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## Impact Evaluation of the BRFSS in New York on Obesity Prevention for Weight Loss Among Women

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*Walden University*

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# Walden University

College of Health Sciences and Public Policy

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Nikisha Skeete

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Walden University  
2022

Abstract

Impact Evaluation of the BRFSS in New York on Obesity Prevention for Weight Loss

Among Women

by

Nikisha Skeete

MS, Kaplan University, 2014

MS, Purdue Global University, 2019

BA, University of North Carolina at Pembroke, 2011

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Public Health

Walden University

August 2022

## Abstract

Obesity has increased among the adult population, specifically women, in the United States within the past few decades. While the increase in obesity has been linked to a lack of physical activity and poor dietary intake, obesity lacks contextual analysis within adult women as a group. The purpose of this quantitative study was to examine the impact of the Behavioral Risk Factor Surveillance System (BRFSS) on obesity prevention for weight loss in women. Health behavior change theory, the transtheoretical theory model, and the health behavior model guided this study. The research questions were designed to examine whether modifiable lifestyle factors are associated with obesity and to examine whether there were differences in outcomes after the intervention was implemented. The research design was quantitative with retrospective secondary data. The population sample was obtained from the BRFSS dataset. The sample consisted of 8,767 adult women aged 18 years and older. The independent variables included physical activity, dietary intake, weight loss in Research Question 1, and year in Research Question 2. The dependent variable was obesity in Research Question 1 and weight loss in Research Question 2. Covariates included age, state, and sex. Multiple logistic regression and between-subjects *t* test were used to test the hypotheses. The results show that sex, age, and state have predictive properties when accounting for the association between physical activity, dietary intake, weight loss, and obesity. The positive social change implications of the findings of the study include their potential use by public health officials and policymakers to increase the implementation of obesity prevention programs that include physical activity, nutrition, and education designed for women.

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## Chapter 1: Introduction to the Study

### **Introduction**

Obesity is a complex disease that remains on the high priority list of health disparities (Centers for Disease Control and Prevention [CDC], 2020). Obesity is increasing among women due to varied factors in comparison to men (Weschenfelder et al., 2018). The isolated varied factors that women experience that contribute to the onset of obesity are pregnancy, menopause, and slower metabolisms (Kim et al., 2019). Public health surveillance systems were developed to determine whether the specific surveillance system is useful for the public health initiative (CDC, 2021). Reports from surveillance systems observing obesity provide insight into the areas most affected by obesity rates, which guides community health assessment planning to develop obesity prevention programs (Groseclose & Buckeridge, 2017).

Obesity prevention programs were developed as a strategy to implement interventions to decrease the prevalence of obesity (Mendy et al., 2017). Public healthcare professionals and clinical professionals are concerned about the cause for the increasing prevalence of obesity in women (Mitchell et al., 2016). In this chapter, I present the background for the study and the problem statement on which the study was founded. This chapter also includes the study's purpose, research questions and hypotheses, theoretical base, nature, definitions of terms, assumptions, scope and delimitations, limitations, and significance, concluding with a summary of the key points of the study.

## **Background**

Obesity has increased among women compared to men in the last few decades. This population has seen an increased prevalence of obesity compared to men due to varied factors. Aubrey (2015) examined the widening obesity gender gap between men and women in America due to the reported higher percentage of obesity in women in comparison to men. The findings of Aubrey's research study indicated a higher obesity rate for women (38%) than for men (34%). The CDC (2020) indicated that the incidence of adults diagnosed with obesity prevalence was 42.4% in 2017–2018, which represented an increase from 30.5% from 1999–2000. Obesity in women is a significant public health concern as the obesity epidemic increases in scope (CDC, 2020). Two concerns are the decrease in maternal health subsequently affecting mothers and infants and an increase in the cost of immediate and long-term women's healthcare. For example, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC program) was developed to ensure that pregnant women and mothers who have children up to the age of 5 years receive vouchers for healthy meal options to address obesity and hunger (Bartholomew et al., 2017). WIC programs have gone on to incorporate physical activity classes, lactation classes, cooking classes, and additional health education for mothers due to policymakers developing strategies to address the various factors that contribute to the prevalence of obesity (Bartholomew et al., 2017). Onarheim et al. (2016) suggested that healthier women and healthier children contribute to positive societal development. Additionally, the cost of immediate and long-term women's healthcare has increased; thus, researchers highlight the economic benefits associated with investing in women's health (Onarheim et al., 2016).

Obesity among racial/ethnic minorities has the highest prevalence among non-Hispanic Black adults at 49.6%, followed by Hispanic adults at 44.8%. The lowest prevalence of obesity is in non-Hispanic Whites at 42.2% (CDC, 2020). Researchers suggest that there is an obesity and education pattern whereby as education increases, obesity prevalence decreases among adults (CDC, 2020). Additionally, obesity prevalence was lower in the highest income group than in the middle and lowest income groups when examining the prevalence of obesity among women in different racial/ethnic groups (CDC, 2020).

Vizcarra et al. (2019) indicated that eating habits of overweight women due to poor nutrition are a significant contributor to the increase in obesity. Food choices of vulnerable women according to their weight status increase the prevalence of obesity due to body dissatisfaction and obstacles to eating healthy (Vizcarra et al., 2019). Researchers reported that it was more difficult for women who were overweight to lose weight in comparison to normal weight women due to these women basing health behaviors on internal and external factors (Vizcarra et al., 2019). Hutchesson et al. (2018) examined the use of eHealth in the Be Positive Be Health<sub>e</sub> (BPBH) program as an online data collection tool that tracks weight loss for young women. In 6 months, the outcome of the study produced a mean difference in treated and untreated groups with a reported finding of the reduction in body fat percentage and dietary intake among young women. The outcome of the research study supported the use of innovative obesity prevention program designs to increase weight loss by modifying physical activity and dietary intake among treated and untreated groups of young women.

There is a lack of recreational facilities in various regions of the United States, resulting in less physical activity, which contributes to higher prevalence of obesity among women. Jones (2015) examined disparities in physical activity resource availability in six U.S. regions, one of which was New York. The results indicated a need for improvements in resource distribution, as the availability of parks and recreational facilities was lower in predominantly minority census tracts across the regions analyzed (Jones, 2015). Health club memberships are more costly to women from lower socioeconomic backgrounds; thus, access to public recreational facilities for all social groups may contribute to a decrease in obesity rates and an increase in physical activity (Schroeder et al., 2017).

The impact evaluation of the Behavioral Risk Factor Surveillance System (BRFSS) on obesity prevention for the weight loss of women in New York state may contribute to the implementation of programs with women's health in mind. Mishra (2017) examined the strategies implemented as methods when conducting an intricate impact evaluation. Impact evaluations examine the causal effect of a program on the changes and outcomes of the program after a particular intervention to completion. The outcome differences at the conclusion of the obesity prevention program will provide insight into the need for social change addressing women in the population and subgroups within this population.

Health behavior change theory was examined to assess the self-efficacy, motivation, and outcome expectations of program participants. Furthermore, the intervention group and control group were measured to analyze differences in weight when physical activity and dietary intake changes were made. Physical activity and

dietary intake are modifiable lifestyle factors that can result in weight loss during obesity management (Gray et al., 2018). Teixeira and Marques (2017) examined the theoretical approach of health behavior change when reviewing the complexity of obesity management incorporated into the lifestyles of program participants. Teixeira and Marques's research study outcomes highlighted the advances made in behavior change science theories and methods in the course of time by examining innovative research.

### **Problem Statement**

New York public health leadership has expressed a need for the evaluation of an innovative initiative as a strategy to address the prevalence of obesity among women (Engel, 2018). Obesity among women contributes to life-shortening chronic diseases and has a negative impact on reproductive health (Kitson et al., 2018). Women are 2 times more likely to be diagnosed as extremely obese compared to men (Weschenfelder et al., 2018). Researchers report that women experience varied factors that influence weight gain in contrast to men, which warrants an impact evaluation of an obesity prevention program for women (Hageman et al., 2019). The varied factors that women experience include pregnancy, lower metabolisms, menopause, and how dietary intake and sedentary activities increase abdominal obesity in women compared to men (Carter, 2015; Kim et al., 2019).

Furthermore, racial, and ethnic minority women, such as non-Hispanic Black women, Hispanic women, and low-income women, have disproportionately high rates of obesity (Petersen et al., 2019). Moreover, 56.0% of Non-Hispanic Black women 20 years of age and older have a body mass index (BMI) of 30 or greater, which is considered obese (U.S. Department of Human Services Office of Minority Health, 2020). Hispanic

women are 29% more likely to be obese where there are food insecurities (Hernandez et al., 2017). Additionally, obesity prevalence is lower in higher income groups of women (CDC, 2020). Hence, these groups of women are significantly impacted by obesity, which calls for further evaluations of obesity prevention programs to develop strategies for inclusion, diversity, and cost-effectiveness, to be scaled to the population level (Senecal et al., 2020).

Research exists on the benefits associated with interventions aimed at implementing health behavior changes to increase physical activity and improve nutritional diet for weight loss (Hageman et al. 2019). New York public health leadership has expressed a need for further research on the results of interventions to assess whether there is an impact on the prevalence of overweight and obese women in New York after the intervention is implemented (Kelly et al., 2016; NYC Health, 2019). Public health surveillance systems provide insight into results of multiple interventions and the impact on the health of the community (Chiolero & Buckeridge, 2020). Surveillance systems health data drive action to implement obesity prevention programs for groups at high risk (CDC, 2021). These studies' randomized control trials and community studies with a control group were effective in women achieving weight loss (5% initial), and there was a high retention rate (70%) in more complex prevention intervention studies (Hageman et al. 2019; Häußler & Breyer, 2015; Redmond et al., 2019; Senecal et al., 2020). However, when evaluating a reduction in mortality and obesity prevalence in women, there were fewer published studies on the two topics researched, and women expressed difficulty with internalizing behavior changes due to program cost, flexibility, and duration, thus increasing the difficulty of having a population-level impact on obesity among women



(Mitchell et al., 2016). Research exists on the benefits associated with interventions aimed at implementing health behavior changes to increase physical activity and improve nutritional diet for weight loss. However, Mitchell et al. identified the limitations of weight loss interventions and called for the inclusion of additional weight loss interventions in academic research. The key question remains of whether obesity rates for women are still rising, and there is a need for an impact evaluation of a specific intervention targeted to improve women's health in New York at the individual level (Dunneram & Jeewon, 2015; Mitchell et al., 2016). An impact evaluation should assess physical activity, nutrition, and weight loss with women as the target audience, which could reduce the prevalence of obesity by measuring the cause of observed changes after an intervention to program conclusion (Mishra, 2017). This study may fill the gap in the literature by focusing on an impact evaluation of a surveillance system on obesity prevention interventions for women that incorporates the monitoring of health behavior change to address physical activity and nutrition (Senecal et al., 2020).

### **Purpose of the Study**

The purpose of this quantitative research study was to evaluate the impact of a behavioral risk factor surveillance system on obesity prevention and weight loss by examining physical activity and nutritional diet in New York after obesity prevention programs were implemented. The two types of interventions that were used were a behavioral intervention and a nutrition and physical activity intervention. The progress of the interventions was measured by weight loss. The aim was to reduce the prevalence of obesity among women in New York. Overall, the results of an impact evaluation of a surveillance system can show a reduction in the BMI of program participants, which

supports that the implementation of similar obesity prevention programs of this type will contribute to a reduction in the number of obesity diagnoses among women (New York State Department of Health, 2019; Redmond et al., 2019). In the literature, the impact of surveillance systems on obesity prevention initiatives promoting weight loss among women has not yet been clarified in New York. The impact evaluation has assessed physical activity, nutrition, and weight loss with women as the target audience, which could reduce the prevalence of obesity by measuring the cause of observed changes after an intervention to program conclusion (Hageman et al., 2019; Mishra, 2017). Subsequently, public health officials can alleviate obesity and chronic diseases linked to obesity by examining strategic methods applied and reporting program outcomes (Kozica et al., 2016).

### **Research Questions and Hypotheses**

Research Question 1: What lifestyle factors are associated with obesity among women?

H<sub>0</sub>1a: There is no association between physical activity and obesity among women.

H<sub>A</sub>1a: There is an association between physical activity and obesity among women.

H<sub>0</sub>1b: There is no association between dietary intake and obesity among women.

H<sub>A</sub>1b: There is an association between dietary intake and obesity among women.

H<sub>0</sub>1c: There is no association between weight loss controlling for physical activity and dietary intake and obesity among women.

H<sub>A</sub>1c: There is an association between weight loss controlling for physical activity and dietary intake and obesity among women.

Research Question 2: Are there differences in outcomes (weight) between the intervention group and control group at posttest?

H<sub>a</sub>: There are differences in outcomes between the intervention group and control group at posttest.

H<sub>0</sub>: There are no differences in outcomes between the intervention group and control group at posttest.

