Mitigating Barriers to Chronic Disease Risk Factor Prevention and Management in Disadvantaged Communities

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Mitigating Barriers to Chronic Disease Risk Factor Prevention and Management in Disadvantaged Communities

by

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A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy Public Health with a concentration in Epidemiology
College of Public Health
University of South Florida

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DEDICATION

To my parents, Mike and Tracey Johnson, who always pushed me to excel personally and professionally so that I had opportunities of which I never could have dreamt.

To my fiancé and best friend, Brenden O'Leary, who has been a fount of encouragement and love throughout this process. Here’s to the beginning of yet another adventure!
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ABSTRACT

Background: The incidence and prevalence of chronic disease (CD) has increased in recent decades due to the advent of CD management and life-extending technologies. To address this burden on the population and healthcare system, evidence-based CD prevention programs have been developed to reduce the incidence and therefore the prevalence of these diseases. Despite the development and dissemination of effective interventions, African-Americans and Hispanics have disproportionately higher prevalence of CD and associated risk factors and disproportionately lower participation in CD prevention programs. Overweight/obesity and CDs may have intergenerational effects, with overweight adults being more likely to have overweight children who are in turn more likely to become overweight adults with CDs. These dissertative projects sought to disrupt this intergenerational cycle of CD by exploring how to engage people of minority background in CD prevention programs, to determine the acceptability and feasibility of a CD prevention program adapted to social media, the preferred method of health education for women of childbearing age, and to identify areas in Florida that would benefit from a CD prevention program such as this.

Methods: Four focus groups of residents of disadvantaged and medically underserved areas and nine key informant interviews with local business owners were conducted using a standardized questionnaire to assess health beliefs, barriers to healthy behaviors, and preferred methods of health communication among the target population. These data were thematically analyzed in Atlas.ti version 8.0. Results of this analysis informed the adaptation of an existing CD prevention
ix program, the national Diabetes Prevention Program (nDPP), to a social media platform, Facebook, to address the needs of the community. The first four weeks of the nDPP were adapted to Facebook using Powtoon and Canva software, were assessed for fidelity by a certified nDPP Lifestyle Coach, and underwent an iterative editing process in collaboration with a community partner, REACHUP, Inc., to ensure cultural appropriateness. Height, weight, and waist circumference were measured pre- and post-intervention via a standardized protocol. Perceived stress, social support, depressive symptoms, and health-related quality of life were also assessed pre- and post-intervention. The final dissertative project utilized the Centers for Disease Control and Prevention and Robert Wood Johnson Foundation’s 500 Cities Data in conjunction with USDHHS locations of existing federally qualified health centers (FQHCs) to identify urban census tracts in Florida with high prevalence of CD and associated risk factors and inadequate access to FQHCs.

Results: Overall, residents and business owners in medically underserved areas of west central Florida identified distrust of medical professionals and pharmaceuticals as a barrier to receiving health care. Lack of transportation and safe recreational areas, were barriers to participating in health behaviors, though participants were concerned about how to prevent and manage diabetes, heart disease, and cancer. The preferred identified method of health communication for women of childbearing was social media, with Facebook being the most used social medium. The nDPP was chosen for adaptation to Facebook because it addressed most of the concerns of the target community. This Facebook-based adaptation of the nDPP, called HealthyLIFE, had no statistically significant results, though there were encouraging reductions in depressive symptom, perceived stress, and health-related quality of life. Tampa, St. Petersburg, Lakeland, and Jacksonville were the urban areas of Florida with the greatest prevalence of CD and associated x
risk factors, with areas with low insurance, low physical activity, poor physical health, high levels of poverty, high concentration of people of minority background, and high prevalence of stroke and diabetes were statistically significantly more likely to be within 0.5 miles of an FQHC.

Discussion: The results of this dissertation demonstrate the need for qualitative research to inform interventions to disrupt the etiology of chronic disease at the population level, particularly for people of minority background and low socioeconomic status who may experience greater barriers to participating in healthy behaviors and accessing preventive healthcare services. Integrating this type of data into the design and implementation of chronic disease prevention programs and targeting these programs to geographic areas with high prevalence of CD and associated risk factors can increase uptake by populations with historically low participation in these programs. With FQHCs serving less than 25% of urban census tracts with high prevalence of chronic disease and associated risk factors, there is a need for cost-efficient, effective, scalable, and accessible chronic disease prevention programs like HealthyLIFE to improve population health and reduce health disparities between racial and socioeconomic groups.
CHAPTER 1: INTRODUCTION

Background of the Study

In the United States, chronic disease rates have consistently increased for decades and comprise over half of the leading causes of death (1–3). These rates are higher in all minority populations, including African Americans, Asian Americans, Hispanics, Native Americans, and Pacific Islanders (4–7). People of minority backgrounds, including African-Americans, Hispanics, and Native Americans, have the most years of potential life lost (YPLL) and spend a higher proportion of their lives with a lower quality of life than their non-Hispanic white counterparts (4,5). Overweight and obesity are risk factors for most chronic conditions, with overweight persons having a body mass index (BMI) of 25 to 29.9 and obese persons having a BMI of 30 or greater. BMI is a calculation of body fat based on a person’s height and weight (8). Recent studies found that women who are overweight or obese at the time of conception and up to 20 weeks gestation are more likely to have an overweight infant who is in turn more likely to be an overweight or obese adult (9,10). Being overweight or obese before and during pregnancy increases the likelihood of complications during pregnancy, threatening the lives of both the mother and the infant (11). Women of minority backgrounds, particularly African-American women, are also more likely to be overweight or obese than their white counterparts, especially if they live in an economically disadvantaged or medically underserved area (4). Economically disadvantaged areas are defined as geographic areas which meet at least three of the following criteria: a median income less than or equal to 80% of the average median income.
of the state, an unemployment rate that is at least 50% greater than the state unemployment rate, an health uninsured rate that is at least 50% greater than the state rate, a food assistance rate that is at least 50% greater than the state rate, and a poverty rate that is at least 50% greater than the state rate (12). Medically underserved areas are areas with too few primary care providers and high infant mortality, poverty, and/or high elderly population (13). One-fifth of African-Americans and 18% of Hispanic Americans live in poverty (14). As such, African-American women are 3 to 4 times more likely to die of complications of pregnancy than are white women (11). Chronic disease risk factors must be addressed in women of reproductive age not only for the health of the women, but also for the health of future generations. Overweight and obesity are risk factors for diabetes, heart disease, stroke, poorer mental health, and poorer quality of life, and can also lead to pregnancy complications, infant overweight, and infant glucose resistance (15). Unaddressed overweight and obesity in women of childbearing age can therefore facilitate a continuous, multigenerational pattern of poor health outcomes which disproportionately affect minorities (9). Since these risk factors are largely behavior-driven, it is essential that researchers identify or develop health behavior change interventions which appeal to high-risk segments of the population and are relevant to the culture of the targeted community.

In the state of Florida, 37% of women of childbearing age have at least one chronic disease risk factor(16); in federally-qualified disadvantaged zip codes in Tampa, 75% of women have at least one chronic disease risk factor(17). Additionally, physiological changes during pregnancy and childbirth make it more difficult to lose weight post-partum (18,19). This weight tends to be distributed around the abdomen, increasing mothers’ likelihood of obesity-related poor health outcomes like heart disease, diabetes, and hypertension (18). Berger, et al. (18), conducted a systematic review of post-partum weight loss interventions to assess the benefits of
nutrition counseling, exercise, and nutrition counseling and exercise combined. They found that interventions with aspects of both nutrition counseling and exercise were the most successful in reducing BMI and adiposity. A limitation of the review was the small number of existing trials and interventions on which to base their conclusions. Researchers surmised that this was due to a lack of recommendations for exercise and nutrition for women in the post-partum period (18). In the absence of exercise and nutrition recommendations of post-partum women, physicians should screen women for obesity before and after pregnancy so that women can attain education and behavioral intervention as well as social support to build a habit of healthy behaviors prior to developing an obesity-related chronic condition (20). Ideally, this would result in women being referred to a health intervention program.

Evidence-based behavioral change intervention programs aimed at decreasing chronic disease risk factors are widely disseminated and translated to multiple modes of delivery (5). The national Diabetes Prevention Program (nDPP), a program created to address the increasing burden of prediabetes and type 2 diabetes in the United States, is traditionally presented as a 1 year, in-class program, which consists of 16 weeks of one-hour long classes and is offered in over 80% of local health departments (21). The short-term goal of the nDPP is a 7% decrease in weight and an increase in physical activity to 150 minutes or greater per week. The contents of the program teach and encourage participants to shop and eat healthier, to exercise regularly, and to engage in self-care and a supportive social network to maintain their progress. Participants are progressively weaned from weekly sessions to monthly and bimonthly sessions for the last 8 months of the program (22).

The nDPP was translated to primary care settings, delivered via self-directed DVD programs, web-based modules, e-mail, text message, mobile apps, telephone and e-counseling,
as well as video conference (22–26). One study that reviewed all of these methods of delivery found that all technology-based diabetes interventions resulted in an average decreased weight of 8.29 lbs, and nDPP-based interventions resulting in a higher weight loss compared with non-DPP interventions (10.6 lbs vs 5.3 lbs, respectively) (24). One type of technology-based intervention which has yet to be researched sufficiently to determine its contribution to health interventions is that of social media.

Despite the fact that 68% of all Americans use Facebook, with nearly equal proportions of whites, blacks, and Hispanics having active accounts (27), there is a paucity of research on how to design and evaluate a social media-based intervention (27). Social media, and Facebook in particular, have potential to be accessible, effective modes for behavior modification because of the ethnic makeup of its users (28) (29). Likewise, 77% of adults have a smartphone, making app-based health programs accessible to over three-fourths of the adult population (30). Young adults prefer the ability to track behaviors and access information on the go (31), making this an ideal method for delivering a lifestyle intervention in women of reproductive age. Studies examining the effectiveness of social media-based behavior change interventions is promising. For example, a social media-based smoking cessation intervention found that for each participant engagement activity (i.e., a “like,” comment, or post), participants smoked one less cigarette during the previous week (32). Since this mode of delivery for a smoking cessation intervention is effective with meaningful engagement, it is plausible that the same type of delivery may be effective in reducing weight and modifying other chronic disease risk factors.

Problem Statement

Chronic diseases and chronic disease risk factors like obesity and hypertension disproportionately affect people of minority background and people of low socioeconomic status
(SES); these groups are also less likely to access preventive health care resources, participate in
disease prevention programs, and meet national recommendations for physical activity due to
financial, social, and structural barriers (33–36). Women of minority background lose
statistically significantly less weight compared to white women when they complete evidence-
based chronic disease prevention programs and do not maintain this weight loss (7). Excess
weight during the childbearing years increases the probability of developing gestational diabetes
and of delivering overweight infants who often become overweight adults (9,20,37), facilitating
an intergenerational cycle of chronic disease morbidity and mortality in disadvantaged
populations.

There is a need to decrease the barriers that prevent people of minority background and
people of low SES from participating in chronic disease prevention programs (CDPPs) and to
create or adapt CDPPs to be culturally appropriate, empowering, and tailored to meet the specific
needs of the community. Creation or adaptation of a scalable and cost-effective CDPP that
effectively reduces weight and waist circumference and increases consistent healthy behaviors
such as physical activity and healthy eating has the potential to reduce health disparities and to
increase access to CDPPs for people of low SES or those who cannot attend a traditional CDPP
due to their work schedule, commitments, or location in an area without adequate transportation.
Since Facebook is the most-used social networking site (26) in the US, it is ideal as the delivery
mechanism for a social media-based health behavior change intervention.

Specific Aims

The purpose of this study is to examine barriers to chronic disease prevention and
management in disadvantaged communities, to include people of minority background and of
low socioeconomic status, as well as how to reduce barriers to participation and to identify
urban census tracts in Florida which could benefit from a tailored chronic disease prevention program.

Aim 1: Describe the health beliefs, barriers to healthcare, barriers to healthy behavior, important health issues, and unmet health education gaps in federally qualified disadvantaged zip codes in west central Florida.

Objective 1.1: Determine if residents’ health concerns are similar to the major health issues identified by quantitative data.

Hypothesis 1.1: Residents’ health concerns will be those health issues which are endemic at high levels within their census tract.

Objective 1.2: Enumerate perceived barriers to healthcare for residents of federally qualified disadvantaged zip codes.

Hypothesis 1.2: There will be structural, interpersonal, and intrapersonal barriers to access healthcare and unhealthy foods.

Objective 1.3: Identify unmet health education and promotion needs which can be incorporated into a future program tailored to prevent conditions identified as important health issues.

Hypothesis 1.3: Unaddressed health education issues will be identified by participants via focus group and interview responses.

Aim 2: Assess the acceptability and feasibility of the first four weeks of a social media-based, community-informed adaptation of the NDPP (HealthyLIFE).

Objective 2.1: Determine the acceptability of the HealthyLIFE program.
Hypothesis 2.1: HealthyLIFE will be accepted by the target population, as evinced by results of the satisfaction survey and focus group data.

**Objective 2.2:** Determine the feasibility of HealthyLIFE as it relates to capturing data on physical activity tracking, meal tracking, waist circumference measurement, and social support.

Hypothesis 2.2.1: Participants will utilize the MyFitnessPal app to track at least one meal per day.

Hypothesis 2.2.2: Eighty percent of participants attending the baseline session will attend the follow up session, resulting in complete anthropometric measures for both data points.

Hypothesis 2.2.3: Participants will complete quality of life questionnaires in their entirety at each data point.

Aim 3: Identify census tracts in Florida with statistically significantly high prevalence of chronic disease risk factors and describe the spatial autocorrelation of high-risk census tracts and federally qualified health centers (FQHCs).

