three different data sets are used to observe trends over time. The three sets of data used are from 2009-2010, 2011-2012 and 2013-14. NHANES is a program of studies designed to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interview and physical examinations. The program began in the 1960s and has conducted a series of surveys focusing on different population groups or health topics. It has been a continuous program since 1999 and has followed an evolving focus on a variety of health and nutrition measurements to meet emerging needs. The NHANES interview includes demographic, socioeconomic, dietary and health related questions.

The dependent variable in the study is going to be (Y) Body Mass Index (BMI) and there are several independent variables which include (X2) Food Security which covers the levels of food security the respondents are currently in, (X3) Education which covers the highest grade or level of school completed or the highest degree received, (X4) Race which covers reported race and Hispanic origin information and (X5) Expenses which shows that during the past 30 days, how much money you spend on eating out. Another dependent variable (Y6) is Smoking

which asks respondents if they currently smoke. This variable will be examined at a later part of the research. In addition, we will use dummy variables for Food Security, Education, Income and Race so additional variables will include for Food Security: Food Security2, Food Security3, Food Security4; for Education, Education2, Education3, Education4 & Education5; for Race: Race2, Race3, Race4 & Race5.

A summary of the definitions and descriptive statistics of variables used in the model is shown in the table below:

## Table1: Definitions of Variables Used in the Empirical Model

| Variable | Description |
|---|---|
| BMI | Body Mass Index (kg/m**2) |
| Food Security 1 | Adult food security category for last 12 months (Full Food Security) |
| Food Security 2 | Adult food security category for last 12 months (Marginal Food Security) |
| Food Security 3 | Adult food security category for last 12 months (Low Food Security) |
| Food Security 4 | Adult food security category for last 12 months (Very Low Food Security) |
| Food Security 5 | Adult food security category for last 12 months (Full Food Security) |
| Race1 | Recode of reported race and Hispanic origin information (Mexican American) |
| Race2 | Recode of reported race and Hispanic origin information (Other Hispanic) |

| | |
|---|---|
| Race3 | Recode of reported race and Hispanic origin information (Non-Hispanic White) |
| Race4 | Recode of reported race and Hispanic origin information (Non-Hispanic Black) |
| Race5 | Recode of reported race and Hispanic origin information (Other Race - Including Multi Race) |
| Education1 | What is the highest grade or level of school completed or the highest degree received? |
| Education2 | What is the highest grade or level of school completed or the highest degree received? |
| Education3 | What is the highest grade or level of school completed or the highest degree received? |
| Education4 | What is the highest grade or level of school completed or the highest degree received? |
| Education5 | What is the highest grade or level of school completed or the highest degree received? |
| Smoking 1 | Do you now smoke cigarettes (Every day) |
| Smoking 2 | Do you now smoke cigarettes (Some days) |
| Smoking 3 | Do you now smoke cigarettes (Not at all) |

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Following are the codes which are going to be used to define the responses for the variables

(a detailed list showing trends over the years is shown in the appendix section)

Table 2: Body Mass Index (BMI)

| BMXBMI - Body Mass Index (kg/m**2) | |
|---|---|
| **Code** | **Value Description** |
| 12.1 to 82.9 | Range of Values |

Table 2.1: Body Mass Index (BMI) Classifications

| Height | Weight Range | BMI | Considered |
|---|---|---|---|
| 5' 9" | 124 lbs. or less | Below 18.5 | Underweight |
| | 125 lbs. to 168 lbs. | 18.5 to 24.9 | Healthy weight |
| | 169 lbs. to 202 lbs. | 25.0 to 29.9 | Overweight |
| | 203 lbs. or more | 30 or higher | Obese |
| | 271 lbs. or more | 40 or higher | Class 3 Obese |

Table 3: Education Description

| Education | |
|---|---|
| **Code** | **Value Description** |
| 1 | Less than 9th grade |
| 2 | 9-11th grade (Includes 12th grade with no diploma) |
| 3 | High school graduate/GED or equivalent |
| 4 | Some college or AA degree |
| 5 | College graduate or above |

Table 4: Food Security Description

| Food Security | |
|---|---|
| **Code in NHANES** | **Value Description** |
| 1 | AD full food security |
| 2 | AD marginal food security |
| 3 | AD low food security |
| 4 | AD very low food security |

Table 5: Race Description

| Race | |
|---|---|
| **Code** | **Value Description** |
| 1 | Mexican American |
| 2 | Other Hispanic |
| 3 | Non-Hispanic White |
| 4 | Non-Hispanic Black |
| 5 | Other Race - Including Multi-Racial |

Table 6: Smoking Description

| Smoking | |
|---|---|
| **Code** | **Value Description** |
| 1 | Every day |
| 2 | Some days |
| 3 | Not at all |

Table 7: Expense

| Expense | |
|---|---|
| **Code** | **Value Description** |
| 0 to 2142 | Range of Values |
| 777777 | Refused |
| 999999 | Don't know |

The data has been partially reorganized as certain respondents have been removed from the source since their responses to single or at times multiple variables were missing. Most respondents have not replied to the smoking category and over 70% of the answers have not been recorded. Therefore, the smoking variable will not be examined at this point of the research.