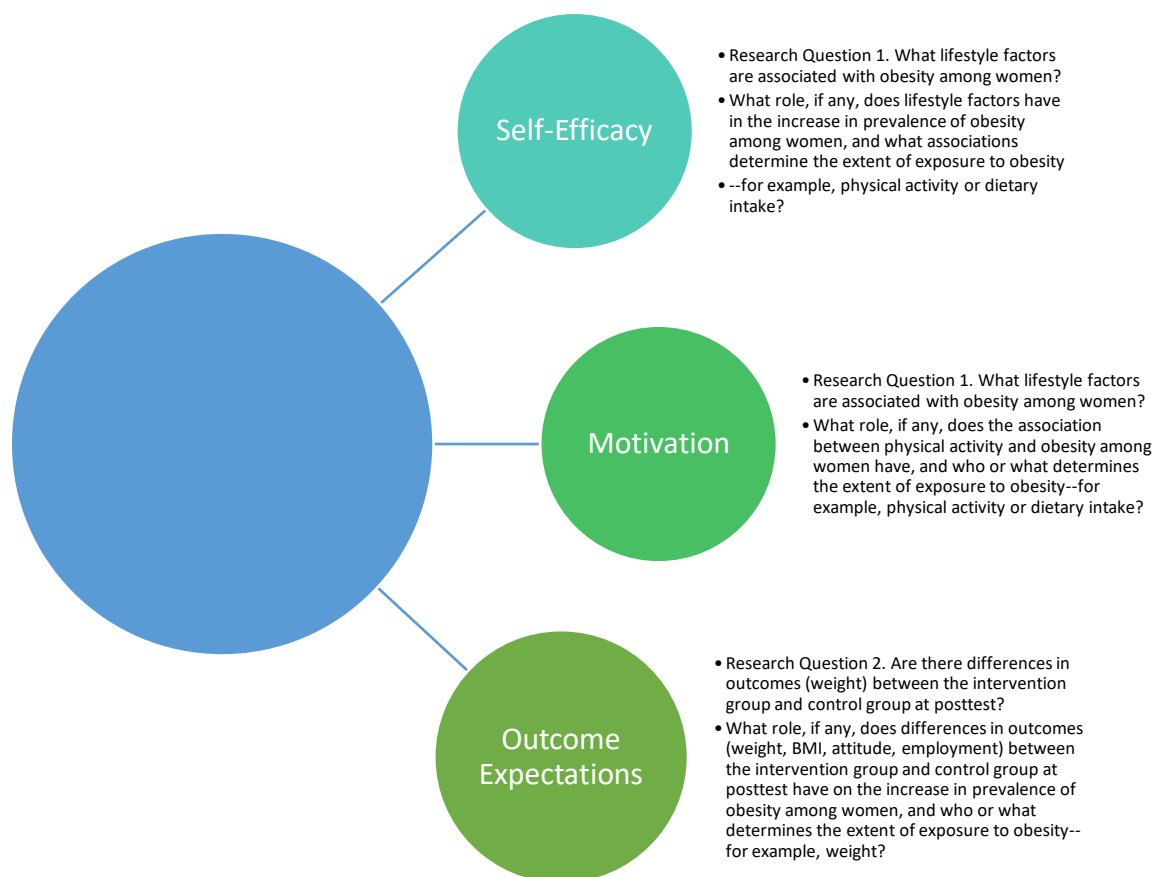
### **Theoretical Base**

Health behavior change (HBC) theory was applied as the framework for the study. HBC theory was applied to conduct an impact evaluation of a behavioral risk factor surveillance system to analyze the outcomes of implemented obesity management programs among program participants. As a theoretical approach, HBC theory has been applied in evidence-based research from existing obesity prevention studies that resulted in weight loss for women due to changes in belief, physical activity, and dietary intake (McCloud, 2018). Teixeira and Marques (2017) reported that HBC interventions manage the progression of obesity by applying strategies to reduce the prevalence of obesity among program participants. Nutrition and physical activity are often lifestyle modifiable risk factors that can significantly influence health outcomes (Kelly, 2016). Thus, using HBC theory to develop strategies to influence changes in policy can assist women at risk for developing obesity (Teixeira & Marques, 2017). HBC theory may support women

who otherwise would not have access to implemented weight loss programs targeting obesity prevention (Teixeira & Marques, 2017).

### Figure 1

#### *Health Behavior Change Theory*



### Nature of the Study

The nature of this study was quantitative. The quantitative research approach, as the research design, aligned with the intended use of secondary retrospective data from a

database (Schlinkmann et al., 2017). Quantitative data are comprised of data such as the responses to closed-ended questions, with numerical values strategically assigned to each item, subsequently producing numeric values (Noyes et al., 2019). This research study used retrospective data to collect information from an organization's database (Schlinkmann et al., 2017). The assessment of the success of analyzing the impact of the surveillance system due to the implementation of obesity prevention programs on weight loss was the sought outcome (Groseclose & Buckeridge, 2017; Schlinkmann et al., 2017).

### **Definitions of Terms**

*Body mass index (BMI):* A person's weight in kilograms divided by the square of their height in meters (CDC, 2015).

*Impact evaluation:* Accountability measure to determine whether a program worked and how well the program worked by measuring program outcomes. The theory of change can assist in examining the consistency of evidence for causal relationships (Sabet & Brown, 2018).

*Surveillance system:* System for the continuing collection, analysis, and interpretation of data to manage preventing and controlling disease and injury (Groseclose & Buckeridge, 2017).

*Obesity prevention programs:* Programs that specialize in obesity prevention, which are defined as using interventions and changes in modifiable lifestyle factors to lower mean BMI level and decrease the rate at which people develop a higher BMI (Pearce et al., 2019). Modifiable lifestyle factors include physical activity, saturated fat intake, sugar consumption, and fruit and vegetable consumption (Gray et al., 2018).

*Obesity:* A weight that is higher than what is considered a healthy weight for a given height. Obesity is often measured with BMI level (CDC, 2019).

*Physical activity:* Any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level (CDC, 2015). Includes exercises and activities that involve bodily movement such as recreational activities, walking, running, and swimming (Thivel et al., 2018).

*Dietary intake:* The daily eating patterns of an individual (Office of Disease Prevention and Health Promotion, 2020).

*Weight loss:* Refers to a reduction of total body mass by a mean loss of fluid, body fat, or lean mass (U.S. National Library of Medicine, 2021).

### **Assumptions**

For this study, I assumed that the data gathered from the BRFSS were accurate. I also considered that lifestyle factors were directly associated with the development of obesity in women. I assumed that increase in physical activity was linked to a decreased prevalence of obesity in women compared to no physical activity. I assumed that changes in dietary intake had a decreased prevalence of obesity in women compared to no dietary change. I also assumed that a surveillance system that monitors obesity annually would produce an increase in weight loss and a decreased prevalence of obesity in women. Finally, I assumed that differences in cultural norms, lack of access to healthy food options, and lack of recreational activities due to neighborhoods might affect this population.

### **Scope and Delimitations**

In this study, I focused on women at risk of or diagnosed with obesity and the impact of lifestyle factors and the surveillance of obesity after the implementation of interventions. I extracted data from the BRFSS using the CDC database. The primary delimitation of this study involved limited data from the BRFSS collected in New York State that I could download.

### **Limitations**

A limitation of this study was participant retention in weight loss programs when implementing HBC theory (Teixeira & Marques, 2017). Evidence-based research has indicated that long-term adherence is a barrier due to participant dropout rates in previously conducted studies (Teixeira & Marques, 2017). Thus, a barrier that might have presented itself was access to enough participants for the surveillance system to determine whether obesity prevention efforts assisted with weight loss. Another potential challenge was selecting a program that would grant access to data to conduct an impact evaluation. In addressing these challenges and barriers, I needed to use strategies to form relationships with programs whose leaders were willing to release data and use a surveillance system with a reach beyond program participants (Groseclose & Buckeridge, 2017; Teixeira & Marques, 2017). Ultimately, the intention was to select a surveillance system as the sample size was large enough to balance participant dropout rates in individual programs (CDC, 2021; Teixeira & Marques, 2017).

### **Significance of the Study**

This research contributes insights on a region-based surveillance system monitoring obesity prevention and health behavior change resulting in weight loss among

women. Kim et al. (2019) observed that women experience more difficulty when attempting to lose weight in comparison to men. Mendy et al. (2017) reported that after an intervention there was a decrease in weight among obese men, but no decline reported in obese women. The National Center for Health Statistics (NCHS) reported that between the years 2013 and 2016, the prevalence of obesity increased from 37.0% to 40.7% among women aged 20 and older (CDC, 2019).

Obesity is an epidemic in New York. In 2018, it was reported that 62.7% of adults in New York were obese (New York State Department of Health, 2020). Minorities are the population majority in New York City at 67.3% and account for 44.6% of the New York State population (U.S. Census Bureau, 2019). African American and Hispanic women have the highest reported cases of obesity due to socioeconomic disadvantages that place them at risk for obesity-related chronic diseases (Knox-Kazimierczuk et al., 2017; Tan et al., 2017). This research study may help in developing interventions for women in New York and contribute to advancing interventions for women in other regions (Jones et al., 2015). The goal of this study was to fill a gap in the literature by examining the impact of a surveillance system on obesity prevention to develop healthy behavior adoption for weight loss focused on women in New York. A research study on a New York-based surveillance system will fill a void in the existing literature.

An impact evaluation assesses intended and unintended changes that occur due to an intervention (Spiegelman, 2016). The purpose of an impact evaluation is to use outcomes to determine how to improve or discontinue the intervention (Cibulskis, 2017). An impact evaluation was the most appropriate for this study, as the impact evaluation could identify which strategies contribute to a reduction in the prevalence of obesity



among women resulting in weight loss (Clarke et al., 2019). This method is aligned with the prevention of health disparities within the community (Walden University, n.d.-a). Thus, in evaluating a surveillance system as obesity prevention programs were implemented with women as the focus, I sought to contribute to social change through this research study (Hageman et al., 2019).

Social change may occur through using the results of this research study to contribute to the development of interventions for women that address health behavior, food insecurity, and a lack of recreational resources in minority and low-income neighborhoods (Derose et al., 2018; Engelberg et al., 2016; “Food Insecurity and Its Potential Consequences,” 2020; Jones et al., 2015). Hence, the benefits of changed nutritional diet were an increase in physical activity, and increased nutritional education in a versatile obesity prevention program (Kozica et al., 2016).

### **Summary and Transition**

This chapter has contained an introduction to concerns with the increasing epidemic of obesity among women and how the surveillance of obesity rates after the implementation of obesity prevention programs impacts the prevalence of obesity. Obesity among women has increased in prevalence compared to 20 years ago, when the diagnosis of obesity in women was less prominent. The gaps in the literature suggest a lack of research specifically associated with an impact evaluation of a surveillance system monitoring obesity prevention programs’ progress with women in New York.

Chapter 2 also addresses the increasing prevalence of obesity among women, which is directly associated with the increase of programs and research studies designed to further examine obesity. Within the past 60 years, physical activity, and dietary

intake have changed drastically within the United States. Physical activity has decreased as the high caloric percentage in dietary intake has increased (Kim et al., 2019). This change has resulted in higher weight-to-height ratios, which are linked to increased BMI levels and lead to adults becoming overweight or obese (Schroeder et al., 2017).

Modifiable lifestyle factors tend to be more difficult to modify among different groups due to poverty, education, and region (Clarke et al., 2019). Socioeconomic status significantly differs among women of different ethnic and racial backgrounds (Derose et al., 2018). Hence, women of lower socioeconomic status report higher rates of obesity due to a lack of nutritional education, lack of recreation, and residing in areas designated as food deserts. In academia, researchers call for the need to conduct research to support evidence-based approaches to reducing obesity. Evaluating obesity prevention initiatives identifies emerging best practices. The results of the surveillance system were used to develop data to strengthen the case for return on investment in obesity prevention programs, which can be shared with policymakers to continue implementing new programs. This study evaluated modifiable lifestyle factors' relationship with obesity. I also examined the impact evaluation of a behavioral risk factor surveillance system on obesity prevention for weight loss in women.

Chapter 3 contains a description of the methodology for this study. Chapter 4 includes descriptive statistics and analysis of results. In Chapter 5, I discuss the interpretation of findings, recommendations for further studies and implications for social change.

## Chapter 2: Literature Review

### Overview

The purpose of this quantitative study was to evaluate an impact evaluation of a behavioral risk factor surveillance system on obesity prevention to examine the weight loss of women in New York, as this topic has not been well researched. There is a problem related to high obesity rates among women, specifically women in certain regions and of certain ethnicities. Moreover, the purpose of this research was to reduce the prevalence of obesity rates among women significantly affected by obesity while preventing the onset of obesity among women who are currently not diagnosed as being obese but are at risk of becoming diagnosed with obesity. Mishra (2017) argued that overweight women have a higher chance of being diagnosed as obese due to their BMI. Within the current literature, authors have explored the phenomenon of how obesity affects women; however, existing literature has not connected all elements of this research together, and it has also not been able to identify how the variables of physical activity, dietary intake, and weight loss correlate to contribute to obesity among this group. This chapter covers the literature on varied factors that contribute to women being more obese in comparison to men, disproportionately high rates of obesity among racial and ethnic minority women, the benefits associated with interventions aimed at implementing health behavior change, and the application of behavioral interventions and nutrition and physical activity interventions (Carter, 2015; Kim et al., 2019; Petersen et al., 2019; Weschenfelder et al., 2018).