**Objective 3.1:** Identify census tract-level hot spots of risk factors for chronic disease in metropolitan areas in Florida.

**Objective 3.2:** Describe the spatial relationship between FQHCs and census tracts with high prevalence of chronic disease risk factors by distance in metropolitan areas in Florida to describe the need for a nontraditional delivery of the national Diabetes Prevention Program in at-risk communities with limited access to FHQC's.
Hypothesis 3.2: The majority of FHQCs in metropolitan areas in Florida will not be located within 0.5 miles of census tracts which are hot spots of risk factors for chronic disease in metropolitan areas in Florida.

Significance of the Study Contributions

The national Diabetes Prevention Program (nDPP) is not only effective in mitigating chronic disease risk factors by the end of the 16-week program and through 1 year of follow-up; the positive health effects lasted at least ten (38) and fifteen years (39) after successful completion of the program. Four years following an intervention which compared a lifestyle intervention group to a metformin group and a control group, all three groups had similar weight changes (39). However, at 10 years, diabetes incidence in the lifestyle intervention and metformin groups were 34% and 18% less, respectively, than the placebo group (38). Fifteen years post-randomization, the lifestyle intervention and metformin groups continue to have reduced diabetes incidence compared with the placebo group (27% and 18% reductions, respectively), and women who participated in the lifestyle intervention group had a lower prevalence of microvascular complications compared with the other groups (39).

Given that participants in the lifestyle intervention group lost weight in the short term and up to 4 years post-intervention (38), and that the decreased risk for diabetes development lasts at least 15 years following the program (39), we can conclude that this program has the potential to mitigate risk factors present in any target population if tailored and delivered effectively. However, a study which examined weight loss during the nDPP by race/ethnic group found that black women lost significantly less weight during the program compared with all other gender and ethnic combinations (7), indicating that there may be other sociocultural and/or environmental barriers which hinder black and other minority women from practicing healthier
behaviors, achieving weight loss, and preventing obesity-related diseases. If an evidence-based program like the DPP was tailored to address the specific needs and concerns of the community and was delivered via an accessible technology-based platform, it is possible that the long-term positive health outcomes could be achieved and sustained by a wider, ethnically diverse population compared with in-person, classroom delivery.

Conceptual Framework

The conceptual framework of these dissertative projects are based on elements of three existing frameworks: the Conceptual Framework for Action on the Social Determinants of Health, the Health Belief Model, and the Christian Community Development Framework. The framework is further informed by the Social Cognitive Theory (SCT) of human behavior. Figure 1 demonstrates how the frameworks were integrated for these projects. Further details on these frameworks and the conceptual framework for these projects are in Chapter 2.

Theoretical Foundation

While there are many evidence-based behavior change theories(40–42), these dissertative projects will be based in social cognitive theory and informed by the theory-driven Health Belief Model. A table and in-depth comparison of the major behavior change theories is located in Chapter 2. Social cognitive theory (SCT) states that learning occurs as a result of interactions between a person, the environment, and their behavior. As such, the theory accounts for past lived experience, the social and physical environment which either encourages or prevents
Figure 1. Conceptual framework for dissertative projects

*Bold indicates quantitatively or categorically collected data. Values that are bolded and underlined will be assessed via qualitative methods.
positive health behaviors, and existing reinforcing factors which encourage positive health behaviors. SCT is therefore well-suited to these dissertative projects, as the purposes are to identify and reduce barriers to healthy behaviors, to engage historically unreachable populations, and to identify environments and communities that may benefit from the implementation of a tailored, accessible chronic disease prevention program. These goals are addressed by the constructs of SCT: reciprocal determinism, behavior capability, observation learning, reinforcements, expectations, and self-efficacy. The Health Belief Model (HBM) further informs these projects, accounting for how a person’s perception of risk of disease and ability to control their risk affect their health behaviors (43). HBM and SCT are complimentary theoretical approaches, with both acknowledging the potential for an internal or external trigger to cause a person to initiate behavior change and the importance of self-efficacy to enable that behavior change (43,44). These constructs likewise support the conceptual framework, explicated in Chapter 2.

Definitions of Terms

Body mass index (BMI): an indirect measure of body fat; weight in kilograms divided by the square of height in meters (8).

CDC Healthy Days(CDC HRQOL-4): a 4 item set of Healthy Days questions; has been part of the Behavioral Risk Factor Surveillance System (BRFSS) (45)

Childbearing age: Range of ages during which a woman may become pregnant; can be defined as 16-49 years of age (46)

Chronic disease: a disease lasting 3 or more months; usually are not vaccine-preventable or curable with medication (47)
Chronic disease risk factors: any of multiple non-modifiable risk factors, behavioral risk factors, and cultural or environmental risk factors that affect a person's likelihood of developing hypertension, hypercholesterolemia, overweight or obesity, or pre-diabetes (48)

Collective impact: a framework for progress in specific social problems characterized by the organized commitment of a group of people and/or institutions to a common agenda/goal (49)

Community-based participatory research (CBPR): a partnership approach to research that equitably involves community members, organizations, and researchers throughout the research process. All partners contribute expertise and share decision making and ownership in the research project (50)

Community-engaged research (CER): a framework or approach for conducting research, incorporating qualitative and quantitative methods, encouraging recognition of the strengths of community institutions and individuals and encouraging people and groups to build on those strengths. CER requires partnership development, cooperation and negotiation, collaboration with community partners and a commitment to addressing local health issues (51)

Disadvantaged: “lacking in the basic resources or conditions (such as standard housing, medical and educational facilities, and civil rights) believed to be necessary for an equal position in society” (52)

Duke Social Support Index: “a brief, easily administered instrument to determine an individual’s level of social support” (53)

Economically disadvantaged areas: “a geographic area, identified by the Commission, which meets three or more of the following criteria: (a) A median income that is 80 percent or less of
the average median household income in the State; (b) An unemployment rate that is at least 150 percent of the unemployment rate in the State; (c) A health uninsured rate that is at least 150 percent of the health uninsured rate in the State; (d) A food stamp or Supplemental Nutrition Assistance Plan (SNAP) rate that is at least 150 percent of the food stamp or Supplemental Nutrition Assistance Rate in the State; and (e) A poverty rate that is at least 150 percent of the poverty rate in the State.” COMAR 10.62.01.01(B)(13).” (12)

Environment: “the aggregate of social and cultural conditions that influence the life of an individual or community” (54)

HealthyLIFE: a Facebook-based adaptation of the National Diabetes Prevention Program (NDPP) supplemented with information that the target area requests via focus groups and key informant interviews

Health disparity: “differences which systematically and negatively impact less advantaged groups” (55)

Maternal child health outcomes (MCH outcomes): health outcomes associated with pregnancy and childbirth and child health up to one year, including fetal death, pregnancy complications, maternal morbidity and mortality, miscarriage, stillbirth, and infant death (56)

Medically underserved areas: “areas or populations designated by HRSA as having too few primary care providers, high infant mortality, high poverty or a high elderly population.” (57)

Minority background: culture or ethnicity that is identifiably distinct from the ethnic non-Hispanic white majority (58)
national Diabetes Prevention Program (nDPP): a Centers for Disease Control and Prevention-recognized lifestyle change program aimed at delaying or preventing the onset of diabetes among prediabetic persons (59)

Normal weight: having a BMI of 18-24.9 kg/m$^2$ (8)

Overweight: having a BMI of 25-29.9 kg/m$^2$ (8)

Obesity: having a BMI greater than 30 kg/m$^2$ (8)

Patient Health Questionnaire-2 (PHQ-2): a two item screener which ascertains the frequency of depressed mood during the prior two weeks (60)

Perceived Stress Scale (PSS): ”a measure of the degree to which situations in one’s life are appraised as stressful” (61)

Postpartum: “being in the period following childbirth” (62)

Physical activity: “any bodily movement produced by skeletal muscles that requires energy expenditure” (63)

Physical activity recommendations: “at least 150 minutes a week of moderate-intensity, or 75 minutes a week of vigorous-intensity aerobic activity, or an equivalence combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes” (64)

Prediabetes: impaired glucose tolerance characterized by an A1C level between 5.7 and 6.4% and/or a fasting blood sugar level from 100 to 125 mg/dL (65)
Protective factors: “conditions or attributes in individuals, families, communities, or the larger society that, when present, mitigate or eliminate risk in families and communities that, when present, increase the health and well-being of children and families” (66)

Risk factor: “any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury” (67)

Social determinants of health (SDH): “the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels” (68)

Social media: “activities among people gathered online who share information using conversational media that make it easy to create and share content in the form of words, pictures, videos, and audios” (69)
CHAPTER 2: LITERATURE REVIEW

Chronic Disease in the United States

In 2014, 60% of American adults had at least one chronic disease and 42% had two or more chronic diseases (1,70); these proportions and the prevalence of chronic disease risk factors continue to increase given the development of chronic disease management life-extending technology (1,70). Of the top ten leading causes of death in the United States, seven are chronic conditions and three of those are obesity-related illnesses: diseases of the heart, cerebrovascular diseases, and diabetes mellitus (71). Two of every three deaths in the United States are caused by heart disease, cancer, stroke, chronic obstructive pulmonary disease, diabetes, or a combination thereof (70). One additional leading cause of death, chronic kidney disease, is a common condition among persons with diabetes mellitus or high blood pressure; both of these conditions are consequences of obesity (71,72). Those with multiple chronic conditions have poorer overall health and access more health services, spending more on health care compared with individuals with no chronic conditions due to the complexity of balancing their conditions with appropriate treatment regimens (1–3,70). Chronic disease treatment and management costs over $1 trillion per year in the United States (73) and the Centers for Disease Control and Prevention (CDC) identifies chronic diseases as, “the most common, costly, and preventable of all health problems in the United States (74),” further emphasizing the need for effective prevention strategies among populations experiencing chronic diseases at higher levels.
Epidemiology and Etiology of Leading Causes of Death in the United States

Heart Disease

One in four deaths in the United States is due to heart disease, making it the leading cause of death for men and women (75) despite decreasing death rates and the decreasing number of deaths by 31% and 16.7%, respectively, since 2010 (76). While there is an overall decrease in heart disease-related deaths, race/ethnic disparities remain (33); while males account for more deaths due to heart disease, black males have a notably higher risk than their white counterparts (369.2 per 100,000 and 278.4 per 100,000 respectively (76)). Similarly, though 1 in 3 deaths in women is attributable to heart disease and 90% of women have at least one risk factor for heart disease (77), this rate also differs by race, with black women having a 40% greater rate of death compared to white women (260.5 per 100,000 and 192.2 per 100,000, respectively (76)). Of note, after the age of 55, female gender is no longer a protective factor for heart disease due to the reduction in estrogen production during and following menopause; this transition occurs at a time when other risk factors such as overweight/obesity and hypertension are also likely to develop (76,77). The risk for heart disease and heart disease-related death also increases with age, with 36.5% of person aged 75 and over having heart disease compared with 22.6% of those 65-74 years of age and 12.2% of persons 45-64 (78). Social support is also a component related to the development of heart disease, with persons who are widowed, divorced, or separated experiencing up to 40% greater prevalence of heart disease compared to their married, cohabitating, or single counterparts (78). Socioeconomic status has a similar relationship with heart disease, with individuals of low SES experiencing 50% greater risk compared with those of high SES (78).
Major risk factors for heart disease include high blood pressure, high cholesterol, and smoking; nearly half of all Americans have at least one of these risk factors (75). While heart disease is a term that encompasses atherosclerosis, heart arrhythmias, heart defects, dilated cardiomyopathy, heart infection, and valvular heart disease, it most commonly refers to the former, atherosclerosis (79). Atherosclerosis is characterized by the hardening of arteries due to the buildup of plaque, narrowing the arteries and increasing blood pressure (75,77,79). When a blood clot forms, it can get caught in these narrowed arteries, causing a heart attack or stroke which may lead to death (77,79). Atherosclerosis can be caused or exacerbated by unhealthy diet, lack of physical activity, overweight or obesity, and smoking (75,77,79). An estimated 12.4% of cases of atherosclerosis and subsequent heart disease could be prevented through mitigation of these risk factors (80). Another risk factor independent of one’s healthy lifestyle behaviors is that of socioeconomic status, with one study finding that socioeconomic status is a significant predictor of heart disease-related death regardless of access to and use of health care(81), indicating that access to health care itself is not enough to eliminate the increased risk of heart disease-related death among those of low socioeconomic status.

Cancers

It is estimated that cancer, the second leading cause of mortality in the United States, afflicted 1.7 million people in 2018, resulting in over 600,000 deaths (82). Cancer incidence is 20% higher in men, and men are 40% more likely than women to die of cancer (196.8 per 100,000 compared with 139.6 per 100,000(83)). African American men specifically have the highest cancer mortality of all race-gender pairs, with a mortality rate of 239.9 per 100,000 (82). Breast cancer, lung cancer, prostate cancer, colorectal cancer, and melanoma are the most prevalent types of cancer (82,84,85), with more than two-thirds of Americans likely to be
diagnosed with cancer in their lifetimes. Despite this high cancer prevalence, the cancer mortality rate has decreased by 25% since 1990 and decreased 1.4% and 1.8% for women and men, respectively from 2006 to 2015 (82).

While the risk factors for specific types of cancer vary (84), there are several behaviors which are established as risk factors for cancers, including tobacco and alcohol use, high intake of red meat, processed meat, hormones, and salted fish, low fiber intake, obesity, and sedentary lifestyles (84). Due to the behavioral nature of these risk factors, it is plausible to reduce cancer incidence substantially through positive health behavior change programs. It is estimated that 30% of cases of lung cancer could be prevented by eliminating tobacco use (86), 7-9% of cases of colorectal cancer could be prevented through reduction of red meat and processed meat consumption (87), and an additional 52% and 62% of total cancer cases could be prevented by maintaining a healthy weight and meeting the United States Department of Health and Human Services’ (USDHHS) physical activity recommendations of 150 active minutes per week for adults for men and women, respectively (88).