### 4.2 Data Description / Summary Stats

Table 6.1 shows the level of food security for respondents with different levels of education. It can be seen from the data that for people with education below 11th grade - there are more people (in percentage terms) with low food security compared to those having marginal food security. As we move up towards respondents with higher education levels, a gradual trend can be noticed for decreasing food security levels and there are more and more people who are food secure.

Table 6.2 is a representation of the BMI levels of individuals with different levels of Food security. The point of concern are those individuals who have low food security but are still obese. The table shows at least 25% of the people fall in this category of being obese or class 3 obese despite being food insecure. One of the reasons for this could be eating unhealthy food or having varied meal portions.

Table 6.3 shows food security levels among different races. It can be seen that among Mexican Americans, more people have low food security then marginal food security which is a very surprising fact. For the 'Other Hispanic' respondents, this trend is picking up as it can be seen that there are more people having marginal food security in 2009-10 and 2011-12 but in 2013-14, their number drops and more people have fallen in the low food security category. Non-Hispanic white respondents have the highest average percentage of food security over the three data sets as 75% of them have full food security whereas only 57% of the Non-Hispanic Black respondents have full food security.

*These tables can be seen in detail in section 6.

### 4.3 Comparison of Variable Responses over time (2009-2014)

| Average $ Spent on Eating out | | | |
|---|---|---|---|
| | 2009-10 | 2011-12 | 2013-14 |
| Full Food Security | 145 | 165 | 171 |
| Marginal Food Security | 108 | 112 | 107 |
| Low Food Security | 83 | 89 | 100 |
| Very Low Food Security | 73 | 83 | 83 |

As shown in the table above, the average expenditure of the respondents on eating out has increased for those who have Full, Low and Very low food security over time from 2009 to 2014, whereas it has slightly decreased for those individuals who are in the Marginal Food security category. The reason for the increase is most likely the increasing trend of eating out in the United States in the past decade and as people now have more options, some of which are affordable as well, this trend is likely to increase even though it is not the healthiest of act as food from restaurants such as fast food is known to be less nutritious compared to food prepared at home.

## 5. Theoretical Model

While examining the role of risky behavior in the association between food security and obesity, it is vital to note that individuals who are food insecure could be obese and vice versa. The factors causing this peculiar occurrence are diverse and will be discussed in the results section. An obvious differentiating factor between people with high and low level of education is the availability of resources. Better educated people are expected to earn more compared to those with lesser education and these difference in earnings could affect health and the behavior associated with the lifestyle. This however does not mandate that all those who are highly

educated will be leading a healthy lifestyle and are avoiding risky behavior such as smoking or excessive eating. The following two hypothesis will be used in this case and they are as follows:

**Hypothesis I**

***Null Hypothesis: Marginal food security is not associated with obesity***

***Alternate Hypothesis: Marginal food security is associated with obesity***

**Hypothesis II**

***Null Hypothesis: Very Low Food Security is not associated with obesity***

***Alternate Hypothesis: Very Low Food Security is associated with obesity***

The independent variable in this study is going to be Food Security, Race, Education and Expense whereas the dependent variable is going to be the BMI level. Following is the model which is going to be used for this study:

$$\mathbf{BMI\ (Y) = ß_0 + ß_1{*}FS2 + ß_2{*}FS3 + ß_3{*}FS4 + ß_4{*}Race2 + ß_5{*}Race3 + ß_6{*}Race4 + ß_7{*}Race5 +}$$

$$\mathbf{ß_8{*}\ Edu2 + ß_9{*}Edu3 + ß_{10}{*}Edu4 + ß_{11}{*}Edu5 + ß_{12}\ Exp + \mu_i}$$

| **Table: Hypothesis Tests** | |
|---|---|
| | |
| Null Hypothesis | Alternate Hypothesis |
| | |
| $H_o$: $\beta_{FS1} = 0$ | $H_a$: $\beta_{FS2} \neq 0$ |
| | |
| $H_o$: $\beta_{FS3} = 0$ | $H_a$: $\beta_{FS3} \neq 0$ |
| | |
| $H_o$: $\beta_{FS4} = 0$ | $H_a$: $\beta_{FS4} \neq 0$ |
| | |
| $H_o$: $\beta_{Race2} = 0$ | $H_a$: $\beta_{Race2} \neq 0$ |
| | |
| $H_o$: $\beta_{Race3} = 0$ | $H_a$: $\beta_{Race3} \neq 0$ |
| | |
| $H_o$: $\beta_{Race4} = 0$ | $H_a$: $\beta_{Race4} \neq 0$ |
| | |
| $H_o$: $\beta_{Race5} = 0$ | $H_a$: $\beta_{Race5} \neq 0$ |
| | |
| $H_o$: $\beta_{Education2} = 0$ | $H_a$: $\beta_{Education2} \neq 0$ |
| | |
| $H_o$: $\beta_{Education3} = 0$ | $H_a$: $\beta_{Education3} \neq 0$ |
| | |
| $H_o$: $\beta_{Education4} = 0$ | $H_a$: $\beta_{Education4} \neq 0$ |
| | |
| $H_o$: $\beta_{Education5} = 0$ | $H_a$: $\beta_{Education5} \neq 0$ |
| | |
| $H_o$: $\beta_{Expense} = 0$ | $H_a$: $\beta_{Expense} \neq 0$ |
| | |