### Literature Search Strategy

A comprehensive literature search for studies published from 2015 to 2020 was carried out including earlier published studies that related to this research. The purpose was to enable insight into an impact evaluation that evaluated a surveillance system for obesity prevention efforts' impact on the weight loss of women as the target audience in New York. An in-depth understanding of the impact of evaluation may be enabled by examining the associations between lifestyle factors (i.e., physical activity, dietary intake, and weight loss) as well as the differences between the intervention group and control group. There is limited current research in this area; thus, when researching databases and journal articles, the keywords had to be carefully applied to locate journal articles that used most of the desired elements.

Searches were conducted in Medline; CINAHL; ScienceDirect; PsycInfo; *PLOS ONE*; *The European Journal of Health Economics*; *American Journal of Nursing*; *BMJ Open*; *Nursing for Women's Health*; *Current Developments in Nutrition*; *BMC Infectious Diseases*; *Preventing Chronic Disease*; *Current Developments in Nutrition*; *Preventive Medicine*; *Frontiers in Public Health*; *Health Promotion Perspectives*; *American Journal of Public Health*; *BMC Public Health*; *SSRN Electronic Journal*; *Journal of Obesity*; *Public Health Nutrition*; *BMJ Global Health*; *Mayo Clinic Proceedings*; *Cochrane Database of Systematic Reviews*; *Implementation Science*; *Health Education & Behavior*; *Women's Health Issues*; *Anais Brasileiros de Dermatologia*; *Preventing Chronic Disease*; *Journal of Women's Health, Issues & Care*; *Current Developments in Nutrition*; *International Journal of Qualitative Studies on Health and Well-Being*; and Walden Library using the following search terms: peer reviewed in the last 5 years, *obesity*

*prevention, program or programme or intervention or training or education, quantitative or experimental or descriptive or correlational or quasiexperimental or clinical trial or randomized control trial or validity or intervention or t test or ANOVA, intervention group and control group, retrospective concept, lifestyle factors, weight loss, physical activity, nutrition, dietary intake, pregnancy, gestational, woman or female or women and females.* Health behavior change was also a factor that made up the literature.

### **Theoretical Foundation**

HBC theory was a theoretical framework that guided this study (Teixeira & Marques, 2017). HBC theory was examined in a study of postpartum weight management, and the findings reported a significant variance of 25.7% in self-regulation at 4 months (McCloud, 2018). Additionally, there was variance in self-regulation among Caucasian and African American women, which highlights differences in ethnic and racial groups of women with the application of the HBC theory (Ryan et al., 2011). Hence, the researchers provided support for the use of theoretical concepts and relationships to understand postpartum weight self-management among women (Ryan et al., 2011).

HBC theory is used as a theoretical basis for changing health habits (McCloud, 2018). HBC theory consists of four behavior change models: the transtheoretical model (TTM), also referred to as the stages of change model, health belief model (HBM), social cognitive theory (SCT), and theory of reasoned action/theory of planned behavior (TRA/TPB). For this research, I focused on the TTM/stages of change model and HBM (Teixeira & Marques, 2017).

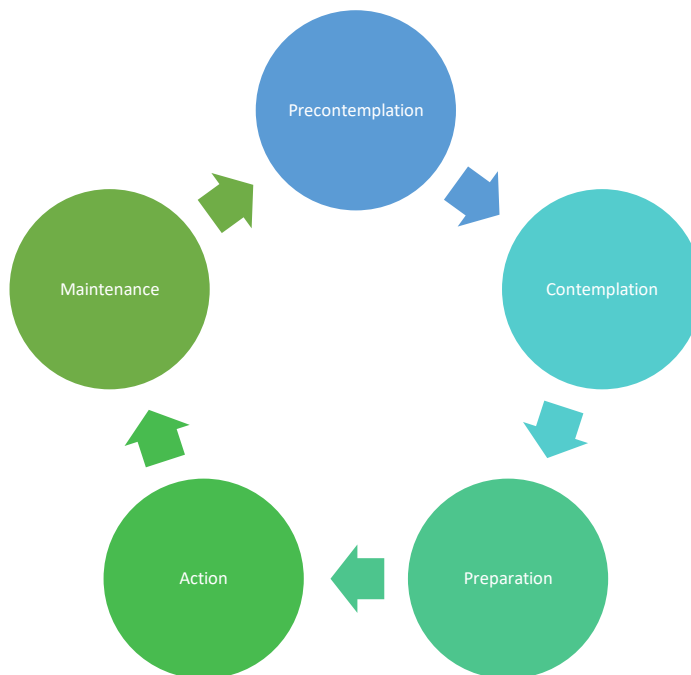
### **The Transtheoretical Model/Stages of Change**

The TTM, also referred to as the stages of change model, was developed by Prochaska and DiClemente in 1977 and is a commonly used method in behavioral change modeling (Prochaska, 2018). The TTM is comprised of five stages of change, which are precontemplation, contemplation, preparation, action, and maintenance (Hashemzadeh et al., 2019).

Weight management is a significant factor in weight loss after program completion. Researchers', public health officials', and health care professionals' major goal in obesity prevention programs is long-term weight loss, which highlights the benefits of such programs for the health of those who complete them. Häußler and Breyer (2015) argued that there are benefits associated with evaluating the cost-effectiveness of the M.O.B.I.L.I.S program, a lifestyle intervention to reduce obesity in high-risk obese persons. This was due to the results showing that upon taking the health care system into account and evaluating the M.O.B.I.L.I.S. intervention and similar diabetes prevention programs for obese people, these programs can pay for themselves in the long run after program implementation. Thus, public- and private-sector funding may be more readily available due to the results of this study. Furthermore, the net cost savings can be further analyzed to account for avoided healthcare cost associated with other obesity-related diseases. The female subgroup experienced positive results with net cost savings; however, when a reduction in mortality and diabetes prevalence were evaluated, the female subgroup was less pronounced. Thus, there was neither a decrease in mortality rates among women nor a decrease in diabetes prevalence, which led to the need for the development of effective programs to address women as an appropriate target group.

**Figure 2**

*The Transtheoretical Model/Stages of Change*



### **The Health Belief Model**

The HBM was developed by social psychologists Hochbaum and Rosenstock to understand the lack of success of program participants in prevention and disease-detecting interventions (Rosenstock, 1974). The HBM was later developed to explore behavioral responses to health disparities. HBM constructs include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The implementation of the HBM when examining self-efficacy in weight loss and weight management has experienced successes and challenges.

Mitchell et al. (2016) argued that to achieve a population-level impact on obesity, efficacy-based research for weight loss interventions needs to be examined with the use of the reach, efficacy/effectiveness, adoption, implementation, and maintenance (RE-

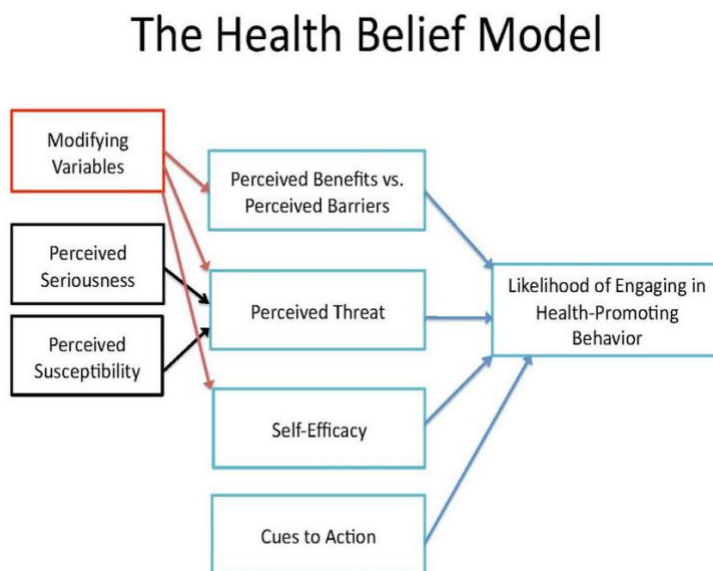
AIM) framework. In the study, RE-AIM was used to evaluate each program. The results indicated that participants experienced difficulty internalizing behavior changes due to program cost, flexibility, duration, and training of staff. Implications for practice identified a need for the use of an approach that includes studies that investigate existing community-based weight loss programs using RE-AIM to improve the development of obesity prevention programs to have a greater impact on the obesity epidemic.

The theory has been applied previously in ways similar to the current study by the means of being applied as the methodology to impact evaluation retrospective studies, which analyzed obesity prevention interventions with women as the target audience (Senecal et al., 2020). Moreover, studies exist where researchers assessed the impact of the lack of indoor and outdoor recreation activities in other regions for women (Jones et al., 2015). Additionally, New York was listed as one of six regions that lacked access to sufficient recreational activities for women to increase their physical activities, a situation that contributed to higher obesity rates within the region (Jones et al., 2015). Furthermore, African American, and Hispanic women often reside in communities that lack recreational activities along with other resources to contribute to their weight loss, which contributes to high obesity rates among women in these areas (Petersen et al., 2019). Researchers have called for the implementation of additional evaluations to perform community health assessments (Petersen et al., 2019). Community health needs assessments can contribute to social change by better informing researchers and public health officials of the factors that contribute to increased obesity rates among women (Gruber et al., 2019).



Ultimately, identifying the region and target audience will greatly assist public health officials in addressing high-priority health disparities. Additionally, the rationale for the choice of this theory derives from academic articles and peer-reviewed articles that highlight the benefits of using HBC theory to achieve weight loss among women who are diagnosed as obese or at risk of becoming obese (Teixeira & Marques, 2017).

The selected theory relates to the present study's aim of conducting an impact evaluation of a surveillance system to analyze obesity prevention for women in New York, as it specifically calls for the assessment of health behaviors, beliefs, and health literacy of women to produce a change. With this in mind, HBC theory involves the use of evidence-based research to develop strategies to address obesity among women from various regions in the future, leading to scientific discoveries to reduce obesity prevalence among women. Through the research questions, I aimed to identify correlations among the variables obesity, physical activity, nutrition, and weight loss to develop strategies to address the impact of these variables on the obesity of women (Kelly et al., 2016). Moreover, to build on the existing theory, women require the tools necessary to change their health behaviors in ways resulting in weight loss.

**Figure 3***The Health Belief Model*

*Note.* From *Methods for Stress Management*, by A. Ulrich, n.d., Pennsylvania State University Open Resource Publishing (<https://psu.pb.unizin.org/kines082/chapter/the-health-belief-model/>). This work is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-sa/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA. Copyright Sharealike 3.0 Unported CC BY-SA 3.0.

### **Background of Lifestyle Factors and Obesity Among Women**

#### **Contributing Lifestyle Factors to Obesity Among Women**

##### ***Physical Activity***

Physical activity is a modifiable lifestyle factor that adversely contributes to obesity in women (Gray et al., 2018). Sedentary activity is the occurrence of no physical

activity or little physical activity. Research has indicated that 40% of adults do not engage in sufficient physical activity (Garber, 2019, p. 288). Physical activity increases the energy expenditure in individuals, resulting in weight maintenance and weight loss (Garber, 2019, p. 288). Researchers have reported that there are significant health benefits of exercise for overweight and obese patients (Redmond et al., 2019). According to research, interventions may be effective in enhancing physical activity engagement to achieve weight control (Jakicic et al., 2018, p. 101).

### ***Dietary Intake***

Food consumption contributes to weight gain, weight maintenance, and weight loss (Guyenet, 2019). Dietary intake contributes to a woman's body fat percentage, muscle mass, and weight (Silveira et al., 2016). Researchers have reported that controlled calorie restriction aids in weight loss (Kim et al., 2017). Fresh produce contributes to an increase in vitamin intake, hence improving the body's functions (Klerman et al., 2017). Researchers argue that the consumption of fruit must be more closely monitored in comparison to vegetables due to the amount of simple sugar and its contribution to obesity (Guyenet, 2019). Women must have the tools needed to monitor their daily food consumption to better manage weight. Dietary intake monitoring can be achieved through health education facilitated by implemented obesity prevention programs.

### ***Weight Loss Among Women***

Carter (2015) argued for the need to examine women's health and associated chronic diseases and illnesses that are more heavily prevalent among women. Moreover, women are predisposed to different illnesses in comparison to men be due to their gender and other unknown factors. Carter's findings showed increases in diabetes between the

years 2001 and 2013 which is associated with a 36% increase of heart disease (Carter, 2015) . The methodology applied in this research study was the use of quantitative data and evidence-based research. Carter reported a need to develop initiatives to encourage women to increase physical activity and improve nutrition diet. Furthermore, this research study provided an in-depth overview of illnesses as they relate to women, with obesity being one of the illnesses discussed.