Stroke

Stroke is the leading cause of long term disability in the United States and is responsible for 1 in every 20 deaths (76,89,90). Of the 795,000 strokes occurring annually, 25% of them are among people who previously had a stroke (89). The American Heart Association estimates that 6.8 million Americans, 2.8% of the population, have had at least one stroke (90). Since 2010, the rate of stroke death and actual number of stroke deaths fell by 35.8% and 22.8% (76). These declines are attributed to reduced stroke mortality in recent decades for all gender, race, and age groups as well as decreased case fatality rates. However, the incidence of stroke did not decrease uniformly across racial groups; the incidence of first-ever ischemic stroke and stroke deaths
decreased from 1993-2010 in whites but did not change significantly for blacks, indicating that the racial health disparity gap is widening for stroke (34). The push to control hypertension in the 1970s is cited as the major contributor to the reduction in stroke incidence and mortality, with diabetes and hypercholesterolemia treatment also contributing to this decrease (76). However, hypertension is 1.4 times more prevalent among blacks, contributing to the continued increased stroke morbidity and mortality (34,78). Age is also a risk factor for stroke, with 2% of persons aged 40-59, 6% of those 60-79, and 15% of those 80 and older having had at least one stroke. Females were also more likely to have a stroke up to age 59; this trend reverses at age 60, when men are statistically significantly more likely to have a stroke (91). Eighty-seven percent of strokes are ischemic, meaning that blood flow to the brain is prevented by a clot or other obstruction. In survivors of ischemic stroke included in the Framingham Study, 26% were dependent on others for activities of daily living 6 months after having a stroke (90). Stroke-related health care services, medicines, and missed days of work cost an estimated $34 billion per year (89), with the long-term care following an ischemic stroke averaging $140,000 per person (90).

Established risk factors for stroke include age, hypertension, hypercholesterolemia, smoking, overweight/obesity, and diabetes (89). CDC recommends an aspirin regimen, blood pressure and cholesterol control, and quitting smoking to reduce the likelihood of having a stroke (92). Reductions in smoking and cholesterol control reduce the contracting of blood vessels which can lead to an ischemic stroke (76,89,92).

Chronic Obstructive Pulmonary Disease (COPD)

Sixteen million Americans have COPD, making it the third leading cause of death in the United States (93). COPD is the primary cause of mortality associated with chronic lower
respiratory diseases (94), affects statistically significantly more women (6.1%) than men (4.1%), and is more prevalent among older age groups. While COPD death rates from 1999-2007 declined for men, they did not change significantly for women (94) and increased for black women from 2000 to 2014 (95). However, men were more likely to die of COPD compared with women from 2000 to 2014 (95). The highest prevalence among men was in the 75-84 age group (11.2%) while for women it was highest among those aged 65-74 (10.4%) and 75-84 (9.7%). COPD is most prevalent among Puerto Rican (6.9%) and non-Hispanic white (5.7%) adults compared with non-Hispanic black (4.4%) and Mexican-American adults (2.6%), and is two times more prevalent among those with a family income below the poverty level than among those with a family income of at least 200% of the poverty level (96). Persons with COPD are less likely to be able to work, climb stairs or walk for long distances, and engage in social activities (93), with over 64% of persons with COPD reporting that shortness of breath negatively affected their quality of life (94). Likewise, persons with COPD were more likely to have depression or other mental/emotional conditions, report a fair or poor health status, experience increased confusion and memory loss, and experience more emergency department visits and hospital stays compared with people without COPD (93,97).

Similar to stroke, cancer, and heart disease, smoking is the leading risk factor for development of COPD, though exposure to air pollutants, respiratory infections, and genetic factors also contribute to the development of COPD (93).

Diabetes

Type 2 diabetes mellitus (T2DM) is characterized by the body’s inability to use insulin well resulting in unregulated blood glucose levels; it may be fatal or lead to kidney disease, macrovascular complications or microvascular complications if not treated appropriately (98–
Over 84 million people in the United States live with prediabetes, over 30 million are living with diabetes (99), and 2-10% of pregnancies are affected by gestational diabetes annually (101). Diabetes is the seventh leading cause of death in the United States and is the leading cause of renal failure, lower-limb amputations, and adult-onset blindness (100). Ninety percent of people with diabetes have T2DM, which develops over many years of exposure to risk factors (100). It is estimated that 25% of people with T2DM (7.2 million people) and 11.6 million people with prediabetes are unaware that they have these conditions (102), indicating a need for screening as well as for preventive measures to reduce the likelihood of progressing from prediabetes to diabetes (5,103,104). According to an analysis of the National Health and Nutrition Examination Survey (NHANES) from 1988-2012, total diabetes (diagnosed and undiagnosed) was highest among those ages 65 and older (33.0%) and age-standardized prevalence was similar among genders (105). The prevalence of diabetes was 1.93 times higher among non-Hispanic blacks (21.3%) compared with non-Hispanic whites (11.3%), though Hispanics had the highest prevalence of diabetes (22.6%). Similarly, non-Hispanic blacks and Hispanics had the highest average body mass indices (BMIs), 30.8 and 29.7, respectively (105). Each of these averages is above the threshold for a normal BMI (18-25), and the average BMI for non-Hispanic blacks is classified as obese (106). This study also found that diabetes prevalence increased in recent years among both sexes, all racial/ethnic groups, and all socioeconomic status levels. While there was a statistically significant increase in diabetes prevalence among persons aged 65-74 and among men, no significant increase was found among younger age groups or women (105). When examined by BMI, diabetes only increased among those who were obese (105). Accessible and relevant diabetes management education programs
could reduce the risk of diabetic complications, including stroke, kidney disease, and lower-limb amputation (103,107–109).

Risk factors for diabetes which are targeted by both diabetes prevention and diabetes management programs include overweight/obesity, high blood pressure, lack of physical activity, and coping with stress and triggers which may impact healthful eating and/or physical activity regimen (59,99,110). More than one-third of Florida women of childbearing age have pre-diabetes, diabetes, and/or are overweight or obese (111). Excess weight during pregnancy can also lead to gestational diabetes, increasing risk for pregnancy and birth complications; this condition develops in 7% of all pregnancies in the United States (37,112,113). Since people with diabetes are more likely to experience decrease in circulation, heart disease, and stroke, diabetes prevention and management programs focus not only on regulation of blood glucose, but on overall healthy lifestyles which are also proven to prevent or manage the aforementioned diseases.

Risk Factors for Chronic Disease

While risk factors for chronic diseases differ widely based on the type of disease, there are several individual risk factors associated with each of the major chronic diseases contributing to mortality in the United States. These risk factors include race/ethnicity, age, sex, lifestyle/behavior, obesity, and one’s working and living environment (109,114,115).

Race/Ethnicity

Collectively, people of racial/ethnic minority background in the United States experience chronic diseases at 1.5 to 2.0 times more frequently compared with non-Hispanic whites (35). Non-Hispanic blacks are 40% more likely to have high blood pressure, 77% more likely to be diagnosed with diabetes (116), 33% more likely to die of cardiovascular disease (33), 2.5 times
more likely to die of stroke, and are projected to live 3.8 fewer years compared with non-Hispanic whites (33). Similarly, Hispanics are diagnosed with diabetes at 1.66 times the rate of non-Hispanic whites (116). Mexican Americans specifically have a national obesity rate of 43%, only surpassed by non-Hispanic blacks, with 48% of adults considered obese (117). Sixty percent of non-Hispanic black women ages 45 and older are overweight or obese and even non-Hispanic black children have a disproportionately higher obesity rate compared with whites and show a decrease in physical activity as they age (114). While mortality rates for kidney disease are similar across racial/ethnic groups, non-Hispanic blacks experience COPD-related mortality and diabetes hospitalization at substantially higher rates compared with non-Hispanic whites (70). Diabetes also disproportionately affects Native Americans (33% prevalence), non-Hispanic blacks (12.8%), and Hispanics (11.8%) compared with non-Hispanic whites (7.1%; (118)).

However, one study found that racial disparities did not exist between low-income men with similar social environments living in urban areas (36), indicating that the social environment may be a greater predictor of chronic disease morbidity and mortality rather than race differences.

Age

Heart disease, cancer, kidney disease, COPD, and diabetes have positive associations with age, likely due to increased risk factor experience (1,2,82,86,88,93,119,120). While 40% of American adults aged 40-59 experience heart disease, 70-75% of those 60-79 years and 79-86% of those over the age of 80 experience cardiovascular disease, demonstrating this positive association (121). Cancer(122), diabetes(123), and COPD(96) incidence have similar trajectories, with incidence increasing sharply after age 45. Only 20% of persons ages 60-69 have chronic kidney disease compared with nearly 50% of persons aged 70-79 (124). However, chronic diseases do not only affect adults; from 1960 to 2005, the percentage of children in the
United States experiencing any chronic disease increased from 1.8% to 7.0%, a surge of 400% (35). The most common chronic diseases were asthma, diabetes mellitus, obesity, hypertension, dental disease, and mental illness (35,125), with youth obesity and extreme obesity increasing significantly since 1988 (126).

Sex

While COPD, heart disease, and stroke are more prevalent among males, studies show that this difference between the sexes is likely due to differences in risk factor experience rather than to biologic differences in the sexes (4,127,128). Further, at the age of 55, heart disease becomes more prevalent among women; menopause and perimenopause eliminate the protective nature of the female gender, as does a hysterectomy procedure, due to the body’s decrease in estrogen production (129). There are also sex differences in cancer, with men having a 20% greater incidence of all cancer, though sex differences vary by cancer type (83). The literature is mixed on the trends in COPD morbidity and mortality among women, though there is consensus that COPD morbidity and mortality is decreasing among men (93,94,127). Age-standardized prevalence of total (diagnosed and undiagnosed) diabetes is similar among men (15.4% [95% CI:13.2%-17.9%] and women (13.8%, [95% CI: 11.4%-16.6%]), indicating that risk experience is a greater predictor of incidence of diabetes than sex, as with COPD, heart disease, and stroke incidence (105).

Behavior

Behavior-based risk factors for chronic diseases are well defined. Lack of physical activity, eating unhealthy foods (specifically not enough fruits and vegetables), cigarette smoking, and excess alcohol intake are the most commonly cited risk factors (1,93,114,115,120,130). Most of these risk factors contribute to the likelihood of a person being
overweight or obese (115, 119, 120), and developing stroke (89, 92), cancers (84, 86, 88, 122, 131), and diabetes (59, 99, 109, 118). Each of these behaviors contributes to chronic disease morbidity and mortality and is potentially modifiable (114, 115, 120, 130). There are evidence-based behavior change programs which have effectively addressed the barriers to participate in healthy behaviors and to facilitate the reduction and cessation of tobacco and alcohol use (32, 132–135). The common themes in these programs include increasing participants’ self-efficacy, social support, and improving access to smoking cessation services to improve professional support. These themes are easily applicable to and overlap with overarching themes in behavior change to prevent chronic diseases or reduce the deleterious effects of chronic conditions (2, 114, 136).

Obesity

Overweight and obesity are proven risk factors for many chronic diseases (2, 72, 88, 105, 114, 115, 131), with obesity contributing to the statistically significant increase in diabetes nationwide since 1988 (105). Since non-Hispanic blacks and Hispanics were the racial/ethnic groups with the highest average body mass indices (BMIs), 30.8 and 29.7, respectively (105), it is likely that this risk factor contributes to the disparity in chronic disease incidence and prevalence in these populations compared with non-Hispanic whites. Each of these averages is above the threshold for a normal BMI (18-25), and the average BMI for non-Hispanic blacks is classified as obese (106). Obesity and extreme obesity have also increased significantly among children 2-19 since 1988, most notably among children 6-19; this age group experienced statistically significant increases in both obesity and extreme obesity between 1988 and 2014 (126). The increase in obesity-related illnesses among children (diabetes, hypertension, and obesity (35)) may likewise be a contributing factor to the increase in adults
with these conditions; conversely, the increase in adults with obesity-related illnesses may be creating living environments which facilitate the increase of these illnesses in youth.

Environment

Environment here is defined as one’s work and home environment, to include their socioeconomic status. It is of note that while non-Hispanic Black race is associated with higher rates of COPD, it is no longer associated after controlling for socioeconomic variables, indicating that the socioeconomic status can be a more important predictor of health outcomes than one’s race/ethnicity, with low income and lower educational attainment related to elevated hazard ratios of 2.1 and 1.5, respectively, compared with persons with a family income greater than 200% of the poverty level and with persons with a college degree (137). CDC considers education the most easily modifiable determinants on health, as increased education is associated with higher income, higher socioeconomic status, and greater healthcare access (120).

Implications of Risk Factors for Chronic Disease

While race, age, and sex are established risk factors for several chronic diseases, nearly all of the difference among these groups in chronic kidney disease (124), cancer (122), COPD (137), and heart disease (81,138) can be explained by the effects of education, income, health behaviors, and overall socioeconomic status on one’s health (81,137–140). However, this does not explain the notably higher prevalence of chronic disease among minority populations, particularly non-Hispanic blacks. The cultural behaviors, diets, and the living, working, and social environments of people of minority background may explain the pervasive chronic health disparities in our country (141). As such, cultural competence among public health professionals and community health workers is necessary to ensure that all efforts to improve the health of people of minority background are relevant, reasonable, holistic, and accessible to the target
population (141). These efforts should not only directly address positive health behaviors (opportunities to increase physical activity and healthy food, decrease weight, blood pressure, and cholesterol) before the onset of chronic disease (3,77,119,122,130), but also engage the population of interest in the design of a chronic disease prevention program, tailoring it to the needs of the community being served (6,142–144).