## 6. Descriptive Results

### Table 6.1

| Food Security Levels (For different levels of Education) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Less than 9th grade | | | 9-11th grade | | | High school graduate | | | Some college or AA degree | | | College graduate or above | | |
| | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 |
| Full Food Security | 47% | 54% | 53% | 57% | 56% | 58% | 66% | 61% | 66% | 73% | 67% | 70% | 90% | 87% | 90% |
| Marginal Food Security | 15% | 16% | 16% | 15% | 16% | 12% | 13% | 14% | 13% | 11% | 13% | 12% | 6% | 6% | 4% |
| Low Food Security | 23% | 20% | 20% | 15% | 15% | 20% | 11% | 14% | 13% | 8% | 10% | 10% | 3% | 4% | 4% |
| Very Low Food Security | 15% | 10% | 11% | 13% | 14% | 11% | 10% | 11% | 9% | 8% | 10% | 9% | 2% | 2% | 2% |
| **Grand Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

### Table 6.2

| Food Security Levels (BMI Levels among food security classes) | | | | | | |
|---|---|---|---|---|---|---|
| **Row Labels** | | **Underweight** | **Healthy Weight** | **Overweight** | **Obese** | **Class 3 Obese** |
| Full Food Security | 2009-10 | 18% | 30% | 25% | 22% | 4% |
| | 2011-12 | 22% | 31% | 23% | 20% | 5% |
| | 2013-14 | 19% | 31% | 23% | 21% | 5% |
| Marginal Food Security | 2009-10 | 18% | 30% | 25% | 22% | 6% |
| | 2011-12 | 22% | 29% | 23% | 21% | 5% |
| | 2013-14 | 21% | 31% | 22% | 21% | 5% |
| Low Food Security | 2009-10 | 22% | 26% | 26% | 21% | 5% |
| | 2011-12 | 21% | 31% | 25% | 19% | 4% |
| | 2013-14 | 21% | 32% | 22% | 21% | 4% |
| Very Low Food Security | 2009-10 | 20% | 28% | 26% | 21% | 5% |
| | 2011-12 | 21% | 34% | 23% | 19% | 4% |
| | 2013-14 | 22% | 28% | 24% | 20% | 5% |

**Table 6.3**

| Food Security Levels (Race Specific) 09-10 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mexican American | | | Other Hispanic | | | Non-Hispanic White | | |
| | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 |
| Full Food Security | 48% | 47% | 55% | 55% | 57% | 57% | 78% | 73% | 74% |
| Marginal Food Security | 19% | 23% | 15% | 19% | 15% | 14% | 9% | 9% | 10% |
| Low Food Security | 21% | 21% | 22% | 14% | 14% | 20% | 7% | 9% | 8% |
| Very Low Food Security | 12% | 9% | 9% | 13% | 13% | 9% | 7% | 9% | 8% |
| **Grand Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

**Table 6.3 (Contd.)**

| Food Security Levels (Race Specific) 09-10 | | | | | | |
|---|---|---|---|---|---|---|
| | Non-Hispanic Black | | | Other Race - Including Multi-Racial | | |
| | 2009-10 | 2011-12 | 2013-14 | 2009-10 | 2011-12 | 2013-14 |
| Full Food Security | 57% | 55% | 61% | 73% | 77% | 79% |
| Marginal Food Security | 17% | 19% | 16% | 11% | 11% | 9% |
| Low Food Security | 14% | 16% | 14% | 11% | 6% | 6% |
| Very Low Food Security | 12% | 10% | 9% | 6% | 6% | 6% |
| **Grand Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

## 7. Appendix

**Table 7.1**

| Smoking habits at different levels of Food Security | | | | | | |
|---|---|---|---|---|---|---|
| | **Year** | **Every day** | **Some days** | **Not at all** | **Refused/Don't Know/ Missing** | **Total** |
| Full Food Security | 2009-10 | 10% | 2% | 15% | 73% | 100% |
| | 2011-12 | 9% | 2% | 13% | 76% | 100% |
| | 2013-14 | 10% | 2% | 13% | 75% | 100% |
| Marginal Food Security | 2009-10 | 12% | 2% | 14% | 72% | 100% |
| | 2011-12 | 10% | 3% | 13% | 74% | 100% |
| | 2013-14 | 10% | 3% | 12% | 75% | 100% |
| Low Food Security | 2009-10 | 11% | 2% | 12% | 74% | 100% |
| | 2011-12 | 9% | 2% | 11% | 77% | 100% |
| | 2013-14 | 9% | 2% | 14% | 75% | 100% |
| Very Low Food Security | 2009-10 | 9% | 3% | 15% | 73% | 100% |
| | 2011-12 | 9% | 1% | 12% | 77% | 100% |
| | 2013-14 | 10% | 3% | 13% | 74% | 100% |

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