Aubrey (2015) argued that there is a widening obesity gender gap between men and women in America. Moreover, it has been reported that the gap is widening due to the higher reported percentage of obesity in women in comparison to men (Nho, 2017). Additionally, the research methods include evaluating studies conducted by the CDC, which identified gender differences as a new development. Aubrey (2015) reported that there are significant gender differences in obesity reporting and obesity rates among low-income individuals and minorities in America are not declining. Aubrey's findings in the research study also indicated obesity rates of 34% for men and 38% for women. Aubrey's research relates to my dissertation topic because it supports the finding that women are statistically reported as being more likely than men to be diagnosed as obese.

Researchers Choo et al. (2014) argued for the need to examine gender differences when measuring abdominal obesity and the health-related quality of life (HRQOL) among men and women. These researchers used a cross-sectional study to determine whether waist circumference, HRQOL, and BMI were correlated with abdominal obesity in Korea. The study participants were 13,754 men and women aged 19–65 years whose height, weight, waist circumference, and EuroQOL-5 Dimensions (EQ-5D) scores were statistically analyzed to factor for HRQOL. The results indicated that after adjusting for

BMI, abdominal obesity and a lower HRQOL remained significant only for women. This finding highlighted the need for further research on obesity prevention programs with women as the target audience to reduce the prevalence of obesity among this gender.

Weight loss for women has historically been more difficult due to varied factors such as pregnancy, lower metabolisms, menopause, age, and differences in the method in which dietary intake and sedentary activities affect their weight gain and fat distribution in comparison to men (Carter, 2015; Kim et al., 2019). Weight loss is imperative to women's health as obesity has a negative impact on pregnancy resulting in increased chances of miscarriages and birth defects (Stubert et al., 2018). For example, infertility is increased three times higher for obese women of childbearing age in comparison to women of normal weight (Nho, 2017). Additional negative health associations for women with obesity are irregular menstruation, polycystic ovary syndrome- PCOS, and altered uterine receptivity and implantation (Nho, 2017).

Researchers stated older women often experience less participation in physical activity and a reduction in leisure-time physical activity (Carmichael et al., 2014). As age increases the prevalence of obesity increases among women (Carmichael et al., 2014; Kapoor et al., 2017). Kapoor et al. (2017) argued, decreased estrogen levels after menopause, aging and difficulty adapting to healthy lifestyle changes contribute to women experiencing weight gain at midlife. Additionally, researchers further explored the application of reviewing the pathophysiology and applying new strategies for weight management were input into the lifestyles of participants to assess the impact of weight gain, mood disorders, and the onset of obesity related chronic diseases such as cancer and cardiovascular disease. Among women aged 50 to 64 years, approximately 50%

reported regular physical activity. The results reported that counseling regarding lifestyle changes, behavioral modification, and psychological support is imperative to alleviate the onset of obesity among women at the midlife stage. Women at the midlife stage are at a higher risk of developing obesity and other chronic diseases associated with obesity. Furthermore, researchers recommend the need to explore barriers that prevent the adherence of the adoption of a healthy lifestyle for women at the midlife stage (Kapoor et al., 2017). Furthermore, results of a research study reported there was the presence of negative constraints on time imposed by employment, age, and health of the older women (Carmichael et al., 2014). Implications for further research exhibit the need for interventions that incorporate the strain work life balance places on weight loss among older working women.

Body size perception and the way young women view themselves physically influences weight gain and weight loss. Sand et al. (2015) argued, the need to examine young adult women and their challenges with being overweight and obesity. Additionally, a qualitative research approach was used, and the collection methods involve participant recruitment. Participants were recruited from a school-based population survey and took a series of surveys which covered background data and lifestyle issues. The authors Sand et al. (2015) examine the body size perception among young women and their beliefs in the severity of an obesity diagnosis. The findings reported transferability may be hard to assess from different regions as there were different and similar perceptions from program participants. This article explores obesity in young women to assess the factors that contribute to the prevalence of obesity among this group.

## **Evaluation of Interventions That Examined Obesity Among Women**

### ***Intervention Group and Control Group***

Intervention groups and control groups provide researchers with the ability to examine associations and differences between two groups. Hence, intervention groups and control groups comparisons provide an in-depth understanding of the impact of a program. Panter et al. (2018) research study examined an obesity prevention program implemented in Nordic countries and the Netherlands that utilized setting-based interventions. The methodology applied was the systematic review of several interventions implemented throughout several regions. Furthermore, the variables examined were community, schools, worksites and analyzed BMI as an outcome. Several studies received a follow up after four months and eight years and the outcomes presented issues with theory application and inconsistencies with BMI measurement after program completion. The results highlighted the importance of creating interventions that incorporated the application of theory and participatory approach in obesity prevention programs.

### ***Surveillance Systems***

Surveillance systems are used to increase the efficiency and effectiveness of the public health system. Groseclose and Buckeridge (2017), surveillance systems assist in developing technology and aids in changes to public health environments and health care. The data from public health surveillance systems drives action and provides opportunities for advancement in the field of public health (Chiolero & Buckeridge, 2020). Hence, the results from surveillance systems contribute to the planning of preventative programs by policymakers. Thus, a community health needs assessments (CHNA) often reference

surveillance systems when planning for the implementation of initiatives that best serve the policymakers and stakeholders communities (Stoto et al., 2019). The collective impact of obesity prevention in women requires the collaborative efforts of the health care delivery sector, public health agencies, and community organizations to improve population health (Stoto et al., 2019).

Redmond et al. (2019) argued the need to develop obesity prevention interventions that are theory and culturally based with consideration to multi-levels and multicomponents can better improve weight loss success. This study used the Social Cognitive Theory (SCT) and the Social Ecological Model (SEM) to evaluate the design of a multilevel, multi-component obesity intervention for Native American adults and households. To decrease obesity by improving diet and increasing physical activity in Native American adults the consideration of different regions and cultures in a multi-level and multicomponent intervention OPREVENT (Obesity Prevention and Evaluation of InterVention Effectiveness in NaTive North Americans) is required. The application of a community-randomized controlled trial was used to evaluate the impact of the multilevel, multi-component intervention in 5 Native American communities. Evaluation instruments collected data to assess intervention outcomes and impacts. Questionnaires used: The Dietary Assessment Questionnaire, Semiquantitative food-frequency questionnaire (SFFQ), The Adult Impact Questionnaire (AIQ), International Physical Activity Questionnaire (IPAQ-SF), The Intervention Exposure Evaluation (IEE). Individual-level data collection, institutional-level data collection and process evaluation was conducted. There was a retention rate of 70% at the completion of the multi-level, multi-component obesity prevention intervention. The results from OPREVENT



influenced the development of a follow-up study OPREVENT2 with a larger cohort to increase the improvements in diet and physical activity. Evaluating a multi-level, multicomponent obesity prevention program for Native American adults better informs researcher of which intervention components were the most impactful and which behavior change strategies are the most effective for the prevention of obesity in different groups of individuals.

Senecal et al. (2020) argued, there was a need for their study which evaluated whether individuals following a weight loss program based on a mobile application, wireless scale, and nutritional program but no face-to-face care can achieve clinically significant weight loss in a large cohort. The application of a weight loss program for obesity prevention using smartphone application and wireless scales as tools in a large cohort over an extended period will see the same results as a smaller cohort. The researchers conducted a retrospective observational analysis. The study examined a remote mobile weight loss program that incorporates dietary replacement, self-monitoring using a wireless home scale, and frequent guidance via mobile application.

Participants report two weights at the baseline and  $\geq 35$  days. Means and standard deviations were used for continuous variables and counts, and percentage used for categorical variables in strata across stratum continuous variables; counts and percentages were used to summarize categorical variables, both across strata and within stratum. The Chi-square tests were also used in the analysis. The mean weight of program participants decreased with the intervention. The majority of the program participants were women at 79% and achieved a mean weight loss of 4.3kg. By the end of the intervention 62.7% of participants loss 5% of their initial weight. Clinically significant weight loss was

achieved in large population using mobile application in commercially available weight loss program. There was more weight loss in participants who weighed themselves more and participants with higher baseline BMI. A remote mobile weight loss program with larger group of female participants can be examined to develop more obesity prevention programs to achieve weight loss for women. Weight loss success after the implementation of a remote mobile weight loss program in large cohort can influence further program evaluations and the development of new programs for women.

### ***Ethnic and Racial Disparities Among Women***

There is the presence of racial and ethnic disparities in adult obesity in the United States (Petersen et al., 2019). The negative effects of obesity are disproportionately burdensome for populations, non-Hispanic black and Hispanic adults (Petersen et al., 2019). Hernandez et al. (2017) argued, that Hispanic women were 29% more likely to become obese where there was the presence of food insecurities, thus, indicating the need to implement programs to address food insecurities in highly populated Hispanic communities. Furthermore, researchers have discovered that neighborhood's locations with varied walkability and traffic volume, may contribute to women's nutrition and physical activity habits (Petersen et al., 2019).

### ***Poverty: Lack of Access to Healthy Food***

New York is a state where there are some of the most historical landmarks, real estate developments, agriculture, farming, industrial production, and entertainment such as Broadway. However, in one of the wealthiest developed states there is a large population that lives below the poverty line (Neiderud, 2015). Income contributes to the quality of service and care received by women. There are rural and urban regions of New

York identified as food desserts. Researchers have presented studies where the results have shown that the quality of fresh produce differs from neighborhood to neighborhood with more wealthy neighborhoods containing better quality produce (French et al., 2019). Furthermore, soup kitchens, food pantries and Supplemental Nutritional Assistance Program-SNAP were implemented to ease the gap in food access to low-income families. However, stigma and shame associated with attending soup kitchens and food pantries have deterred some New Yorkers from standing in long lines for food (Fitzpatrick & Willis, 2020).

SNAP placed a controversial ban on prepared foods fit for immediate consumption and hot foods was implemented (Klerman et al., 2017). Additionally, SNAP placed regulations on certain purchases made with SNAP such as beer, wine, liquor, cigarettes, or tobacco which has a positive effect on preventing weight gain, however, participants are not allowed to purchase vitamins, medicines, and supplements which may help promote weight loss or weight maintenance (U. S. Department of Agriculture, 2020). SNAP also regulates fraud committed by cashing in the money value for other items or physical cash. SNAP officials recommend guidelines to healthy food shopping for eligible program participants; however, program participants are allowed to purchase food items high in saturated fat, high fructose corn syrup, sodium, and sugar (U. S. Department of Agriculture, 2020). Hence, contributing to the continued prevalence of obesity and chronic diseases related to obesity. Poverty contributes to the quality of food, quantity of food and regulations places on food consumed by obese and overweight women in New York.

### *Cultural Norms*

Food choices and meal preparation are often connected to cultural norms. In New York, the state is traditionally a melting pot made up of women from hundreds of nations and different cultural backgrounds (Abramitzky & Boustan, 2017). Through Ellis Island, families migrated from nations such as Italy, France, Africa, and Spain (Abramitzky & Boustan, 2017). Pasta dishes from Italy contain high amount of carbohydrates, the French are revered for their use of cheese, which is high in fat, many African dishes use palm oil which is high in saturated fat and Spain with its famous dish paella which uses a large amount of rice, a carbohydrate (Springmann et al., 2020). In the Southern region of the United States, soul food is high in fat, sodium, and sugar. Eating behaviors were found to be related to cultural attitudes of African American women (Oney et al., 2015). Enslaved African Americans were given food of low quality and low nutritional value which led to the creation of recipes incorporating the food options available to this population (Oney et al., 2015). The preparation of soul food recipes has been passed down for centuries. Women who were given traditional soul food recipes have migrated all over the world and have carried these methods of meal preparation along with them, often migrating to states in the north such as New York (Oney et al., 2015). In research from Shikany et al. (2015, p. 806), the southern dietary pattern is linked to hazard acute coronary disease. The plethora of high in fat food choices from different regions provides insight into the cultural influence behind the choices women make in the foods they consume daily which contributes to astounding levels of obesity.

***Lack of Health Education***

Nho (2017) argued, health literacy is imperative to making healthy nutritional choices and participating in physical activity. Health education leads to individuals knowing correct and incorrect health choices to make changes in their health behavior (Walsh et al., 2019). A research studies results reported, health education and health advice given to patients from healthcare providers were given as BMI increased with missed opportunities to prevent overweight patients from progressing to obese and often of poor quality for obese patients (Walsh et al., 2019). However, interventions that incorporated nutrition education, physical activity, and stress management proved to improve health education for female program participants (Senecal et al., 2020). Health literacy is developed by increased knowledge in the form of educational facilities, through program participation and self-learning (Rademakers & Heijmans, 2018). Thus, a lack of health education will result in poor nutritional and physical activity choices which will result in adverse health consequences often increasing weight gain (Nho, 2017). Public health practitioners and researchers must focus on implementing nutrition education and health promotion into obesity prevention programs with women as the target audience (Kenney et al., 2017).