Maternal Morbidity and Mortality

While chronic disease risk factors and chronic diseases can affect infant and future weight, they may also lead to severe pregnancy complications in early and late pregnancy, potentially resulting in fetal, infant, or maternal death (11,145). Severe maternal morbidities (SMM) include severe heart attacks and hemorrhages (19,56,145). The rate of SMM doubled from 2000 to 2010, likely due to overall increases in maternal age, pre-pregnancy obesity, increases in chronic conditions, and cesareans or other complications during pregnancy (11). Pre-pregnancy overweight or obesity and excessive weight gain during the gestational period are associated with increased risk of maternal complications such as gestational diabetes and preeclampsia, which are associated with T2DM and other morbidity postpartum (145). Obesity in women 15–44 also reduces fertility, increases the time to conception, increases the likelihood of early pregnancy loss and increases the risk for congenital fetal malformation (145). Infants born to obese women are likewise more likely to be obese, to be large for gestational age, to have spontaneous or medically indicated premature birth or stillbirth, and to develop T2DM and cardiovascular disease later in life in the case of live births (37). Just as African American and Hispanic women have higher average BMIs compared with white women, they also are at increased risk of pregnancy complications, with African American women 3 to 4 times more likely to die of pregnancy complications compared with white women (11). Kotch, et al (56),
argue that while African American background is a known risk factor for pregnancy complications, it is more likely that race acts as a proxy for socioeconomic disadvantage and lack of access to prenatal care.

Despite the existence of evidence-based weight reduction programs in postpartum women, particularly those which included both nutritional counseling and exercise, there are no recommendations for exercise and nutrition for postpartum women (18). Evidence-based programs which are effective in non-pregnant persons, however, are less effective for women of minority background and in particular for African-American women, who lose statistically significantly less weight and do not maintain weight loss compared with all other race-gender pairs (7,146). Physicians should screen women for obesity before and after pregnancy so that women can attain education and participate in behavioral interventions, as well as receive social support, to build a habit of healthy behaviors prior to developing an obesity-related chronic condition (19,20,145). Ideally, this screening and education process would result in women being referred to health intervention programs that are tailored to ethnicity and culture to improve their uptake and acceptability to improve the health and health outcomes of women and infants before, during, and after pregnancy (145).

Social Determinants of Health: Determinants of Chronic Disease Risk Factors

While many chronic disease risk factors are related to one another, they do not occur or develop in a vacuum. There are innumerable outside factors which may reinforce or enable the behavioral chronic disease risk factors, most of which are encompassed in the term “social determinants of health” (68,107,114,131,147). The social determinants of health (SDH) are broadly defined as factors where people live, work, play, and learn which can affect their health (68,148,149). SDHs include five major components: economic stability, education, social and
community context, health and health care, and neighborhood and the built environment; all of these aspects are influenced by policy decisions (68,125,149). Due to the policy-level influences, it can often be difficult for socially and socioeconomically marginalized populations to overcome barriers resulting from each of the components of social determinants of health (125).

Economic Stability

The component of economic stability encompasses socioeconomic status, poverty, and employment (125). Socioeconomic status is related to rates of physical activity, with people of higher socioeconomic status perceiving their neighborhoods as having more green spaces and in turn engaging in more physical activity (147). People of lower socioeconomic status perceive their living and working environments as markedly less attractive, more prone to traffic, and more stressful for participating in physical activity (147). Neighborhood socioeconomic status (NSES) is also associated with obesity among the largest ethnic groups in the United States, with the poorest 25% of people having two times the risk of obesity compared with the richest 25% (150). Likewise, socioeconomic status is a major predictor of all-cause mortality and mortality due to heart disease and cancer (81), indicating that this component of SDHs has a powerful impact on one’s health and longevity. However, it is not simple or time-efficient to improve one’s socioeconomic status, requiring the availability of gainful employment, affordable housing, and, often, increased education or skill-building (151).

Education

Education level has a positive association with income, lifetime income, and property ownership, all of which positively affect socioeconomic status and health outcomes (68,81,138,152). Education is known as, “the single most important modifiable social determinant of health (152).” United States men and women aged 25 who never finished high
school were expected to live 5.3 fewer years compared to those who did complete high school, leading to the inclusion of high school graduation rates as a health priority in Healthy People 2020 (152). However, increasing one’s education to improve socioeconomic status is more difficult for children and young adults from low socioeconomic status families, as they develop academic skills more slowly, and are more likely to experience poor cognitive, language, memory, and social-emotional processing compared with their high socioeconomic status counterparts (151). Schools in low income areas also experience a lack of physical and personnel resources: there are fewer engaging leisure books, older textbooks, and fewer well-qualified teachers willing to teach in these under-resourced areas (151). As such, while education may be the most modifiable SDH, inequalities in the distribution of other SDHs may prevent modification of this essential SDH.

Social and Community Context

As evinced by the discussion of the importance of place in reference to educational facilities and the ability to increase educational attainment, the social and community context can greatly influence and interconnect with other SDHs. This component of SDH includes experiences of discrimination, perception of equity, and the influence of family structure on one’s health (125,148,149). Rather than focusing on one’s physical environment, this component includes a person’s perceptions of their environment, their personal support system, their behavior relative to the social norms of their community, and their connectedness through civic participation, incarceration, and social cohesion are also considered (153). Reduced civic participation by community members, reduced social cohesiveness, and increased incarceration and single parent homes lead to a fractured community; this fracturing negatively affects perceptions of the community as well as health outcomes in the community (68,153). Social
cohesiveness, civic participation, and social capital foster a positive social and community context. These tenets all have a negative relationship with crime, adult and infant mortality rates, and health outcomes, creating a positive impact on the community at large (154). Increasing social cohesiveness through community engagement can increase social capital and trust in the community, a factor that is predictive of community-level mortality (154). Social cohesiveness is threatened by incarceration and discrimination, but is not threatened by ethnic diversity in the absence of these institutions (155). In short, as long as there is no latent social conflict and there are strong social bonds within the community, the community can be socially cohesive regardless of the interpersonal differences within the community (154).

Health and Health Care

The Health and Health Care component of SDH specifically refers to access to and quality of health care services in an area (125). While health care delivery is responsible for only 20% of all health outcomes (156), this component is integral to the overall health of a person, particularly because many people are unaware they are at risk for or have a chronic disease until they are informed by a clinician (102,109,157). However, in a survey of 11 high income countries, the United States ranked last in financial access to care and availability of care outside of regular office hours, with uninsured people reporting excess barriers to care (158). Likewise, lower-income U.S adults are more likely than citizens of other high-income countries to skip a dose of medication, refuse medical tests or doctor visits, or fail to attend follow up care due to cost; at least 30% of lower-income U.S. adults reported financial barriers to care compared with an average of 10% among all other surveyed countries (158). These pervasive barriers to health care prevent lower-income adults from accessing necessary diagnostic care and treatment which may save and prolong their lives, particularly if they have a chronic disease which can be well-
managed after diagnosis (123,130,159). While many health departments offer chronic disease prevention and treatment programs (160), they may not be accessible to the lower-income persons who need them most due to cost, transportation, work schedules, or lack of affordable child care (36,107,137,150).

Neighborhood and Built Environment

The Neighborhood and Built Environment component of SDH includes access to foods that support healthy eating patterns, quality and affordability of housing, crime and violence, and environmental conditions (161). Established communities must constantly evolve to meet the needs of their residents as well as businesses for their health and economic stability. Since many communities were not designed to encourage physical activity but rather to maximize land use, these environments often support unhealthy eating and lack of physical activity (18,147,162,163). Accessibility of healthy foods can influence healthful behavior, with both food deserts and food swamps typically located in low income and urban areas. Food deserts are areas that lack grocery stores or markets with fresh healthy foods, while food swamps are areas with many food options, all of which are fast food options that are low in nutritional density (164). It is estimated that 22% of homes in the United States have major threats to health and safety. Quality, affordable housing further affects health, as substandard housing can lead to respiratory infections, asthma, and mental health issues, particularly in areas of high crime where stress at home can be excessive, negatively affecting overall health (164). Lead poisoning, another common illness associated with older housing, can also hinder one’s ability to improve their socioeconomic status, as exposure to lead paint will result in cognitive delays which prevent academic achievement, limiting a person’s ability to further their education in an endeavor to get out of poverty (164).
Further, perceived home and neighborhood safety, attractiveness, and presence of usable sidewalks and open public spaces have major influences on rates of physical activity even after controlling for sociodemographic variables, suggesting that innovating the built environment would enable greater physical activity, particularly in disadvantaged neighborhoods (147,165). Environmental resources available in one’s neighborhood have a significant influence on rates of physical activity, with perceptions of green space among both men and women linearly related to rates of physical activity among those groups (147). According to the United States Department of Health and Human Services, only 20% of residents live within a half mile of a park or recreation center, though some of these parks are unusable or unsafe due to graffiti, garbage, and poorly maintained equipment or grounds (164). Jennings, et al.(166) concluded that public parks-associated recreational activities are an essential means of increasing physical activity in lower-income and minority neighborhoods and communities, finding that engaging community members in planning of green spaces and activities may increase the level of support, community engagement, and use of the facilities.

One’s neighborhood and built environment can influence health in many ways, ranging from cognitive development to healthful eating and physical activity to pervasive stress resulting from internal and interpersonal conflict (161,164,167). This component requires input from gatekeepers, stakeholders, and community members to facilitate positive change that accurately addresses the needs of the community (150,164). As such, improving one’s environment is likely the most difficult component of SDH to modify, particularly for low-income individuals who may not have the option to relocate to a neighborhood which more positively influences health (164). This component, as with all of the components of SDH, requires an iterative process to
determine the needs of segments of the population experiencing health disparities, to address those needs, and to reassess until those disparities no longer exist (168).

The Intergenerational Cycle of Chronic Disease Risk Factors

As demonstrated by the interrelated nature of the SDHs, improving one’s health prospects can be an arduous process. People with chronic diseases suffer increased morbidity and mortality and decreased quality of life, however these sequelae also impact future generations. Women who are overweight before and during pregnancy are more likely to give birth to overweight infants, who are in turn more likely to be overweight or obese as adults (2,18,112). Additionally, it is estimated that 7% of all pregnancies in the United States result in gestational diabetes, a condition that increases the risk of T2DM later in life (37,113). These risk factors lead to a cyclical, intergenerational continuation of obesity and obesity-related illnesses (37,114,150), particularly in minority populations due to their disproportionate risk for obesity and decreased access to healthful foods and to recreational areas. However, recent research shows that behavioral interventions that include healthy eating and exercise and addressing weight loss and weight management prior to, between, and during pregnancies decrease risk for gestational diabetes (2,112,169,170) and overweight in infants (112) and increases fat free mass and lean mass in infants (170), indicating that the intergenerational effects of obesity and obesity-related disease can be mitigated. Likewise, the preconception and gestational periods are critical points in the transmission of poor health outcomes and risk factors (37,171).

Poverty itself is a risk factor for chronic disease, showing a positive relationship with all types of chronic disease (4,81,112,137–139,171,172). Poverty is related to substandard living conditions (131,150,173), lack of access to quality foods (162,163,174,175) and learning resources (4,151,152), and to obesity and obesity-related illnesses (125,131,162,176). Getting
out of poverty requires a person to overcome a series of intrapersonal, interpersonal, and systemic/institutional barriers to increase his/her education level, access healthful foods and recreational facilities, and overcome race and gender discrimination to achieve professional and personal goals (177). In fact, children who grow up in households in the lowest quintile of family income are more likely than those in all other quintiles to remain in poverty once they reach adulthood. The path out of poverty and to break the cycle of chronic disease is a winding one, requiring both individual motivation and opportunities provided by educational, community-level, and national institutions to enable those who seek greater quality of life and health to be successful in these endeavors (37,171,177).

Community-based Methods/Frameworks for Behavior Change

There are multiple available methods and frameworks for behavior change at the community and individual levels, though some of these frameworks do not account for the additional challenges faced by economically disadvantaged and medically underserved areas (12,13,178).

Collective Impact

Collective Impact framework (CI) is a relatively new framework for community change that consists of three preconditions and five conditions. The preconditions include having influential leaders, a sense of urgency for the issues, and adequate resources to address the issue. The conditions of CI include: a common agenda, shared measurement tools, mutually reinforcing activities, continuous communication, and a backbone support organization, as mentioned above (179–181). These preconditions and conditions are not sequential, but are all required to intersect continuously within a coalition or collaborative to ensure the outcome of a collective impact on the issue being addressed (178–181)
There are a multitude of strengths of CI: CI is highly relevant to most public health issues because they do not occur in a vacuum and require multi-level interventions to create systemic improvements in health. This framework is best suited to multi-faceted, non-linear issues which require the input and expertise of a variety of community partners and leaders (49,180,181). In initiating a CI-structured collaborative, all relevant parties are brought to the table to discuss the dynamics of the collaborative and how to best ascribe to CI throughout this process. It is at this point that the backbone organization is identified by the group. The direction of the initiative and goals of the CI project are data-driven and aim to address an urgent issue (180–182). When a CI collaborative actively and quickly engages leaders, it can expedite the process of making changes in the community, policy, and existing programs, increasing funding for and visibility of an initiative (49,180,181). When each of the preconditions and conditions of CI are applied well, there is a continuous feedback loop among the collaborative which allows it to be responsive to needs and challenges (180–182). Meeting any of the conditions or preconditions increases the likelihood of success and enriches partnerships (179–181), although meeting only some aspects does not create a collective impact (181). This framework has shown great promise, leading to 53 policy changes and positive impacts for over 200,000 households in Canada in less than ten years (181). CI is currently being implemented in Canada and the United States to address the multi-faceted, multi-level issues of poverty and educational attainment, with the outcomes of these programs pending evaluation (49,183).