***Lack of Recreational Activities in Regions*** Access to recreational activities provides women with the ability to increase their physical activity to increase weight loss and maintain a healthy weight (Panter et al., 2018). Recreational activities can include yoga classes, Zumba classes and Kickboxing at the local community center and access to gyms to use equipment and parks to use the outdoors to complete routine workouts (Carmichael et al., 2014). In rural regions researchers expressed a need for research

examining meaningful weight loss and weight management. Hageman et al. (2019) argued, there was a need to examine whether a web-based lifestyle intervention weight loss is associated with improved quality of life among rural women who complete the intervention. Research questions presented by the authors are 1. Can a web-delivery format promote lifestyle modification for initial weight loss? 2. Can a web delivery format promote lifestyle modification for guided weight loss? Can a web delivery format improve the quality of life of rural women? The methodology used in this research study was a Randomized controlled trial Secondary analysis of the Women Weigh-in for Wellness clinical trial. The trial used a web-delivery format to promote lifestyle modification for initial weight loss (baseline to 6 months) and guided weight loss (6 months to 18 months). 216 rural women, ages 40-69 baseline and 18-month PROMIS-29. The analysis and results reported *t* tests and Logistic regressions. Women with  $\geq 10\%$  weight loss were more likely to report lower depression, higher physical function, and less pain interference, compared to women who gained weight or lost  $< 5\%$ . Based on PROMIS-29 scores weight loss was associated with improved HRQOL. In conclusion, weight loss from baseline associated with improvement from multiple PROMIS-29 v 1.0 domains. Likelihood of improvement was found to be significantly higher among women who attained  $\geq 10\%$  weight loss. Implications for future research are based on the notion that this study was comprised of rural 98.1%

Caucasian women who were employed at 84.3%, educated with some college or more at 82.9%, reported a household income  $\geq \$40,000$  at 80.2% and were majorly healthy. Thus, there is the need for the inclusion of metropolitan city underserved women who are ethnically diverse, lack education, low-income and of poor health (Fiske et al.,

2019). Additionally, the use of a web-based lifestyle intervention weight loss program was developed to accommodate rural women with limited access to travel to an intervention program site and relied heavily on self-efficacy (Hageman et al., 2019). Furthermore, implications for practice to improve social change highlighted by potential for public health officials to use the results from the research study as these results may influence a woman's adherence to lifestyle modification weight loss and weight maintenance program.

### **Positive Social Change**

The many contributions of research studies have led to the development of innovation obesity prevention programs after the analysis of surveillance systems. Moreover, weight loss programs and obesity prevention programs are continuously designed to incorporate varies populations which experience varied factors which contribute to the onset of obesity. There has been strides in the field of public health research in addressing obesity among women. Unfortunately, the obesity rates among women are steadily increasing, thus, requiring the need for additional research studies to fill the gap in the literature in academic research. An impact evaluation of a surveillance system on obesity prevention for women will result in an insightful understanding of the association and differences between factors that contribute to the obesity and weight loss of women residing in the state of New York.

### **Summary and Conclusions**

The major themes in the literature provide insight into the challenges obese and overweight women experience, thus, highlighting the importance of the evaluation of surveillance system on obesity prevention to further develop programs designed to

improve women's health. Authors have contributed to the well-researched areas of obesity prevention interventions that were successful, however, little is known about how specific obesity prevention intervention programs in specific regions are reducing the prevalence of obesity among women.

Obesity among women is well researched, however, the prevalence of obesity remains prevalent on the priority health disparity list. The HBC theory has successfully enabled an in-depth understanding of the health behaviors and beliefs of women in obesity prevention programs (Teixeira & Marques, 2017). The transtheoretical theory model and the health belief model will be two of the four models of HBC that will be explored with the evaluation of interventions examining factors contributing to women's obesity. The HBC theory is introduced into weight loss programs that incorporate self-regulated weight management and peer support to encourage and maintain weight loss (McCloud, 2018). However, the health behavior theory is yet to be well researched with an impact evaluation of a surveillance system on obesity prevention programs on the weight loss of women in New York. Associations between lifestyle factors that contribute to obesity and the impact of an evaluation of a surveillance system on obesity prevention for women in the region of New York is not well known in the discipline. Fewer articles are published on retrospective impact evaluations of surveillance systems influence on obesity prevention programs in New York with women as the target audience. Furthermore, the less researched program evaluations in regions where women are experiencing obesity is a gap in the literature that may correlate the methods that can be applied to identify the relationships between obesity, physical activity, nutrition, weight loss and region.



The impact evaluation of a surveillance system on obesity prevention in New York with women has highlighted how weight loss is achieved through the implementation of behavioral interventions and nutrition and physical activity interventions. Thus, the results from the associations between lifestyle factors physical activity, dietary intake, and weight loss as well as interventions conducted with an intervention group and control at posttest were analyzed in the appropriate statistical analysis.

## Chapter 3: Methods

### **Introduction**

The purpose of this study was to examine the impact of a surveillance system after obesity prevention efforts on the weight loss of women in New York. In Chapter 3, the focus is on providing insight into the quantitative methodology for this study. The sections in Chapter 3 address the research design and approach, target population, sample size and power calculations, instrumentation and operationalization of constructs, and threats to validity. In addition, the secondary data source is described in terms of the characteristics of selected data, data management, and data analysis plan to test the hypotheses of the research questions.

### **Research Design and Approach**

This study had a quantitative, retrospective research design, with a secondary data analysis as the approach. I examined a surveillance system for obesity prevention for women to conduct an impact evaluation. The overall research question concerned whether lifestyle factors and interventions have a significant effect on the prevalence of obesity among women. The retrospective design allows previously collected data to be analyzed from two time periods. The dependent variable in the study was obesity, whereas the independent variables were physical activity, dietary intake, and weight loss (see Table 1).

**Table 1***Operational Measures of Study: Independent, Dependent, and Covariate Variables*

Variables	Survey questions	Data code	Variable type
Obesity (body mass index)	About how much do you weigh without shoes?—Weight (lb/kg)  About how tall are you without shoes?—Height (ft/in/m/cm)	@BMI5	Dependent
Weight loss	About how much do you weigh without shoes?—Weight (lb/kg)	WEIGHT2	Dependent /Predictor
Physical activity	How many minutes of physical activity per week? #Minutes	@_MINAC11	Predictor
Dietary intake	How often did you eat fruit? (1 or more times per day) #Times per day fruit consumed	@_FRTL1A	Predictor
Year	1 2017 control group 2 2019 intervention group	YEAR	Predictor
Age	Are you 18 years of age or older? 1 Yes 2 No Age in years	AGE_RC	Covariate
Sex	Are you male or female? 1 Male 2 Female	SEX	Covariate
State	State FIP code 36 New York	@_STATE	Covariate

## Methodology

### Target Population

The target population for the study was women within New York with obesity. The age range for women in this study was 18 to 65 years. Weschenfelder et al. (2018) indicated the percentage of women with obesity is on the rise and reporting higher in comparison to their male counterparts. Secondary data from the BRFSS were used to test the hypotheses. The data originated from BRFSS using the CDC.

### Sampling and Power Calculations

Utley (2019) indicated that there are three factors that influence accurate and appropriate conclusions in scientific research when examining the power of a study: the alpha level, effect size, and sample size. The calculation of a study's power and the minimum number of participants are required for a properly powered study (Brysbaert, 2019). The sample size was based on secondary data that were obtained for this study. Sample size was determined using G Power 3.0 software. Multiple regression analysis was performed; therefore, the *F* test: multiple regression—omnibus (deviation of  $R^2$  from zero), fixed model was used to determine the sample size. I used the effect size of 0.15,  $\alpha$  error prob – 0.05, power ( $1 - \beta$  err prob) – 0.95, with the number of predictors of 3 and 3 covariates (6). The total sample size result was 119 participants, and the actual power was 0.95. Additionally, an independent-samples *t* test was performed; therefore, the *t* tests: means difference between two independent means (two groups), fixed model was used to determine the sample size. I used the effect size of 0.05,  $\alpha$  error prob – 0.05, power ( $1 - \beta$  err prob) – 0.95, with the allocation ratio  $N_2/N_1$  (1). Mean Group 1 = 0, and mean Group 2 = 1 with *SD* or Group 1 = 0.5, and *SD* or Group 2 = 0.5. The sample size of Group 1

was 105 participants, and the sample size of Group 2 was 105 participants. The total sample size result was 210 participants, and the actual power was 0.95. The independent-samples  $t$  test is the higher power; for the purpose of this study, 210 participants were used to determine the sample size. The BRFSS has collected over 400,000 interviews annually from 1984 to the present from individuals 18 years of age and older.

### **Setting and Sample Size**

The sampling method was probabilistic, in that it was based on probability (Wiśniowski et al., 2020). The specific subcategory was simple random sampling, whereby participants could be equally selected at random (Elfil & Negida, 2017). Wiśniowski et al. (2020) suggested that the strength of the probabilistic sampling method is valid generalization to the population from which the samples were drawn. For example, the use of probabilistic sampling increases external validity by reducing bias and being more representative of the general population (Taherdoost, 2016). The weakness of the probabilistic sampling method is that it can be costly (Jager et al., 2017). The inclusion criteria encompassed participants ages 18-65 who were at risk for obesity or had obesity from neighborhoods with low socioeconomic status in New York. Furthermore, adult females were included.

### **Instrumentation and Operationalization of Constructs**

I examined secondary dataset surveys that were specific to the dependent and independent variables used in this study. The most recent data set was for the period 2020 to the present for BRFSS. I provided examples of the exact questions and response choices when permission to use the dataset of the surveillance system was granted by the Institutional Review Board (IRB) 09-08-21-0741188. This question was used to further

break down the given data received from the data sets. I am not sure whether the survey asks about previous bariatric surgery or weight loss medication use.

### **Data Collection**

The data were collected from the BRFSS, with women as the target audience. The BRFSS is a nationwide cross-sectional telephone survey conducted annually with adults 18 years or older with a landline or cell phone. BRFSS is administered by the CDC, and guidelines are adhered to by state health departments in 50 states, the District of Columbia and territories, Puerto Rico, and Guam. The BRFSS is used to collect data on the prevalence of health risk behavior. New York State participated in the BRFSS, the database for which contains archival data from 2011 to the present with self-reported data on obesity and weight. The data contained nonidentifiers to provide survey participants with anonymity and confidentiality. This was a retrospective research study that used secondary data. The aim was to conduct the research study to examine the two study arms which are health risk behavior and outcomes. The participants were recruited voluntarily from CDC and ICF Macro Inc. via call centers on behalf of the New York State Department of Health for the purpose of supporting New York State public health programs from 2017 to the present. Participants completed the survey via phone. Because the dataset requires permission from the IRB, information from the menu of the dataset was included.

### **Statistical Analysis**

The primary objective of the study was to examine whether obesity prevention programs have a significant effect on the prevalence of obesity among women by conducting an impact evaluation of a surveillance system. The study had three

independent variables and one dependent variable in Research Question 1; therefore, multiple logistic regression was used. According to Zhang et al. (2017), multiple logistic regression is used when a study has one dependent variable with two or three ordinal categories. The independent variables can be continuous, categorical, or ordinal. The independent variables' coefficients can be easily converted into odds ratios and will be the predictors of the odds of having obesity, and the analyses will be controlled by several covariates (Real et al., 2016; Zhang et al., 2017). Odds ratios can compare the magnitude of different risk factors over an outcome (Chu et al., 2020). The coefficients of the model can directly determine key variables, along with the magnitude and direction of association between each independent variable and the dependent variable (Gholizadeh & Esmacili, 2020). Thoresen (2019) indicated that an interaction effect is used to measure moderation and expressed that two or more predictor/independent variables combined will have a significantly larger effect on an outcome/dependent variable compared to the predictor/ independent variables individually. The joint effect can be significantly greater or significantly less than. Interaction was evaluated to determine what lifestyle factors are associated with obesity among women.

The other primary objective of the study was to examine differences in outcomes between the intervention group and control group. Weight was examined as the dependent variable, and year was examined as the independent variable. In this study, weight could be a dependent or an independent variable, depending on the research question. The means of the intervention and control groups were compared. Therefore, a between-subjects *t* test was used. According to Kim (2019), the independent-samples *t* test requires one independent categorical variable with two levels and a continuous

dependent variable. Liang et al. (2019) indicated that computing the test statistics displays information in the sample data, and the test statistics are used to either reject or accept the null hypothesis. The comparison of the calculated value and the value on the table provided a conclusion on the differences between the populations (Kim, 2019).

According to Gerald (2018), an independent-samples *t* test indicates whether there is a statistically significant difference between the mean scores for two groups or not. An independent sample is a sample in which participants in each group are independent of each other (Derrick et al., 2020). An example of independent groups might be the comparison of women who received obesity prevention interventions and women who did not receive obesity prevention interventions (Lek et al., 2021). Interaction was evaluated to determine whether there were differences in outcomes (weight) between the intervention group and control group at posttest.

### **Research Questions and Hypotheses**

Two research questions were answered in this study. The dependent variable was obesity in Research Question 1 and weight loss in Research Question 2. The independent variables included physical activity, dietary intake, and weight loss in research question 1 and year in Research Question 2. Amrhein et al. (2019) suggested that statistical analysis involves the use of both descriptive and inferential statistics with numbers and graphs. The use of frequency and percentage formats was included in a portion of the descriptive statistics (Sinayev et al., 2015). Inferential statistics include odds ratios to examine the odds of an event occurring in one group to the odds of the event occurring in another group by quantifying the strength of association (Chu et al., 2020). The research



questions are depicted below with their associated description of variables and statistical tests.

Research Question 1: What lifestyle factors are associated with obesity among women?

H<sub>0</sub>1a: There is no association between physical activity and obesity among women.

H<sub>A</sub>1a: There is an association between physical activity and obesity among women.

H<sub>0</sub>1b: There is no association between dietary intake and obesity among women.

H<sub>A</sub>1b: There is an association between dietary intake and obesity among women.

H<sub>0</sub>1c: There is no association between weight loss controlling for physical activity and dietary intake and obesity among women.

H<sub>A</sub>1c: There is an association between weight loss controlling for physical activity and dietary intake and obesity among women.

Research Question 1 was answered with multiple logistic regression to examine the extent to which lifestyle factors predict obesity among women. The significance value ( $p < .050$ ) and 95% confidence intervals determined whether the overall regression model was a good fit for the collected data as well as assessing significance of association. SPSS was used to run analyses of the BRFSS from the CDC data catalog. The predictors, which included physical activity, nutritional diet, and weight loss, were also examined in the

regression model. The covariates, which included age, sex, and state, were also examined in the regression model.

Research Question 1 refers to the key component of self-efficacy within HBC theory. The question addressed how lifestyle factors are associated with obesity among women. This research question also referred to the key component of motivation within HBC theory and addressed what association, if any, lifestyle factors have with the increase in the prevalence of obesity among women and who or what determines the extent of association with obesity (e.g., physical activity or dietary intake). Research Question 1 also addressed to what extent the association between weight loss controlling for physical activity and dietary intake and obesity among women is relevant to the increased prevalence of obesity among women.

Research Question 2: Are there differences in outcomes (weight) between the intervention group and control group at posttest?

H<sub>a</sub> 2: There is differences in outcomes between the intervention group and control group at posttest.

H<sub>0</sub> 2: There is no differences in outcomes between the intervention group and control group at posttest.

Research Question 2 was also answered with between-subjects *t* test to examine the extent to which the surveillance system predicts weight loss among women. The significance value ( $p < .050$ ) and 95% confidence intervals determined whether the overall *t* test was a good fit for the collected data as well as assessing the significance of the association. SPSS was used to run analyses of the BRFSS from the CDC. The

covariates, which included age, sex, and state, were also examined in the regression model and the *t* test model.

Research Question 2 refers to the key component of outcome expectations within HBC theory (Michaelsen & Esch, 2021). The question addressed what role, if any, the surveillance system had in the decrease in the prevalence of obesity among women by measuring differences in outcome between the intervention group and control group at pretest and posttest (e.g., How much weight was lost?). Table 2 shows how HBC theory aligned with each of the two research questions.

**Table 2***Theory Alignment With Research Questions*

Health behavior change theory key components	Theory questions	Research questions
Self-efficacy	What role, if any, does lifestyle factors have on the increase in prevalence of obesity among women and what associations determines the extent of exposure to obesity, for example physical activity or dietary intake?	Research Question 1. What lifestyle factors are associated with obesity among women?
Motivation	What role, if any, is the association between physical activity and obesity among women and who or what determines the extent of exposure to obesity, for example physical activity or dietary intake?	Research Question 1. What lifestyle factors are associated with obesity among women?
	To what extent is an association between dietary intake and obesity among women?	Research Question 1. What lifestyle factors are associated with obesity among women?
	What role, if any, is the association between weight loss controlling for physical activity and dietary intake and obesity among women?	Research Question 1. What lifestyle factors are associated with obesity among women?
Outcome expectations	What role, if any, does differences in outcomes (weight,) between the intervention group and control group at posttest have on the increase in prevalence of obesity among women and who or what determines the extent of exposure to obesity, for example (weight, BMI, attitude, employment)?	Research Question 2. Are there differences in outcomes (weight,) between the intervention group and control group at posttest?

**Protection of Human Participants**

Ethical considerations have been made with enrolling program participants in the BRFSS survey. There was a significant responsibility of reviewing research involving human subjects to ensure that a proposed protocol meets the appropriate ethical guidelines before subjects may be enrolled in any study and examined (White, 2020). Furthermore, appropriate consent was collected via telephone for each program

participant as participation is random and voluntary. The participant responds with 'yes' via telephone to confirm informed consent when the interviewer indicated the purpose of the research and how the data will be collected and analyzed. Each participant was provided with the appropriate contact information of the BRFSS coordinator and provided the opportunity to remove themselves from the study at any point (Behavioral Risk Factor Surveillance System (BRFSS), 2021; Licari & Manti, 2018). Program participants personal information such as names have not been collected by interviewers as personal identifying information such as names, addresses are not collected and replaced by an ID number to non-identify survey participants. The confidentiality of recovered data will always remain, and the identification of participants will not be available during or after the study.

### **Threats to Validity**

Heale & Twycross (2015) defined validity as the extent to which a concept is accurately measured in a quantitative study. Two types of threats to validity are associated with quantitative research designs. External and internal validity are the two types of validity.

External Validity refers to the extent to which the results of a study are generalizable to different persons, treatments, settings, and outcomes in various experiments (Patino & Ferreira, 2018). The threat to external validity is an erroneous interpretation analyzed by the researcher from the data to other persons, other settings, and past or future experiments (Creswell, 2009). Torre & Picho (2016) suggested the three types of threats to validity include multiple treatment interference, interaction of

selection bias and experimental treatment and reactive effects of experimental arrangements.

Internal validity is the method in which determines how well an experiment of treatment will be performed in a research study (Patino & Ferreira, 2018). The threat of internal validity threatens to inhibit the researcher's ability to assess appropriate interpretations from the data (Creswell, 2009). The threats pose alternate explanations for the apparent causal relationship between the independent variable and dependent variable of an experiment if they are not adequately controlled in the experiment (Flannelly et al., 2020). Flannelly et al. (2020) indicated eight types of threats to internal validity exist, which include, history, maturation, instrumentation, testing, regression to the mean, selection bias, social interaction, and attrition.

All adult women 18-65 within the surveillance system in New York were included. The process of random selection reduced the possibility of choosing participants with specific lifestyle factors associated with obesity or differences in outcomes at the two time periods. To avoid the internal validity threat of diffusion of treatment the independent variables were separated from one another.

### **Summary and Transition**

The research design and approach of this study had a quantitative, retrospective research design, with a secondary data analysis approach. The impact evaluation was used to examine a surveillance system on obesity prevention for women. Women were examined as the target audience. The sampling and power calculation were calculated by running an Independent Sample *t* test on G\*power with a power of 0.95 and requires 210 program participants to be feasible. Research questions and hypotheses include

Research Question 1. What lifestyle factors are associated with obesity among women? and Research Question 2. Are there differences in outcomes (weight) between the intervention group and control group at posttest? The research questions aim to highlight implications for future interventions aiming at lifestyle modification to reduce the prevalence of obesity among women.

A multiple logistic regression is the statistical analysis that was used to examine the independent variables and dependent variable in research question 1. Additionally, a between subjects *t* test was used to examine the independent variable and dependent variable in Research Question 2. SPSS was the software that ran the statistical analysis. The HBC theory alignment with theory questions and each of the two research questions were displayed in Table 3. The HBC theory key components self-efficacy, motivation and outcome expectations were aligned with theory questions and research questions assessing the role and extent lifestyle factors association with obesity and differences in outcomes from pretest to posttest determined exposure to obesity.

The protection of human participants is imperative in any research study and requires an in-depth understanding of the protocols and disclosures that must be adhered to ensure the validity of the research being conducted. Participants must be provided informed consent and the purpose of the study must be disclosed to participants. Additionally, confidentiality and anonymity require participant identifiers to be converted to nonidentifiers. Furthermore, it is imperative to examine internal threats to validity and external threats to validity. When examining to internal threats to validity it is done to ensure inferences can be made by causal relations between variables in the research. Additionally, when examining to external threats to validity it

is imperative as it measures whether the research study outcomes conducted can be generalized. Chapter 4 will include data collection, analysis, and interpretation of the data.



## Chapter 4: Results

### **Introduction**

In this chapter, I report results of this quantitative study, which examined the impact of a surveillance system on obesity prevention for the weight loss of women in New York. There is no relationship between obesity and physical activity, obesity, and dietary intake, and weight loss and obesity. There are differences in weight as an outcome between the intervention group and control group at posttest; however, there is limited research on the impact of individual obesity prevention programs on obesity among women in New York. This chapter provides a description of the characteristics of the population of New York women. First, the chapter presents the associations between modifiable lifestyle factors and weight loss among at-risk and obese women in New York relative to the impact evaluation of the surveillance system from most recent years. Next, the data of those women who self-report health status as well as women who completed the obesity prevention programs in New York are reviewed and reported. Finally, data are interpreted and presented in charts to provide in-depth understanding.

### **Data Collection**

In this study, I analyzed data from the 2017 and 2019 BRFSS in New York, an annual state-based survey conducted by randomized telephone surveys that included the Social Context Optional Module. The results reflect modifiable lifestyle behaviors of physical activity and nutritional diet resulting in weight loss and the impact of the surveillance systems on obesity prevention for women's weight loss. The results also reflect differences in the outcome between the intervention group and control group at posttest.

I used BRFSS, a nationwide cross-sectional telephone survey that produced a quantitative retrospective secondary dataset, to examine the associations between physical activity, dietary intake, weight loss, and obesity. Additionally, I evaluated differences in outcomes between the intervention and control groups at posttest. I examined self-reported measures of physical activity, dietary intake (measured in fruit consumption), weight loss, and obesity (BMI) among the female adult population in New York. All statistical models controlled for the three demographic variables: sex, age, and state. SPSS Statistics version 28 was used for descriptive regression analysis and between-subjects *t* test, as well as to apply design weights to the data to represent the entire state.

### **Descriptive Analysis**

Data for a total of 8,767 adult women 18 years and older at risk for obesity were analyzed from the 2017–2019 New York BRFSS telephone survey. The data represented the female population in New York. Approximately 77% of the population were non-Hispanic White, and 21.2% of the population were minority women. Over half of the population had health care coverage, at 52.8%. Almost half the population was overweight or obese, at 49.3%. About a third (31%) had annual incomes of less than \$35,000, and about two thirds (66.1%) had completed high school or a lower education level. Table 3 presents the demographic characteristics of the sample by study group.

**Table 3***Sociodemographic Characteristics of New York Adult Women, 2017–2019*

Variables	Frequency	Percent
State		
New York	8,767	100
Age		
18–65	8,767	100
Sex		
Female	8,767	100
Race/Ethnicity		
Non-Hispanic White	6,752	77
All others	1,860	21.2
Missing	155	1.8
Income level		
< \$10,000	371	4.2
< \$15,000 (\$10,000 to less than \$15,000)	378	4.3
< \$20,000 (\$15,000 to less than \$20,000)	531	6.1
< \$25,000 (\$20,000 to less than \$25,000)	675	7.7
< \$35,000 (\$25,000 to less than \$35,000)	762	8.7
< \$50,000 (\$35,000 to less than \$50,000)	1,029	11.7
< \$75,000 (\$50,000 to less than \$75,000)	1,163	13.3
\$75,000 or more	2,252	25.7
77 Don't Know/ Not Sure	837	9.5
99 Refused	769	8.8
Education level		
Never attended school or only kindergarten	14	.2
Grades 1 through 8 (Elementary)	196	2.2
Grades 9 through 11 (Some high school)	427	4.9
Grade 12 or GED (High school graduate)	2,438	27.8
College 1 year to 3 years (Some college or technical school)	2,419	27.6
College 4 years or more (College graduate)	3,250	37.1
Refused	23	.3
Health insurance coverage		
Yes	4,629	52.8
No	676	7.7
Missing	3,462	39.5
Body mass index (kg/m <sup>2</sup> )		
Not obese (BMI < 30)	4,204	48
Obese (≥ 30.0)	4,320	49.3
Missing	243	2.8
Body mass index categories (kg/m <sup>2</sup> )		
Underweight (< 18.5)	368	4.3
Normal weight (18.5–24.9)	3,836	43.8
Overweight (25–29.9)	2,727	31.1
Obese (≥ 30.0)	1,593	18.2
Missing	243	2.8

Note. Source: Behavioral Risk Factor Surveillance System.