CI was first introduced in the Stanford Social Innovation Review in 2011 to address the isolated impact of many existing social solutions (179,180). Weaver (181) noted that while the relative newness of this framework is a limitation, the greater limitation is not the structure of the program or the details of the preconditions and conditions, but because of the lack of information
on the best practices for implementing the framework (175,178,184). Though this framework requires a balance of flexibility and responsiveness, Kania and Kramer (179,180) offer no methodology on how to achieve this feat, nor on how to ensure that all partners are equally willing to work toward a goal under the CI (175,181). There is a pervasive lack of strategy in CI, with multiple articles specifically criticizing the lack of advocacy and systems change strategies, particularly when working toward the improved health and social outcomes of marginalized populations (49,175,178,181,184). The authors of CI acknowledge that is can be difficult to engage leaders and often requires making the case that an issue is urgent, especially when a community faces many structural, social, or health-related issues (180,181). Unlike traditional community collaboratives, CI requires that partners have different assets and backgrounds but have the same goal and all partners agree on the methods to reach that goal, simultaneously implementing these methods.

Weaver (181) notes that established collaborators and collaboratives are skeptical of the novelty of CI and are therefore hesitant to change their collaboration practices to adhere with its preconditions and conditions, largely because this framework requires a substantial amount of negotiation of terms of the collaborative, including role, common agenda, and ensuring that there are adequate human and financial resources to implement the agenda. In addition, CI initiatives aim to affect upstream causes of downstream effects which can take at least five years to show an impact (178,181). CI is therefore dependent on long-term, consistent funding sources which cannot be guaranteed by many institutions, particularly grant-dependent non-profits (181). There is also a lack of data on evaluation of CI initiatives, though that body of knowledge will likely continue to grow as more programs based on CI are completed and evaluated (49,178,185). CI fails to acknowledge the contributions of previous literature, operating without regard to
previous theories or frameworks involving coalition-building, community engagement, and community change. CI also imposes shared metrics on the community and has a top-down approach rather than a community-driven approach, decreasing the depth of information collected and the community investment in an initiative (184).

Several of the limitations of or concerns about CI are factors that are not addressed or adequately addressed by CI. Requiring that all entities convene at the beginning to negotiate the terms of their roles a collaborative may be prohibitive to the creation of a collegial relationship between partners (178). CI is predicated on the existence of a backbone organization which guides the agenda and activities rather than on a lateral management structure in which all entities are treated as equally responsible and valuable to the collaborative, as they are in coalition-building (175, 178, 180, 181, 184). CI gives no recommendations on how to approach leaders, how to make the case that an issue is urgent, and no dichotomous key to determine if an issue is multi-faceted enough for CI to be effective and cost-beneficial (175). Perhaps current practitioners would be more amenable to implementing CI if the authors provided strategies for implementation and analogized it to existing frameworks with the explanation of how CI can be compared with current frameworks (175, 184), as Christens and Inzeo (178) sought to do. These researchers argued that CI should not be viewed as all-inclusive and should not be implemented in a vacuum but should be implemented guided by existing knowledge and establish aspects and assets of coalition-building and collaboration (49, 178). The systems-level interventions which CI seeks to achieve should make use of the tools established and validated by literature on coalition-building and collaborations, including social network analysis to understand the effect of social ties on impact of interventions (178). Perhaps the most glaring omission throughout CI is that of advocacy and racial and economic justice. While most frameworks acknowledge and address
marginalization, disenfranchisement, and historical injustices, CI fails to mention it at all (175,184). Beyond that, CI completely excludes residents and constituents of the community and contributions from grassroots stakeholders (175,184). This blatant oversight of fundamental tenets of community change calls into question the integrity of the authors and efficacy of the framework, as these omissions are pervasive social necessities and overlooking them would, in many populations, result in reduced community engagement and meager community improvement (175,184).

Christian Community Development Association

The Christian Community Development framework (CCD) has several tenets that focus on the importance of involving the community in development projects to improve quality of life in a community. While there is a lack of data on the effectiveness of the CCD within or outside of the faith-based community (186), this is likely due to word-of-mouth dissemination of these techniques to faith-based organizations. There are, however, data on faith-based initiatives which use principles of CCD without mentioning the CCD (187,188). The tenets of CCD are relocation, reconciliation, redistribution, leadership development, empowerment, holistic approach, faith-based, and listening to the community.

**Relocation** involves a person or organization actively relocating to the community which that person or organization wants to facilitate change, identifying three types of people living in that community: relocators, returners, and remainers. Relocators are those who are not from the community but who have moved into the community to facilitate change from the inside. Returners are those that left to gain an education or to pursue a career and have returned to be an asset to their neighborhood, while remainers are those who could have left the neighborhood but chose not to leave and intend to better the community in which they live (186,189); CCD makes
no mention of those who did not have a choice in staying in the community or who may not have the resources to or luxury of acting to change their community. The purpose of the relocation tenet is to enable those who can enact change in the community to better understand the needs of the community because of their personal investment in the prosperity of the neighborhood, community, and infrastructure. Residents are intimately aware of the challenges facing their community, so relocation serves as the primary foundation for all other tenets of CCD (189).

The next tenet is **reconciliation**, which consists of bringing all races and cultures in a community together not only by living near one another but also by working toward a common goal. While CCD identifies this goal as worshipping, this goal could be a non-faith-based goal which equally unites and supports the community. The purpose of reconciliation is to build trust in people who may have had negative experiences in the past, to get to know community members in their element, and to know their hopes and concerns in addition to their needs. Finding common ground to connect on a deeper level is a means by which to break down barriers associated with race, ethnicity, and socioeconomic status, to achieve a better outcome for all members of the community.

**Redistribution** is the practical application of relocation and reconciliation; residents, whether relocaters, remainers, or returners, use the information they have learned about the needs and hopes of the community and use the capacity built during reconciliation to create change. A particularly poignant point from CCDA (2009): “justice has been available only to people with the economic means to acquire just treatment.” The populations most at risk for chronic disease and chronic disease risk factor experience have faced discrimination and disenfranchisement for decades, and some have experienced incarceration, poverty, and homelessness (190,191). According to CCD, those in the community who have the power and economic means to bring
about healthy transformation should do so and should empower those without those means to seek to achieve change, too, to continue the process of reconciliation between socioeconomic status levels (189).

A particularly critical tenet which enables sustainability is that of **leadership development**. This involves encouraging young people in the community to develop their leadership skills, to pursue their education, and then to return to the community to share their knowledge for the betterment of the community. The major obstacle to leadership development is that young people in disadvantaged communities tend to believe that, “success is defined as being able to move out of inner-city communities, not remaining there” (189). It is exceedingly difficult to convince people who are suffering from lack of resources and who manage to leave to better their prospects to return to the place of their suffering and to alleviate it for future generations. In other cases, escapism takes the form of drug use, preventing leadership development and success (192). However, research shows that the greater the ratio of adults to children in a community, with the adults serving as role models, the greater the rate of graduation in those communities (167). That study found that this affect was greater among populations with a larger proportion of African-Americans and males, though it was also found that this relation was larger in higher socioeconomic status communities, possibly due to the increased resources in these communities (167). Another study found that over the life course, living in an economically advantaged community has greater benefits for white respondents compared with black respondents (140). Taken together, these studies imply that community support and positive influences can have a greater positive influence than living in an economically advantaged neighborhood, so using that positive influence to encourage young leaders could be markedly beneficial in urban underserved communities.
Many of the tenets of CCD seek to facilitate **empowerment**, which is itself a tri-faceted tenet of CCD. This principle seeks to interject dignity into the community change process, (1) presenting disadvantaged populations with an opportunity to have their needs met while (2) requiring that the person in need also be willing to work for the thing they need. The third facet of this principle is that when the first two conditions are met, a person in need maintains their dignity as opposed to feeling embarrassed or guilty for accepting charity. Further support for requiring some work for a benefit or service comes from the field of marketing, where there is hesitance to refer to products of services as, “free” for fear of devaluing it in the eyes of the consumer (193). CCD also includes a holistic approach to meeting the needs of the community through coalition-building in communities to create multi-faceted solutions to the areas of need identified by the community. This approach is extensive, addressing spiritual, social, economic, political, cultural, emotional, physical, moral, judicial, educational, and familial issues. The needs addressed are those identified by relocaters, remainers, and returners, as well as unclassified residents and stakeholders in the community (189).

The next tenet of CCD is “church-based”, which for the purposes of this dissertation will be addressed as **organization-based,** for greater inclusiveness. The purpose of this principle is to find an organization in which many people participate and to meet them there. In some instances, there may already be a community-formed entity which has a defined mission to improve conditions, such as Neighborhood Watch. What is most emphasized is that these organizations, “should be seen as lovers of their community and neighborhoods,” (189) to build trust, effectively encourage and develop potential leaders, and to address the needs, hopes, and concerns of the community. This reinforces the principles of relocation, empowerment, and reconciliation.
The last tenet of CCD is **listening to the community**, something the USF-REACHUP, Inc., partnership has sought to do from the beginning, but which it could also do in a more systematic and positivity-influenced way. As defined in CCD, this tenet includes asset-based community development (ABCD), which is very similar to appreciative inquiry (AI). Where ABCD refers to “hopes,” AI refers to “dreams,” which might seem abstract to community members until they begin to plan a path to improvement using their own skills and abilities. Community members are asked to name assets in their community and positive change is achieved by building onto these assets based on what the community members want to improve. This allows community members to see themselves and their neighbors as a solution, affirming dignity and encouraging engagement for sustainable improvements.

Community-engaged Research

According to the Centers of Disease Control and Prevention, community engagement is, “the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest, or similar situations to address issues affecting the well-being of those people” (51). Community-engaged research (CER) is not a research methodology but rather is an approach for conducting research designed to mitigate health disparities through community involvement (51,195,196). As such, a CER study may employ qualitative and quantitative methodologies to identify and build upon existing community strengths and assets (51). CER requires partnership development, collaboration with community partners, and a goal of addressing issues pertinent to the community (51,197). These partnerships and collaboratives include the stakeholders from all aspects of health services, including clinical care, public health, community nonprofits, research institutes, and government agencies (197). As such, CER incorporates research and practice, with researchers collaborating, often partnering, with
community organizations and stakeholders to alleviate disparate levels of disease or SDHs negatively impacting a community or population (198). This collaboration and process of networking and fostering relationships and trust is a long-term process but the results can be effective; it is often the community’s perspective and input that can provide the information necessary to ensure that an intervention works or the final piece of a theoretical model (51,197,198).

Due to requirements for community engagement in recent nationally funded studies, there are now internally validated evaluation tools to determine the level of engagement of a community, ensuring that researchers can measure their level of engagement and adjust their methods of outreach accordingly (198). The National Institutes of Health emphasizes the need for translational research such as CER because there is a gap between health research and health practice, resulting in worse health outcomes compared with other industrialized nations (199). However, one study found that community- and university-based researchers thought that community engaged university researchers were uncommon and irregular in the academic setting, were skeptical about the sustainability of university involvement in CER, and were concerned about the role of race/ethnicity, power dynamics, and privilege in research relationships, particularly in disadvantaged populations (195). While CER encompasses a spectrum of community involvement, though the most frequently discussed is that of community-based participatory research (CBPR), which consists of partnership with community members in the design and implementation of the research study (144,195,200). The distinct differences between traditional research, CER, and CBPR can be seen in Table 1.
Table 1. Differences between traditional, community-engaged, and community-based participatory approach

<table>
<thead>
<tr>
<th>Traditional research approach</th>
<th>Community-engaged research</th>
<th>Community-based participatory research approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Researcher defines the problem</td>
<td>Research in the community or with the community</td>
<td>Community identified the problem or works with the researcher to identify the problem</td>
</tr>
<tr>
<td>Research in or on the community</td>
<td>Research with the community</td>
<td>Research with community as full partner</td>
</tr>
<tr>
<td>People as subjects</td>
<td>People as participants</td>
<td>People as participants and collaborators</td>
</tr>
<tr>
<td>Community organizations may assist</td>
<td>Community organizations may help recruit participants &amp; serve on Advisory Board</td>
<td>Community organization are partners with researchers</td>
</tr>
<tr>
<td>Researchers gain skills &amp; knowledge</td>
<td>Researchers gain skills &amp; knowledge, some awareness of helping community develop skills</td>
<td>Researchers &amp; community work together to help build community capacity</td>
</tr>
<tr>
<td>Researchers control process, resources, &amp; data interpretation</td>
<td>Researchers control research, community representatives may help make minor decisions</td>
<td>Researcher &amp; community share control equally</td>
</tr>
<tr>
<td>Researchers own data, control use &amp; dissemination</td>
<td>Researchers own the data &amp; decide how it will be used &amp; disseminated</td>
<td>Data is shared, researchers and community decide its use and dissemination</td>
</tr>
</tbody>
</table>

Adapted from McDonald MA. Practicing Community-Engaged Research. MedEdPORTAL Publications [Internet]. 2008 [cited 2018 Sep 7]; Available from: https://www.mededportal.org/publication/1127

Community-based Participatory Research (CBPR)

CBPR is the most collaborative type of CER, encompassing the highest level of partnership development and community engagement and partnership throughout the planning, design, development, implementation, and evaluation of a research study, specifically in reference to academic-community partnerships (51,196,198,200). Arguably the most important
aspect of CBPR is that it confronts established power dynamics between academic institutions, community organizations, and community members to create a lateral collaborative structure, allowing the community to determine the issue to be addressed, the method via which it will be addressed, and the ideal method of evaluation (50,195,200). Jagosh, et al. (201), assert that trust among partners can lead to a ripple effect of sustaining CBPR partnerships and reaping unanticipated benefits based on the initial goal of the research. In this way, CBPR creates a positive feedback loop which allows researchers and community partners to address the evolving needs of the communities they serve while fostering trust with the community (201).