## Results

The following section shows the results for the statistical tests used to analyze the data in this research. The first part shows the descriptive analysis of the data: the multiple regression of physical activity, dietary intake, and weight loss as predictors of obesity (Table 4); group statistics (Table 5); the independent-samples *t* tests (Tables 6–8); and the independent-samples *t* test effect sizes using obesity as the reference value to categorize the dependent variable (Table 9).

### Execution

The data set provided by BRFSS contained the information requested and needed to perform all proposed analyses. Multiple regression was conducted to measure associations between the variables obesity, physical activity, dietary intake, and weight loss. Between-subjects *t* tests were used to measure outcome differences by conducting between-group comparisons with the intervention group and control group. It is of general knowledge that many of the individuals served in the BRFSS are considered to be women at risk of developing obesity. Attitudes were dropped from the analysis because the data were missing. Employment was dropped from the analysis because the data were missing.

### Research Questions and Hypotheses

For each research question, I used a multiple regression model to determine whether the independent variables significantly predict the continuous outcome, after adjusting for the demographic variables of sex, age, and state. One of the main assumptions of multiple regression is that the dependent variable must be continuous.

This assumption was met in using obesity (BMI) in Research Question 1 and weight (pounds) in Research Question 2 as dependent variables.

Research Question 1: What lifestyle factors are associated with obesity among women?

H<sub>0</sub>1a: There is no association between physical activity and obesity among women.

H<sub>A</sub>1a: There is an association between physical activity and obesity among women.

H<sub>0</sub>1b: There is no association between dietary intake and obesity among women.

H<sub>A</sub>1b: There is an association between dietary intake and obesity among women.

H<sub>0</sub>1c: There is no association between weight loss controlling for physical activity and dietary intake and obesity among women.

H<sub>A</sub>1c: There is an association between weight loss controlling for physical activity and dietary intake and obesity among women.

Research Question 1 was answered with multiple logistic regression to examine the extent to which lifestyle factors predict obesity among women.

### **Multiple Regression**

For this study, a multiple linear regression was conducted. Physical activity, weight loss, and dietary intake were three predictor variables that were loaded into the model. All three were treated as continuous variables. Next, the outcome variable obesity was used and was also treated as a continuous variable. Examination of the

model summary table revealed an adjusted  $R^2$  of .832, or 83.2% of the variance was explained by the variables in the model. Based on this, further examination of the coefficients table was warranted. Examination of the coefficients table revealed that of the predictors, physical activity was not significant. Examination of the coefficients table revealed that of the predictors, weight and fruit consumption were significant at  $p < .05$ . In order to determine which of the significant predictors contributed most to the model examination of the standardized beta, weights were employed. Based on this, weight was determined to be the largest contributor with a standard beta weight of .911, followed by dietary intake (fruit consumption) at .022 and physical activity at -.005. Next, the unstandardized betas were examined for obesity. For every unit that physical activity increased, the outcome decreased by -.009. For every unit that fruit consumption increased, the outcome increased by 9.937. For every unit that weight increased, the outcome increased by 15.093.

**Table 4**

*Multiple Regression of Physical Activity, Dietary Intake, and Weight Loss as Predictors of Obesity*

Model		Unstandardized coefficients B	Standardized coefficients Std. error	Standardized coefficients Beta	<i>t</i>	Sig.
1	(Constant)	289.192	15.803		18.300	< .001
	Minutes of physical activity per week	-.009	0.10	-.005	-.892	.372
	Reported weight in pounds	15.093	0.93	.911	163.042	< .001
	Consume fruit 1 or more times per day	9.937	2.556	.022	3.888	< .001

*Note.* Source: 2017–2019 New York BRFSS adults, controlling for sex, age, and state.

Research Question 2: Are there differences in outcomes (weight) between the intervention group and control group at posttest?

H<sub>a 2</sub>: There are differences in outcomes between the intervention group and control group at posttest.

H<sub>0 2</sub>: There are no differences in outcomes between the intervention group and control group at posttest.

Research Question 2 was also answered with between-subjects *t* test to examine the extent to which the surveillance system predicts weight loss among women.

### **Between-Subjects *t* Test**

For the purpose of this study, a between-subjects *t* test, also referred to as an independent-samples *t* test, was conducted. Year was one predictor variable loaded into the model. The predictor variable was treated as a continuous variable. Next, the outcome variable weight was used and was also treated as a continuous variable. Examination of the group statistics table revealed mean differences among groups. Examination of the independent-samples test table revealed that variances in two groups were different. Levene's test for equality in variances revealed equal variances not assumed; thus, the values from equal variances not assumed were examined. Based on this, further examination of the independent-samples effect size table was warranted. A between-subjects *t* test indicated that female participants in the intervention group in the year 2019 ( $M = 164.68, SD=42.1659$ ) weighed significantly higher than female participants in the control group in the year 2017 ( $M= 160.94, SD=40.454$ )  $t(8438.7) = -4.159, = p < .001$ . As a result, the null hypothesis was rejected, indicating that there are differences in

outcomes between the intervention group and control group at posttest as measured by the 2017 and 2019 New York BRFSS.

**Table 5**

*Group Statistics*

	Year	N	Mean	Std. deviation	Std. error mean
Reported weight in pounds	2017	4,145	160.94	40.454	.628
	2019	4,296	164.68	42.159	.643

*Note.* Source: 2017–2019 New York BRFSS adults, controlling for sex, age, and state.

**Table 6**

*Independent-Samples Test*

		Levene's test for equality of variances		<i>t</i> test for equality of means	
		<i>F</i>	Sig	<i>t</i>	<i>df</i>
Reported weight in pounds	Equal variances assumed	11.585	< .001	-4.156	8439
	Equal variances not assumed			-4.159	8438.746

*Note.* Source: 2017–2019 New York BRFSS adults, controlling for sex, age, and state.

**Table 7**

*Independent-Samples Test*

		<i>t</i> test for equality of means			
		Significance		Mean difference	Std. error difference
		One-sided <i>p</i>	Two-sided <i>p</i>		
Reported weight in pounds	Equal variances assumed	< .001	< .001	-3.740	.900
	Equal variances not assumed	< .001	< .001	-3.740	.899

*Note.* Source: 2017–2019 New York BRFSS adults, controlling for sex, age, and state.



**Table 8***Independent-Samples Test*

		95% confidence interval of the difference	
		Lower	Upper
Reported weight in pounds	Equal variances assumed	-5.504	-1.976
	Equal variances not assumed	-5.504	-1.977

*Note.* Source: 2017–2019 New York BRFSS adults, controlling for sex, age, and state.

**Table 9***Independent-Samples Effect Sizes*

		Standardizer <sup>a</sup>	Point estimate	95% confidence interval	
				Lower	Upper
Reported weight in pounds	Cohen's <i>d</i>	41.330	-.090	-.133	-.048
	Hedges's correction	41.334	-.090	-.133	-.048
	Glass's delta	42.159	-.089	-.131	-.046

*Note.* Cohen's *d* uses the pooled standard deviation. Hedges's correction uses the pooled standard deviation,

plus a correction factor. Glass's delta uses the sample standard deviation of the control group. Source:

2017–2019 New York BRFSS adults, controlling for sex, age, and state.

<sup>a</sup> The denominator used in estimating the effect sizes.

### Summary

The purpose of this study was to examine the association between physical activity, dietary intake, weight loss, and obesity. Dietary intake may be measured by the amount of fruit consumption per day, physical activity may be measured by the minutes of physical activity per week, and weight loss may be measured in pounds. The results showed that sex, age and state have predictive properties when accounting for the association between physical activity, dietary intake, weight loss, and obesity.

Furthermore, the first null hypothesis was accepted, indicating that physical activity,

dietary intake, and weight loss are not significant predictors of obesity when accounting for other demographic variables such as sex, age, and state. Dietary intake and weight loss were significant; however; physical activity was not a significant predictor of obesity in this study. Additionally, the second null hypothesis was rejected, indicating that there are differences in outcomes between the intervention group and control group. In Chapter 5, I discuss the interpretation of the findings with peer-reviewed literature. The limitations, recommendations for future research in this area, and implications for social change are discussed.

## Chapter 5: Discussion, Conclusions, and Recommendations

### Introduction

The purpose of this quantitative study was to examine the impact of a public health surveillance system for obesity prevention on the weight loss of women in New York. The obesity rate for women is high in the United States at 38% and is increasing annually in New York (CDC, 2020). The findings in the study support these rates, as women in the intervention group gained weight 2 years after obesity prevention programs were implemented and improved. In New York, Hispanic women's and non-Hispanic Black women's obesity rates are the highest in this group of women (CDC, 2020). There is a lack of obesity prevention programs in New York for the adult population, especially women, as only five programs were located from the New York State Department of Health (New York State Department of Health, 2019).

Chen et al. (2018) indicated that women experience varied factors that contribute to weight gain. For example, women have historically gained weight during pregnancy and experienced difficulty with weight loss after childbirth, subsequently contributing to higher obesity rates among adult women (Chen et al., 2018). Further, there is a need for more obesity prevention programs that incorporate health behavior change, lifestyle modification, and education that are cost-effective for the population (Helland & Nordbotten, 2021).

The current study addressed two main questions: (a) What lifestyle factors are associated with obesity among women? (b) Are there differences in outcomes (weight) between the intervention group and control group at posttest? I focused on adult women in New York, and my findings supported previous studies indicating that dietary intake

and weight loss may significantly predict obesity. My findings, however, did not support previous studies indicating that physical activity may significantly predict obesity. Furthermore, my findings supported previous studies where there were differences in outcomes between the intervention group and control group. The first null hypothesis was accepted, indicating that there is no association with lifestyle factors and obesity. Further, the second null hypothesis was rejected, indicating that there were differences between the intervention group and control group at posttest. In Chapter 5, the focus is on summarizing the findings of this study. The sections in Chapter 5 include an introduction, interpretation of the findings, limitations of the study, recommendations, implications, and a conclusion.

### **Interpretation of the Findings**

The main purpose of this study was to examine the impact of a public health surveillance system for obesity prevention for women in New York. There were 8,767 female participants in the 2017 and 2019 New York BRFSS telephone survey. Weight had a substantial amount of missing data. The sample consisted of  $N=8767$  participants after cleaning the dataset. For the intervention group in 2019, weight increased by approximately 4 pounds compared to the control group in 2017. This outcome warrants further interpretation. As a result, the null hypothesis was rejected, indicating that weight loss significantly predicted the odds of obesity among adults as measured by the 2017 and 2019 BRFSS.

Research Question 1: What lifestyle factors are associated with obesity among women?

The purpose of this research question was to determine whether lifestyle factors contribute to obesity among women. Physical activity, dietary intake, and weight loss were all lifestyle factors contributing to obesity among women. These findings supported previous studies indicating that incorporating physical activity and dietary intake changes as health behavior change and their influence on weight loss are associated with obesity rates among women. Physical activity, nutrition, and behavior outcomes served as a behavioral lifestyle intervention (PEARS) for pregnant overweight and obese women, as there was an impact in improved dietary intake and increased motivation to engage in physical activity (Ainscough et al., 2020). I found that as the minutes of physical activity increased, they did not affect obesity among women. I also found that fruit consumption affected obesity among women. Finally, dietary intake and weight loss affected obesity among women in New York.

Research Question 2: Are there differences in outcomes (weight) between the intervention group and control group at posttest?

The purpose of this research question was to determine whether there were differences in outcomes between the intervention group and control group at posttest. These findings supported previous studies indicating that there are differences between the intervention group and control group at posttest compared to pretest. Lek et al. (2021) indicated that after 2 years, there were differences in BMI and quality of life after the implementation of an overweight and obesity intervention program. I found that for women in the intervention group, weight increased compared to women in the control group.

### **Limitations of the Study**

The initial challenge was selecting a program that would grant access to data to conduct an impact evaluation. The process of collaborating with partner sites was difficult, as decision makers from some organizations initially expressed interest and later during the process ceased communication or declined to continue due to staffing, lack of variables needed to complete the study, or unwillingness to share data. Hence, when addressing these challenges and barriers, there were communication-building strategies used to form relationships with programs willing to release data. Furthermore, the findings of this study support the need for the development of initiatives to create partnerships with organizations willing to share data to reduce the prevalence of obesity among women. The use of the BRFSS will provide surveillance of obesity to evaluate the impact of implemented obesity prevention efforts in New York among women.