Evidence-Based Behavior Change Interventions

There are many existing evidence-based behavior change interventions that are implemented widely by local health departments (LHDs) in the United States. Of over 1400 LHDs surveyed (overall response rate of 76%), 57% and 60% currently implement primary prevention programs aimed at chronic disease and physical activity, respectively (21). LHDs serving populations of 50,000 or greater were 13-29% more likely to have these programs compared with LHDs serving smaller populations (21). Diabetes-related programs were the most prevalent, accounting for 240 of the 375 total programs (64%) (160). Public health practitioners have sought to lessen chronic disease risk factors in high risk populations, including disadvantaged populations, through programs addressing diabetes-related risk factors, obesity, physical activity, nutrition, and tobacco use with some success (6,25,39,110). These programs are detailed in Table 2.

The national Diabetes Prevention Program (nDPP) was the most prevalent single program presented by LHDs in the United States (21). While diabetes self-management education (DSME) programs do not prevent diabetes, though they do seek to prevent cardiovascular, microvascular, and macrovascular complications which may be related to diabetes or the risk
factors associated with the development of diabetes (108). DSME programs also decrease hospital admissions and readmissions, reducing the overall cost of diabetes (108). Worksite wellness interventions for obesity are also quite prevalent (83% of LHDs), though this included any type of worksite wellness program without consideration of rigor or available resources. Social support and access to physical activity locations were the most abundant physical activity interventions, though only one-third of LHDs reported delivering these programs directly. Of note, just 44% of LHDs reported using technology as part of any evidence-based intervention (160). The nDPP is a 16-week intensive program which seeks to increase physical activity, decrease consumption of non-nutritionally dense foods, and increase overall self-care to reduce the risk of diabetes and heart disease, usually in prediabetic populations (59). This method of addressing multiple health behaviors concurrently is effective in achieving and sustaining behavior change (136,202). The nDPP has been delivered via multiple delivery mechanisms and is effective in each: traditional in-person delivery, e-delivery, conference call delivery, text message delivery, and smartphone application-based delivery (24).

Delivery Mechanisms for Behavior Change Interventions

Traditional Delivery

The efficacy of the nDPP is evinced by randomized clinical trials; its effectiveness was demonstrated many times over through community translations of the program (22,23,26). However, one study that translated the nDPP from the clinical setting to a medically underserved area included very few minorities (26), and most other studies translating this program faced similar issues regarding generalizability (6,22,25,203). Another study found that while the nDPP is effective in reducing weight and BMI in white and Hispanics, African-Americans, in
Table 2. Evidence-based interventions delivered by local health departments (LHDs) directly or in collaboration with a partner organization

<table>
<thead>
<tr>
<th>Risk factor addressed</th>
<th>Program</th>
<th>% of LHDs Delivering</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes-related</td>
<td>national Diabetes Prevention Program</td>
<td>82%</td>
<td>The nDPP or diet and physical activity promotion program with people at increased risk for T2DM</td>
</tr>
<tr>
<td>(n=240)</td>
<td>Community Health Workers (CHWs)</td>
<td>60%</td>
<td>CHWs deliver information on diet, physical activity promotion, and weight management to groups or individuals at increased risk for T2DM</td>
</tr>
<tr>
<td></td>
<td>DSME</td>
<td>82%</td>
<td>Diabetes Self-Management Education (DSME) with persons with diabetes delivered in community gathering places</td>
</tr>
<tr>
<td></td>
<td>Identify and Treat</td>
<td>66%</td>
<td>Diabetes management: Identifying patients with diabetes and determining effective treatment</td>
</tr>
<tr>
<td>Obesity (n=24)</td>
<td>Worksite Wellness</td>
<td>83%</td>
<td>All types of worksite programs, policies, or environmental changes to support nutrition/healthy food and physical activity</td>
</tr>
<tr>
<td></td>
<td>Reduce Screen Time</td>
<td>40%</td>
<td>Behavioral interventions to reduce screen time among children OR reduce screen time plus increase physical activity/healthy eating</td>
</tr>
<tr>
<td></td>
<td>Multicomponent with Technology</td>
<td>44%</td>
<td>Multicomponent interventions with coaching that uses technology to communicate with individuals or groups to help them lose or maintain weight (including pedometers and social media)</td>
</tr>
<tr>
<td></td>
<td>Screen and Manage</td>
<td>43%</td>
<td>Obesity screening and management: screening adults and referring patient with a body mass index (BMI) of 30kg/m2 or higher to behavioral interventions</td>
</tr>
<tr>
<td>Physical Activity (PA)</td>
<td>(n=31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social Support</td>
<td>80%</td>
<td>Programs that set up social support for physical activity (walking groups, buddy systems)</td>
</tr>
<tr>
<td></td>
<td>Safer Streets</td>
<td>70%</td>
<td>Programs, policies, or environmental changes to make streets safer for pedestrians and cyclists</td>
</tr>
<tr>
<td></td>
<td>Access to PA Places</td>
<td>83%</td>
<td>Programs or policies that create or improve access to places for physical activity</td>
</tr>
</tbody>
</table>
Table 2 (Continued)

<table>
<thead>
<tr>
<th>Nutrition (n=38)</th>
<th>Schools</th>
<th>70%</th>
<th>Programs or policies that increase physical activity in schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access</td>
<td>86%</td>
<td>Policies or environmental changes to improve access to healthy foods in worksites, schools, or other local facilities (changing cafeteria options, vending machine content)</td>
<td></td>
</tr>
<tr>
<td>Food Assistance</td>
<td>83%</td>
<td>Policies or changes that improve healthier food choices through nutrition assistance programs (WIC, SNAP)</td>
<td></td>
</tr>
<tr>
<td>School Gardens</td>
<td>58%</td>
<td>School gardens that allow students to garden during school or non-school hours with school staff guidance</td>
<td></td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>89%</td>
<td>Policies, environmental changes, or programs promoting breastfeeding initiation, exclusive breastfeeding, and duration of breastfeeding</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tobacco (n=42)</th>
<th>Provider Reminders</th>
<th>83%</th>
<th>Reminders for clinic healthcare providers to discuss tobacco/nicotine cessation with clients (chart stickers, medical record check lists)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quitline</td>
<td>82%</td>
<td>Mass health communication with cessation messages AND quitline number</td>
<td></td>
</tr>
<tr>
<td>Indoor Air</td>
<td>79%</td>
<td>Public education about clean indoor air policies or the expansion of these policies</td>
<td></td>
</tr>
<tr>
<td>Price Education</td>
<td>66%</td>
<td>Public education about the effects of tobacco unit price on preventing and reducing tobacco consumption</td>
<td></td>
</tr>
</tbody>
</table>

particular, African-American females, lost less weight and did not retain their weight loss compared with all other race-gender pairs (7). Research suggests that barriers to healthcare including lack of time, lack of transportation, lack of paid time off, and cost of participation, may be responsible for this decreased effectiveness (6,26,40,204). To overcome these obstacles, many researchers have translated the nDPP to technology-based interventions with varying levels of success (24,205). The most successful interventions were those that sought meaningful engagement from participants rather than simply completion of modules or lessons using more traditional didactic methods (24,32). Likewise, in-person components of behavior change programs significantly impact the success of behavior change programs, creating accountability, social support, and allowing for tailored feedback to and from participants (206).

Telephone-based Delivery

Telephonically delivered interventions became increasingly popular since the 1990s, particularly when the intervention being delivered is theory-driven (207). However, unless the telephone-based intervention is proactive, such as in the case of scheduled conference calls, they do not necessarily reach the intended audience, especially if that audience was an underserved population (207). A meta-analysis found that telephone delivery was most effective when it was individual rather than group counseling and when telephone interventions were combined with a web-based supplement (24).

Text Message Delivery

Text message delivery of programs is usually used in conjunction with other intervention delivery mechanisms (24). While text message-based weight loss (208), diabetes self-care (209), and physical activity (210) interventions showed no significant effect on behavior beyond one week, a binge drinking study found that the text message-based intervention reduced alcohol
consumption and alcohol-related injury for up to six months following the program (211). Likewise, a smoking cessation intervention found that persons receiving text messages were 36% more likely to quit smoking compared with a control group (132). A meta-analysis of text message-based interventions found that these interventions have the potential to increase preventive health behaviors, finding that interventions with supplementary intervention components and those lasting six to twelve months were most effective (212). Similarly, Bian, et al. (24), found that a study combining text messages with emails and a mobile app were 36 times more effective compared with an nDPP-based intervention communicated solely via text message. Given these findings, there seems to be consensus in the literature that text message campaigns alone are not as effective as when they are combined with another intervention delivery mechanism.

E-delivery

Web-based or E-delivery of behavior change programs has become more common with increased internet and computer access (24,206,213). A comparison of the results of a program which sought to increase exercise, nutrition, asthma, healthcare access, weight loss, and improved body shape perception that was delivered via web-based and non-web-based delivery mechanisms showed that persons in the web-based delivery were more likely to meet the outcomes for improvement than those in the non-web-based delivery (214). Another study found that web-based programs that used theory, multiple behavior change techniques, and encouraged meaningful engagement with and among participants were more likely to be successful (213). Santarossa et al. (206), suggest that this engagement should at least partially consist of face-to-face interactions with behavior change coaches or advocates to maximize personal investment and to establish accountability, social support, and enable participants to give feedback on the
program in an informal way. As such, a video conferencing-based delivery of the NDPP was highly effective, likely due to the accountability created by the internet-based support system (24).

Smartphone applications

A recent study of smartphone apps to manage blood glucose in persons with T2DM showed a 0.5% decline in blood glucose, though there is no existing data on how smartphone apps affect blood glucose or other diabetic indicators among prediabetics or persons with other risk factors for chronic disease (215). Noom, an existing and trending smartphone application, is based on the national Diabetes Prevention Program (nDPP) and is recognized by the CDC because of its effectiveness in meeting weight reduction goals with comparable success to the nDPP (216). A study published in 2016 found that Noom users’ frequency of reporting their dinner was the most important predictor of weight loss and more frequent self-reporting of weight reduced the likelihood that participants regained the weight(217). A 2018 retrospective cohort study of Noom outcomes found that greater engagement with the application was associated with greater percentage of weight lost and 80% of the sample completed 9 or more lessons (218). However, each of these studies neglected to evaluate the effect of race/ethnicity, education level, or socioeconomic status on weight loss and the 2018 study was only able to obtain complete information on 43 individuals, who were likely systematically different from the 93 participants who either declined to participate or were lost to follow up throughout the study.

Social Media Delivery

Social media are additional mechanisms through which social support can be created and fostered (219). Social media use is increasing widely, with meta-analyses showing that positive effects on primary outcomes increase with the use of social media in addition to or rather than
traditional intervention delivery methods (206). While a smoking cessation intervention found that participants consumed one less cigarette for every interaction with the Facebook page (32), there is an overall lack of evidence to determine the effectiveness and degree of effectiveness of social media for behavior change (27,206). However, social media-based interventions are low cost and highly scalable, though they require intensive privacy awareness and risk privacy breaches (219).

Adding to its appeal, social media is readily available to most adults in the United States. Despite financial barriers and income disparities, 95% of adults own a cellphone and 77% of adults have a smartphone, making app-based health programs accessible to over three-fourths of the adult population (30). Prior to the introduction of Noom, a social media platform called Prevent was created to test the effectiveness of a social media-based delivery of the nDPP. However, this platform was not integrated into an existing social media platform, requiring current social media users to create a new profile and log into this platform separately. An efficacy evaluation of Prevent showed that participants on average did not meet the nDPP’s goal of 7% weight loss, but they did lose and sustain a weight loss of 5%. Following the Prevent efficacy study, the delivery mechanism was modernized, revamped, and marketed as Noom. While the mechanisms of Noom and Prevent are not very different, their purposes are: Prevent sought to create a social media platform around the nDPP program while Noom sought to encourage positive behavior change via a moderately interactive, education-based smartphone application. This difference in communicated purpose and the type of people accessing each of these programs may account for Noom’s increased success compared with Prevent. While the purposes and presentations of these programs differed, the content and implementation of these programs did not differ substantially (216,217).
While Prevent was not as successful as the traditional delivery, its results were encouraging (220). Prevent researchers collected no information on participant satisfaction or suggested improvements, but one can conclude that the ability to include one’s existing support system in a new healthy behavior change can positively affect health outcomes (125,153). To do this, a popular existing social media platform could be used to deliver the program, increase participation, and improve participant engagement (29,219,221).

As of 2016, 79% of all online adults and 68% of American adults used Facebook. Data from 2014 showed that of internet users who used Facebook, 71% were non-Hispanic whites, 73% were Hispanic, and 67% were non-Hispanic blacks indicating that usage of the platform is prevalent among all internet users, independent of race (18, 19). Users log into Facebook at least daily and spend 40 minutes/day on this platform (219), allowing ample time for content delivery and participation in a social media-based intervention. Despite the apparent availability of smartphones and social media access, African American adults continue to be underrepresented in health and mobile health (mHealth) research. One study sought to examine this discrepancy, finding that 71% of African Americans own a smartphone and 62% were willing to participate in mHealth research studies. Facebook was identified as the best social media venue through which to deliver a CDPP because most people have a Facebook account, though participants said that person-to-person recruitment techniques are most desirable to build trust, ideally through churches or other trusted community centers (223).