Limitations of this study included the use of secondary data sets, self-reported data, and random telephone sampling. The data used for this study were from the BRFSS 2017–2019, a random telephone survey. The secondary data set's limitations included a lack of previous research studies on the topic and potential changes in the way that data were measured over time, which could have made evaluations and comparisons difficult (Littenberg & Lubetkin, 2016). Furthermore, due to the many different topics and questions in the BRFSS, the data set had to be filtered to separate New York from the other states in the United States. The questionnaires from the years 2017 and 2019 differed in some sections or modules within the survey; thus, variables that were not used in both years were excluded from the study. The modules used in the 2017 and 2019 BRFSS are not included in all state surveys annually. The years 2017 and 2019 were

modules that included the same surveys and updated variable terms. Data from 2018 and 2020 at the beginning of each year were included in the study in Group 1 2017 and Group 2 2019, respectively, as the survey remained the same; however, 2018 and 2020 BRFSS modules differed and would have limited the reported data after analysis.

Self-reported data can threaten reliability and validity of measurement and introduce recall bias. Respondents may provide answers that they feel comfortable providing rather than being truthful. Respondents may also lack introspective ability and assess themselves incorrectly. For example, a woman may not have weighed herself recently and may increase or decrease her weight in pounds, thus inaccurately remembering her weight, a form of recall bias (Ross & Wing, 2017).

Another limitation of the current study may have been the use of the data from random telephone sampling. Households with cell phones and landlines were included in the study. Random telephone sampling may have excluded women who could have provided insightful data on their physical activity, dietary intake, and weight loss in New York. The use of random telephone sampling limited the number of adult women participants who were at risk of obesity or obese who could have been included in the study (Shook-Sa et al., 2016).

### **Recommendations**

The impact evaluation of the quantitative study findings indicates a need for the further development of obesity prevention interventions with women as the target audience. There is a need for policymakers and public health officials to implement obesity prevention programs to create opportunities for women in underserved areas to participate in weight loss programs to improve their overall quality of life. Annually,

community needs assessments are conducted with policymakers from various specialties in the public health field, to assess which strategies are required to implement programs to better improve communities in New York (New York State Department of Health, 2016).

Collaborative efforts among community leaders contribute to the development or improvement of obesity prevention programs after evaluations are conducted. Furthermore, longstanding obesity prevention programs in New York include but are not limited to Hunger Prevention and Nutrition Assistance Program (HPNAP); Special Supplemental Nutrition Program for Women, Infants and Children (WIC); and Just Say Yes to Fruits and Vegetables Project (JSY; NYC Health, 2019). However, there was a small number of obesity prevention programs that were responsive to providing data to assess the impact of the program on obesity prevention and the weight loss of women prior to data collection. Ultimately, decision makers in hospital-based programs were more interested in collaborating in academic research efforts, whereas those in community-based programs were less willing to share data on obesity prevention programs. For example, student evaluators face several challenges when conducting evaluations and collaborating with organizations. However, with the use of tools such as communication skills and presenting alignment in research, organizational decision makers were willing to consider sharing data (Billings, 2017).

Additionally, the incorporation of the goal-oriented intervention arm, outcome-oriented intervention arm, and the health behavior change arm did not contribute to significant weight loss among program participants over the years analyzed. Thus, policymakers and public health officials must focus on program planning to develop



obesity prevention programs and studies, adjusting to focus on different types of program participation such as weight management programs, monetary incentives, and resources for self-monitoring such as fitness watches and scales, to progress and see results from self-efficacy, motivation, and outcome expectations for weight loss from program participants (Murriel et al., 2020).

HBC theory guided this study, thus the impact of the theory-based goal-oriented intervention arm, outcome-oriented intervention arm, and health behavior change arm incorporated the tools needed for women to lose weight with self-monitoring physical activity, nutritional diet, and weight loss program participation. Furthermore, this impact evaluation of a surveillance system after the implementation of obesity prevention programs with women can serve as a framework for the development of additional impact evaluations on this area of study, which are needed in academia to reduce the prevalence of obesity among women.

### **Implications**

The positive social change implications from the findings of the study may include use by public health officials and policymakers to increase the implementation of obesity prevention programs that examine physical activity, nutrition, and educational programs designed for women. Moreover, weight loss sustainability, health behavior change, increased physical activity, improved nutritional diet, and increased quality of life are all benefits from the findings of this study. According to Saghafi-Asl et al. (2020), HBC theory indicates that individuals and society incorporate health behavior change gradually based on beliefs, susceptibility, and barriers. Furthermore, researchers must incorporate health behaviors in the implementation of additional obesity prevention

programs for obese women in New York to decrease the prevalence of obesity (Abiola & Mello, 2019). Findings provide empirical evidence in the benefits associated with surveillance systems that measured obesity annually, as obesity prevention programs were implemented or improved to prioritize action to target groups at the highest need. However, the findings are of great value, as the data analyzed were from an understudied population group. The sample under study is already at higher risk due to women in New York carrying a greater risk of developing chronic diseases linked to obesity, due to there being less programs focused on reducing the prevalence (NYC Health, 2019; Rummo, 2018). Overall, the risk of obesity was increased among persons in the intervention group compared to the control group. This provides evidence that weight increased after interventions were implemented.

### **Conclusion**

In conclusion, women who participated in the intervention group with additional obesity prevention programs implemented experienced an increase in weight and obesity compared with women in the control group. In a predominately understudied sample, women who were Hispanic and Black presented a higher priority for obesity prevention because they experienced a greater risk of developing obesity due to sociodemographic factors. This requires innovative strategies to decrease the prevalence of obesity. Further, BRFSS data incorporate data collected on poor nutrition, physical inactivity, and obesity in New York to be used in annual summary reports such as Community Health Needs Assessments (CHNA), and for funding purposes such as grant proposals to improve implemented obesity prevention programs and population health (Kavin & Stefanacci, 2019; Pennel et al., 2016).

In the state of New York, BRFSS data have been used to support program planning for the local health department's independent initiatives and the cardiovascular program (CDC, 2016). Additionally, BRFSS data have been used in New York to assist with national diabetes objectives after impact evaluations have been conducted for diabetes surveillance (CDC, 2016). However, increased efforts are needed to use the BRFSS data to develop considerably more obesity prevention programs to better address obesity among women in New York. This study was important, as it documented the association between physical activity, dietary intake, weight loss, and obesity in New York, a state with a high prevalence of obesity among women. The prevalence of obesity in New York adults is higher than the Healthy People objective (Rummo et al., 2018).

This impact evaluation fulfilled the theoretical framework of the study by building an evidence-based model of the interactions of physical activity, dietary intake, weight loss, and obesity. These findings could promote positive social change by evaluating the impact of obesity prevention programs individually to develop strategies to improve program outcomes by increasing weight loss with interventions focused on modifiable lifestyle factors. It is of high priority to focus on adult women as obesity rates increase in New York and other states in the United States. With an increase in weight gain in New York after obesity prevention programs have been implemented, and a disproportionate number of these residents displaying high rates of obesity, it may be especially important to focus on women in New York when developing intervention strategies.

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## Appendix A: Behavioral Risk Factor Surveillance System

## Questionnaire and Social Context Module

Adult Random Selection

I need to randomly select one adult who lives in your household to be interviewed. How many members of your household, including yourself, are 18 years of age or older?

LL.6 \_\_ Number of adults

**If "1,"**: Are you the adult?

**If "yes,"**:

Then you are the person I need to speak with. Enter 1 man or 1 woman below (Ask gender if necessary).

**[GO TO PAGE 8]**

**[CATI NOTE: IF "NO," IS THE ADULT A MAN OR A WOMAN? ENTER 1 MAN OR 1 WOMAN BELOW. MAY I SPEAK WITH [FILL IN (HIM/HER) FROM PREVIOUS QUESTION]?] [GO TO "CORRECT RESPONDENT" ON THE NEXT PAGE]**

LL.7 How many of these adults are men?

\_\_ Number of men

So the number of women in the household is \_\_\_\_

\_\_ Number of women

Is that correct?

**INTERVIEWER NOTE: CONFIRM NUMBER OF ADULT WOMEN OR CLARIFY THE TOTAL NUMBER OF ADULTS IN THE HOUSEHOLD.**

The person in your household that I need to speak with is .

**If "you," [GO TO NEXT SECTION]**

State

CP.8 In what state do you currently live?

\_\_\_\_\_ENTER FIPS STATE

Section 8: Demographics

**8.1** Are you ... (125)

1 Male

2 Female

9 Refused

**8.2** What is your age? (126-127)

\_\_ Code age in years

07 Don't know / Not sure

09 Refused

**8.3** Are you Hispanic, Latino/a, or Spanish origin? (128-131)

If yes, ask: Are you...

**INTERVIEWER NOTE: One Or More Categories May Be Selected.**



- 1 Mexican, Mexican American, Chicano/a
- 2 Puerto Rican
- 3 Cuban
- 4 Another Hispanic, Latino/a, or Spanish origin
- Do not read:
- 5 No
- 7 Don't know / Not sure
- 9 Refused

**8.4** Which one or more of the following would you say is your race? (132-159)

**INTERVIEWER NOTE: SELECT ALL THAT APPLY.**

**INTERVIEWER NOTE: IF 40 (ASIAN) OR 50 (PACIFIC ISLANDER) IS SELECTED**

**READ AND CODE SUBCATEGORIES UNDERNEATH MAJOR HEADING.**

Please read:

- 10 White
- 20 Black or African American
- 30 American Indian or Alaska Native
- 40 Asian
- 41 Asian Indian
- 42 Chinese
- 43 Filipino
- 44 Japanese
- 45 Korean
- 46 Vietnamese
- 47 Other Asian
- 50 Pacific Islander
- 51 Native Hawaiian
- 52 Guamanian or Chamorro
- 53 Samoan
- 54 Other Pacific Islander
- Do not read:
- 60 Other
- 88 No additional choices
- 77 Don't know / Not sure
- 99 Refused

**8.10** Is your annual household income from all sources—  
(191-192)

- 1 Less than \$10,000
- Notes: **If "no,"** code 02
- 2 Less than \$15,000 (\$10,000 to less than \$15,000)
- Notes: **If "no,"** code 03; **if "yes,"** ask 01
- 3 Less than \$20,000 (\$15,000 to less than \$20,000)
- Notes: **If "no,"** code 04; **if "yes,"** ask 02

4 Less than \$25,000 (\$20,000 to less than \$25,000)

Notes: **If "no,"** ask 05; **if "yes,"** ask 03

5 Less than \$35,000 (\$25,000 to less than \$35,000)

Notes: **If "no,"** ask 06

6 Less than \$50,000 (\$35,000 to less than \$50,000)

Notes: **If "no,"** ask 07

7 Less than \$75,000 (\$50,000 to less than \$75,000)

Notes: **If "no,"** code 08

8 \$75,000 or more

**Do not read:**

7 7 Don't know / Not sure

9 9 Refused

**8.19** About how much do you weigh without shoes?

**INTERVIEWER NOTE: IF RESPONDENT ANSWERS IN METRICS, PUT "9"**  
**IN**

**COLUMN 183. ROUND FRACTIONS UP**

(183-186)

\_\_\_\_ Weight

(pounds/kilograms)

7777 Don't know / Not sure

9999 Refused

**8.20** About how tall are you without shoes?

**INTERVIEWER NOTE: IF RESPONDENT ANSWERS IN METRICS, PUT "9"**  
**IN**

**COLUMN 187. ROUND FRACTIONS DOWN (187-190)**

\_\_ / \_\_ Height

(f t / inches/meters/centimeters)

77/ 77 Don't know / Not sure

99/ 99 Refused

Section 12: Fruits and Vegetables

Now think about the foods you ate or drank during the past month, that is, the past 30 days,

including meals and snacks.

**INTERVIEWER INSTRUCTIONS: IF A RESPONDENT INDICATES THAT THEY CONSUME A FOOD ITEM EVERY DAY THEN ENTER THE NUMBER OF TIMES PER DAY. IF THE RESPONDENT INDICATES THAT THEY EAT A FOOD LESS THAN DAILY, THEN ENTER TIMES PER WEEK OR TIMES PER MONTH. DO NOT ENTER TIMES PER DAY UNLESS THE RESPONDENT REPORTS THAT HE/SHE CONSUMED THAT FOOD ITEM EACH DAY DURING THE PAST MONTH.**

**12.1** Not including juices, how often did you eat fruit? You can tell me times per day, times

per week or times per month. (215-217)

**INTERVIEWER NOTE: ENTER QUANTITY IN DAYS, WEEKS, OR MONTHS  
READ IF RESPONDENT ASKS WHAT TO INCLUDE OR SAYS ‘I DON’T  
KNOW’: INCLUDE FRESH, FROZEN OR CANNED FRUIT. DO NOT INCLUDE  
DRIED FRUITS.**

1\_\_ Days

2\_\_ Weeks

3\_\_ Months

888 Never

777 Don’t Know

999 Refused

Section 13: Exercise (Physical Activity)

The next few questions are about exercise, recreation, or physical activities other than your

regular job duties.

**INTERVIEWER INSTRUCTION: If respondent does not have a “regular job duty” or is retired, they may count the physical activity or exercise they spend the most time doing in a regular month.**

**13.4** And when you took part in this activity, for how many minutes or hours did you usually keep at it? (239-241)

\_: \_\_ Hours and minutes

777 Don’t know / Not sure

999 Refused

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