Evaluation of Behavior Change Programs’ Feasibility and Acceptability

Previous studies have examined the feasibility and acceptability of alternate delivery mechanisms for behavior change programs, here defined as programs that use at least one delivery mechanism that is not in-person content delivery. Feasibility assessment is defined
broadly as all logistical preliminary trial work that leads to the development of a clinical trial or pilot (224). Acceptability in behavior change programs refers to how positively participants in a program view the program based on delivery and outcomes (225). Acceptability and feasibility are most often assessed prior to the implementation of a full pilot program assessing effectiveness (225). These studies do not need to extend as long as a full pilot study; they need only extend long enough for participants to form opinions of the program and content and for study staff to experience challenges associated with the program (226). These studies focus on identifying participation bias and include a qualitative assessment of participants’ perceptions of the program.

When comparing a 12-week in-person weight loss program to an e-mail-based delivery of the same content and using weekly participation as a measure of feasibility, Garcia, et al. (227), found that 60.1% of e-mail-based participants actively participated each week and had comparable weight loss results to an in-person 12 week weight loss program; these results are similar to other electronic-based weight loss programs (228,229). A computer-adapted positive health behavior change program for pregnant women examined recruitment and perceptions of their program as elements of feasibility analyses. This study exceeded recruitment goals and showed improvements in smoking cessation, stress management, and fruit and vegetable consumption over the abbreviated duration of the study. Ninety-two percent of participants said that they would recommend the self-directed program to a friend, indicating high acceptability (225). Another 12-week study which compared persons using a food intake monitoring smartphone application to those using the application and getting feedback related to the entries as well as those using the application, getting feedback, and attending 3 in-person educational sessions. In that study, the participants had similar adherence in using the food intake monitoring
smartphone application (55-65%) and mean retention (74%) did not vary between groups. Self-efficacy was also assessed as a measure of feasibility; only the group using solely the app made statistically significant improvements over the course of this abbreviated study (230).

Social Media-based Feasibility and Acceptability

There is a limited amount of data on the feasibility of social network-based behavior change interventions, though these interventions have become more prevalent in recent years. A Twitter-based, 12-week weight loss program showed that 67% of depressed participants found the Twitter-based program helpful; 100% of non-depressed regular social media users found it helpful; and 90% of a group who received a full weight loss program via Twitter found the program helpful (231). Of note, researchers in that study concluded that social media-based interventions were most successful among those who regularly use social media. An Australian efficacy, engagement, and feasibility study of a Facebook-based intervention which aimed to increase physical activity found high levels of engagement with the intervention and self-monitoring, though increased physical activity did not persist to the 20 week follow up (232). A Facebook-based smoking cessation program was more successful, with 82% and 72% retention at 6 and 12 months, respectively, and 71% of participants willing to recommend the program to others. Over a third of participants reduced cigarette consumption by at least 50% and 61% commented on posts throughout the program, indicating meaningful engagement. Those who were abstinent at 3 months and those who received monetary incentives for their participation were more likely to engage in the Facebook group (133).

Another Facebook- and text message-based intervention aimed at increasing weekly physical activity among African American women assessed feasibility and acceptability via satisfaction surveys, finding that the culturally tailored Facebook intervention was viewed more
positively than the print-only intervention, with 94% of Facebook participants reporting that they are motivated to be physically active compared with 7% of the print-only group (208). Several of the published studies of social media-based behavior change interventions are more focused on proving effectiveness or efficacy than establishing feasibility and acceptability in a systematic manner. Even the single study which focused on African American women of childbearing age only assessed acceptability via a satisfaction survey and did not actively solicit qualitative feedback on the program (208).

Since social media-delivered behavior change interventions are an emerging intervention delivery mechanism, there are no standard areas for measuring feasibility and acceptability, though existing social media-based program results are structured similarly to their in-person and electronically-based counterparts. Pagoto, et al., have proposed reporting guidelines for social media-delivered interventions for future use (Table 3(27)).

Methods of Targeting Interventions

Since addressing multiple behavior changes concurrently can result in long-term adherence to positive health behavior recommendations (136,202), the next step is to determine which behavior changes a community would most benefit from these programs based on need. Types of intervention targeting include social network-based (233), geographically-based (234), and agent-based targeting (235).

Social Network-based Targeting

Social network-based targeting of health behavior change interventions is a newer and more cost-effective form of intervention targeting, working with the natural diffusion of innovations of novel programs using word of mouth (236). This method does not refer
<table>
<thead>
<tr>
<th>Intervention/Participant characteristics</th>
<th>Reporting guidelines</th>
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<tbody>
<tr>
<td><strong>Intervention in general</strong></td>
<td></td>
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<tr>
<td>Type (ie, host, user, or host and user</td>
<td>Is the social network</td>
</tr>
<tr>
<td>generated)</td>
<td>content intended to</td>
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<td>be host generated,</td>
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<td>user generated, or</td>
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<td>host and user</td>
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<td>generated?</td>
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<tr>
<td>Primary modality</td>
<td>Is the social network</td>
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<td>the primary intervention</td>
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<td></td>
<td>modality or adjunctive?</td>
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<tr>
<td>Purpose of social network site</td>
<td>What is the purpose of</td>
</tr>
<tr>
<td></td>
<td>the social network?</td>
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<tr>
<td><strong>Participants</strong></td>
<td></td>
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<tr>
<td>Experience with social media</td>
<td>What is the social media experience level of participants? Current users? Nonusers? Expert users?</td>
</tr>
<tr>
<td><strong>Intervention content</strong></td>
<td></td>
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<tr>
<td>Post frequency</td>
<td>How often will posts</td>
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<td>be made by the</td>
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<tr>
<td></td>
<td>interventionists?</td>
</tr>
<tr>
<td>Content</td>
<td>What is the content</td>
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<td></td>
<td>of the posts?</td>
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<tr>
<td>Microcounseling</td>
<td>Will interventionists</td>
</tr>
<tr>
<td></td>
<td>be providing counseling?</td>
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<tr>
<td>Automation</td>
<td>Will posts be</td>
</tr>
<tr>
<td></td>
<td>automated? If so, how</td>
</tr>
<tr>
<td></td>
<td>many? When?</td>
</tr>
<tr>
<td>Chats</td>
<td>Will moderated chats</td>
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<td></td>
<td>be held? If so, how</td>
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<td></td>
<td>often?</td>
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<tr>
<td><strong>Participant engagement metrics</strong></td>
<td></td>
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<tr>
<td>Likes/favorites</td>
<td>How many likes did</td>
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<td>each post get? On</td>
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<td>average, what</td>
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<td>percentage of posts</td>
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<td>did each participant</td>
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<td>like?</td>
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<td>Replies/comments</td>
<td>How many replies did</td>
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<td>each post get? On</td>
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<td>average, what</td>
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<td>percentage of posts</td>
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<td></td>
<td>did each participant</td>
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<td></td>
<td>reply to?</td>
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<tr>
<td>Original posts</td>
<td>How many original</td>
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<td></td>
<td>posts did participants</td>
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<td></td>
<td>make? On average, how</td>
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<td></td>
<td>many original posts</td>
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<td></td>
<td>did each participant</td>
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<td></td>
<td>make?</td>
</tr>
<tr>
<td><strong>Intervention fidelity</strong></td>
<td></td>
</tr>
<tr>
<td>Page membership</td>
<td>What percentage of</td>
</tr>
<tr>
<td></td>
<td>participants actually</td>
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<tr>
<td></td>
<td>joined the group/page/</td>
</tr>
<tr>
<td></td>
<td>community?</td>
</tr>
<tr>
<td>Posts</td>
<td>What percentage of</td>
</tr>
<tr>
<td></td>
<td>planned posts were</td>
</tr>
<tr>
<td></td>
<td>actually posted?</td>
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<tr>
<td>Views</td>
<td>How many views did</td>
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<td></td>
<td>each post get? On</td>
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<td></td>
<td>average, what</td>
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<td></td>
<td>percentage of posts</td>
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<td></td>
<td>did each participant</td>
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<td></td>
<td>view?</td>
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<tr>
<td>Interventionist log-in frequency</td>
<td>How often did the</td>
</tr>
<tr>
<td></td>
<td>interventionist log in?</td>
</tr>
<tr>
<td>Interventionist likes</td>
<td>What percentage of</td>
</tr>
<tr>
<td></td>
<td>participant posts/comments did the interventionist like?</td>
</tr>
</tbody>
</table>
Table 3 (Continued)

<table>
<thead>
<tr>
<th>Interventionist replies/comments</th>
<th>What percentage of participant posts/comments did the interventionist reply or comment on?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retention</strong></td>
<td></td>
</tr>
<tr>
<td>Group membership retention</td>
<td>How many participants exited the group before the intervention ended?</td>
</tr>
<tr>
<td>Viewership</td>
<td>How many participants stopped viewing posts before the end of the intervention? At what point in the intervention?</td>
</tr>
<tr>
<td>Attrition</td>
<td>How many participants did not attend follow-up visits?</td>
</tr>
</tbody>
</table>

exclusively to the use of social media, though that is another mechanism through which to increase awareness of a program in a social network. Rather, this method encourages participants in an intervention to talk with their friends and acquaintances about the intervention, increasing participation in preventive health behaviors by as much as 12% compared with targeting an intervention to a random sample of people (233,236). Critics of social network-based intervention targeting assert that this method is time consuming and costly, as it requires knowledge of how a population is interrelated and how they interact prior to identifying well-connected persons to diffuse the intervention throughout the population (235). Similarly, social network data can be difficult to collect, though there is software available to assess social network structure via social media or individually-collected data (233).

Geographically-based Targeting

Geographically-based targeting includes the targeting of interventions based on geographic areas that have a high prevalence of risk factors or incidence of disease. These interventions typically address a common environmental exposure, including the built environment as an exposure (234). However, this method of targeting is most useful when between-area variability in incidence/prevalence is high and within-area variability is small, making small areas, particularly sub-county areas, ideal for this method of health intervention targeting (234,237).

Agent-based Targeting

Agent-based targeting involves the use of simulations of actual dynamic patterns of human adaptive behavior, modeling and capturing emergent behavior at the population level. This allows public health practitioners to determine the potential impact of an intervention given a limited amount of resources, established efficacy, and cost per person. This modeling approach
allows researchers, policymakers, and decisionmakers to determine the population in which
resources would make the greatest impact rather than exclusively selecting persons based on
their location, risk factor, or random selection (235).

Consolidated Conceptual Framework

The conceptual framework of these dissertative projects are based on elements of three
existing frameworks: the Conceptual Framework for Action on the Social Determinants of
Health, the Health Belief Model, and the Christian Community Development Framework. The
framework is further informed by the Social Cognitive Theory (SCT) of human behavior.

Conceptual Framework for Action on Social Determinants of Health (CSDH)

The World Health Organization (WHO; (149) defined the social determinants of health
(SDH) as “the conditions in which people are born, grow, live, work, and age,” further stating
that inequality in SDH is the root cause of health inequity. While WHO’s conclusion was
targeted toward global health inequity, this conclusion also holds for domestic health inequity.
The CSDH was developed based on existing theories of the effect of society on health, including
psychosocial approaches, eco-social frameworks, and the social production of disease and the
political economy of health (238). CSDH (Figure 2) acknowledges that many factors affecting
health are clustered at the individual level and result from long causal chains. This framework
explicated how social, economic, and political entities and policies influence one’s
socioeconomic status which further influences health status through differing risk experiences by
social status, environment, and occupation (238). One’s health state can likewise influence their
ability to gain education or advance in an occupational field, creating a negative feedback loop
which can enable an intergenerational cycle of poverty and illness. As such, policies should be
created to address determinants of health inequities in addition to addressing the determinants of
health (238). The upstream or macro-level determinants of health, socioeconomic factors, intermediary determinants, and overall impact of SDH are therefore included in the conceptual framework for these dissertative projects.

Figure 2. Final Form of the CSDH Conceptual Framework


Health Belief Model (HBM)

Many people with chronic diseases (CDs) or CD risk factors have a fatalistic perspective of CDs, meaning that they believe that there is no way to prevent CD, especially if close family members have CDs (2,130). The Health Belief Model (Figure 3) is a behavioral framework
which asserts that behavior change is most likely to be achieved when a program or intervention addresses perceived barriers, perceived benefits, self-efficacy, and threat to a person’s wellbeing (43). As such, this dissertative study will also incorporate the Health Belief Model (HBM) into the conceptual framework, as each of the projects will seek to understand the health beliefs and barriers to care of the target population, communicating the benefits of healthy behaviors for the target population and subsequent generations, and increasing the target population’s self-efficacy to participate in healthy behaviors through mental and physical empowerment exercises. A review of HBM found that perceived barriers and perceived susceptibility were the strongest predictors of preventive health behaviors. This evinces the need to address barriers and susceptibility to diseases of interest in a population of interest, first by identifying barriers and perceived health beliefs regarding chronic diseases. Once these aspects are explicated, programs and interventions can appropriately address and overcome barriers and mitigate incongruencies in perceived and actual susceptibility to chronic disease in the population of interest (239).

These dissertative projects will assess health beliefs, perceived benefits and susceptibility, and cues to action to prevent chronic disease via a qualitative study. These results will then inform a tailored intervention that will be designed to overcome identified barriers and to close the gap between perceived and actual susceptibility to and severity of chronic disease.

Christian Community Development Framework (CCD)

The CCD, fully explained earlier in this chapter, has 8 core elements, several of which inform the conceptual framework for these dissertative projects (186). CCD emphasizes the importance of the community creating its own leaders via relocation and empowerment. These projects will therefore recruit leaders living in economically disadvantaged areas of Tampa and
will seek to empower research participants to not only achieve positive health behavior change but also to advocate for themselves and their communities. The existing and emerging leaders can then inform the direction of these research projects as well as work with city and county level officials to improve health resources and outcomes in their communities.

Theoretical Foundation

While there are many evidence-based individual- and population-level behavior change theories (Table 4), the theoretical foundation for these dissertative projects is Social Cognitive Theory (SCT). This theory encompasses many of the concepts/constructs of several other
theories and is also the theoretical foundation for the evidence-based national Diabetes Prevention Program (59). SCT focuses on a person’s autonomy to shape their future, increasing self-efficacy to participate in preventive health behaviors with consideration of how a person’s physical and social environment, their own learned experiences, and their behavior interact with one another (reciprocal determinism; (40,44)). SCT also asserts that a person can achieve behavioral capability, which fosters self-efficacy, through observing another person completing the desired/recommended behavior (observational learning). This observation included what a person can expect from performing the behavior, including risk and benefits. Realistic expectations increase the likelihood that behavior change will be successful and sustained. Positive and negative reinforcements are the final component of SCT. A successful program would ideally challenge participants to identify negative reinforcements and how to overcome them. Likewise, participants would be asked to identify and perhaps create positive reinforcements to encourage them to continue their positive behavior change and progress toward their long-term fitness or health goal (44).

Summary and Conclusions

While the etiology of the top chronic diseases in the United States differ widely, their risk factors are similar. Unbalanced diets, lack of physical activity, increased stress, and tobacco use lead to or exacerbate all of the major chronic diseases (2,74,92,93,109,114,129). As such, a behavioral intervention that addresses multiple risk factors would likely be more effective than an intervention addressing just one risk factor (136,202). The national Diabetes Prevention Program (nDPP) addresses diet, physical activity, and stress management, making it an ideal
<table>
<thead>
<tr>
<th>Theory</th>
<th>Concepts/Constructs/Stages</th>
<th>Summary</th>
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</thead>
<tbody>
<tr>
<td><strong>Individual Level Theories</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Precaution Adoption Process Model</strong></td>
<td>Stage 1: Unaware of Issue</td>
<td>A person’s awareness, understanding, and engagement in a health issue are factors affecting the decision to act to prevent or treat a health issue, all of which should be influence by public health or medical practitioners.</td>
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<td></td>
<td>Stage 2: Unengaged by Issue</td>
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<td>Stage 3: Deciding about acting</td>
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<td></td>
<td>Stage 4: Decided not to act</td>
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<td>Stage 5: Decided to act</td>
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<td></td>
<td>Stage 6: Acting</td>
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<tr>
<td></td>
<td>Stage 7: Maintenance</td>
<td></td>
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<tr>
<td><strong>Health Belief Model</strong>(40,43)</td>
<td>Perceived susceptibility</td>
<td>“… addresses the individual’s perceptions of the threat posed by a health problem (susceptibility, severity), the benefits of avoiding the threat, and factors influencing the decision to act (barriers, cues to action, and self-efficacy).”</td>
</tr>
<tr>
<td></td>
<td>Perceived severity</td>
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<td>Perceived benefits</td>
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<td>Perceived barriers</td>
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<td></td>
<td>Cues to action</td>
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<td></td>
<td>Self-efficacy</td>
<td></td>
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<tr>
<td><strong>Transtheoretical Model</strong>(40–42)</td>
<td>Pre-contemplation</td>
<td>“… posits that individuals move through six stages of change: precontemplation, contemplation, preparation, action, maintenance, and termination.”</td>
</tr>
<tr>
<td></td>
<td>Contemplation</td>
<td></td>
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<td></td>
<td>Preparation</td>
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<td></td>
<td>Action</td>
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<td></td>
<td>Maintenance</td>
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<td></td>
<td>(Termination)</td>
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<td></td>
<td></td>
<td>*Termination was not part of the original model and is less often used in application of stages of change for health-related behaviors.</td>
</tr>
</tbody>
</table>
| **Social Cognitive Theory** | Self-efficacy  
Behavioral capability  
Reciprocal determinism  
Observational learning  
Reinforcements  
Expectations | “…describes the influence of individual experiences, the actions of others, and environmental factors on individual health behaviors.” |
|---------------------------|--------------------------------------------------|
| **Theory of Reasoned Action/Theory of Planned Behavior** | Behavioral intention  
Attitude  
Subjective norm  
Perceived behavioral control | “…suggest that a person's health behavior is determined by their intention to perform a behavior. A person's intention to perform a behavior (behavioral intention) is predicted by 1) a person's attitude toward the behavior, and 2) subjective norms regarding the behavior.” |
| **Community Organization and Other Participatory Models** | Empowerment  
Community capacity  
Participation  
Relevance  
Issue selection  
Critical consciousness | Community groups are helped by researchers or outside organizers “to identify common problems, mobilize resources, and develop and implement strategies to reach collective goals” (40). |
| **Socio-ecological Model** | Intrapersonal factors  
Interpersonal factors  
Institutional/Organizational factors  
Community factors  
Public policy factors | “…the interaction between, and interdependence of, factors within and across all levels of a health problem. It highlights people’s interactions with their physical and sociocultural environments” |
Table 4. (Continued)

| **Diffusion of Innovations Theory** | **Innovation**<br>Communication channels<br>Social system<br>Time | **Theory addressing how new ideas, interventions, and behavioral participant spread through the population or from one population to another.** |

program to be tailored to prevent chronic disease, particularly in economically disadvantaged areas, where there is a pervasive lack of recreational physical activity resources (147,163,171) and poor access to fresh produce (18,162,163,175). Geographically-based targeting of such an intervention is acceptable if small area estimates of incidence and/or prevalence are available (234), so a tailored nDPP-based program may be feasible if targeted at the zip code or census tract level.

To ensure that a tailored nDPP-based intervention adequately addresses the needs of a community, researchers must first determine the health behaviors, beliefs, and concerns of the targeted community and explore the current methods of health information delivery. Once this community description is established, the nDPP can be tailored to address the identified health needs via a delivery mechanism that is accessible to persons in the disadvantaged area being studied. Further, to effectively target such an intervention, urban areas with high levels of chronic disease risk factors and impaired access to preventive healthcare in Florida must be identified. These areas could then be targeted for tailored, culturally relevant chronic disease risk factor prevention and reduction programs to positively influence the health or women of reproductive age as well as their children (19,145). This systematic improvement in health of women, infants, and children can contribute to a disruption in the intergenerational cycle of chronic diseases and their risk factors (37,171,240).
CHAPTER 3: METHODS

Over two-thirds of Americans are overweight or obese, contributing to increased rates of obesity-related diseases such as diabetes, hypertension, and heart disease; rates vary widely by race/ethnic groups due to differences in dietary and exercise patterns (241). Successful completion of the national Diabetes Prevention Program (nDPP) showed increased quality of life and decreased chronic disease (CD) burden lasting at least 15 years (39). While some CD prevention programs, such as the nDPP (5–7), effectively reduce CD risk factors, they have targeted middle-aged to senior adults, and have yet to consistently recruit a meaningful amount of participants of minority background and low socioeconomic status due to barriers to access (23,24,39,110,242), partially because the nDPP does not address cultural/ethnic or generational differences.

More than one-third of Florida women of childbearing age have pre-diabetes, diabetes, are overweight or obese (111). A mother’s weight up to the midpoint of gestation affects infant weight gain (243), and overweight newborns are 1.3 to 9 times more likely to be obese later in life (244). Evidence-based weight and chronic disease risk reduction programs which are effective in non-pregnant persons are less effective for women of minority background and, in particular for African-American women, who lose statistically significantly less weight and do not maintain weight loss compared with all other race-gender pairs (7,146). Likewise, African American women have higher average BMIs compared with white women and African American women are 3 to 4 times more likely to die of pregnancy complications compared with white women (11). In federally qualified disadvantaged zip codes in west Central Florida, 75%
of women reported at least one chronic condition (245). These zip codes have a demographic composition of 52% black, 39% white, and 36% Hispanic ethnicity (17). Since obesity is an underlying condition of many CD, this cycle of overweight minority women giving birth to overweight infants who are then more likely to be obese later in life creates a high-risk population across the lifespan (37). Addressing obesity and other risk factors for chronic disease can break this cycle, improving the health of mothers, infants, and families.

To reach minority women of childbearing age, chronic disease risk reduction and prevention programs must utilize the communication channels favored by this target population. As of 2016, 79% of all online adults and 68% of Americans used Facebook, with women representing higher global usage rates than men (83% vs 75%) (246). Data from 2014 showed that 71% of non-Hispanic whites, 73% of Hispanic individuals, and 67% of non-Hispanic blacks used Facebook regularly, indicating that usage of the platform is prevalent among all internet users, independent of race (222). These data indicate that a Facebook-based chronic disease risk reduction program could effectively reach minority adults of childbearing age.

Web-, text message-, and teleconference-based adaptations of the nDPP demonstrate modest success, though there are no adaptations using an existing social media platform as a delivery mechanism and many have not targeted adults of childbearing age who are forming their own and their children’s dietary and exercise habits (24,205). One app-based nDPP adaptation (220) achieved the quantitative goals of the nDPP and reached a younger audience; however, it required the use of a new social network and is not covered by insurance, making it inaccessible to socioeconomically disadvantaged populations. Published research shows that all race/ethnic groups access Facebook at similar rates therefore it has the capacity to serve as a program delivery mechanism to reach disadvantaged communities which have previously been
inaccessible to CD prevention programs (24,27,32,220). While smartphone application- and web-based CD prevention programs exist, little research exists on the acceptability, feasibility, and effectiveness of integrating such a program into Facebook for current Facebook users.

The overall goal of this research was to determine effective methods for mitigating chronic disease risk factors in minority mothers of childbearing age. Project 1 addressed the lack of community-specific information available to tailor an evidence-based program to meet the needs of the federally qualified disadvantaged zip codes in Tampa. Project 2 used the results of the Project 1 to design an accessible, culturally tailored adaptation of an evidence-based program which will address the chronic disease risk factors prevalent in the federally qualified disadvantaged zip codes in Tampa. Project 3 identified census tracts in Florida with increased risk factors for chronic disease and increased poor maternal child health outcomes and examine the ecologic relationship between these factors.

Project 1: A qualitative study of barriers to healthy behaviors and intergenerational chronic disease prevention in federally-qualified disadvantaged zip codes in west central Florida

Aim 1: Describe the health beliefs, barriers to healthcare, barriers to healthy behavior, important health issues, unmet health education gaps, and preferred methods of receiving health information of residents of federally qualified disadvantaged zip codes in west central Florida

Study design

This qualitative study consisted of key informant interviews and focus group discussions guided by a questionnaire and will be conducted among predominantly African-American residents of federally-qualified disadvantaged zip codes in west central Florida. REACHUP, Inc., recruited all participants. The questionnaire was designed by University of South Florida (USF) researchers and doctoral students, with the guidance of REACHUP, Inc., and an experienced
community health interviewer. The questions were intentionally open-ended to give participants the opportunity to address themes and community issues that researchers and partners may not have anticipated. REACHUP, Inc., has a longstanding partnership with USF researchers since its establishment as a non-profit agency serving federally-qualified disadvantaged areas of Tampa. Their mission is to collaborate with other non-profits to connect minorities and low-income families with resources to improve health outcomes.

Participants

Participants were required to be at least 18 years of age, not pregnant, willing to participate in a focus group, and residents of the federally-qualified zip codes which REACHUP, Inc., serves: 33602, 33604, 33607, 33605, or 33610. Clients were informed about the topic of the focus groups, and once an adequate number of participants were recruited, the group was scheduled at a time that was convenient for everyone. Key informants were leaders in the community with which REACHUP, Inc., has a partnership. Individual interviews were scheduled at participants’ convenience. REACHUP, Inc., identified key informants (n=10) in the community to be interviewed and identified participants for four focus groups: postpartum women, older women, postpartum women and their support partners, and men who served as support partners to postpartum women. These groups of participants were chosen to collect information on factors affecting maternal and family health from community members who currently have children or serve as resources to current parents. In this community, older women are seen as wise advisers, so it was imperative to include their perspectives in this study. The Institutional Review Board at the University of South Florida designated this project as non-human subjects research.
Procedures

Data were collected by REACHUP, Inc., and a contracted community health interviewer. All interviews and focus groups were conducted by an experienced community health interviewer using a standard protocol. Each interview and focus group was conducted using an interview guide created by the study team under the advisement of the REACHUP, Inc., community engagement director, chief executive officer, and community health interviewer (Appendix 4). Target recruitment was 6-10 participants per focus group and 10 key informants. No more than 12 persons were recruited per focus group to ensure the qualitative power of the data collected (247). Focus groups concluded once saturation is reached, defined as receiving consistent responses about health beliefs, barriers to health care and healthy behaviors, and unmet health needs in the federally qualified disadvantaged zip codes. Prior to data collection, the community health interviewer read the informed consent, asked participants to use a pseudonym, discussed the purpose of the focus group, obtained consent to audio record the discussion, and emphasized that participation was voluntary. The community health interviewer read all questions aloud during the interviews and focus groups. During each focus group, the community health interviewer probed participants’ responses and encouraged all members to participate, calling them by self-assigned pseudonyms to protect their identity. The interviewer’s assistant took notes and provided a summary at the end of the focus group to ensure that participants felt that their responses are recorded correctly. At the end of each interview or focus group, participants were compensated for their time, effort, and travel costs with a $25 gift card.

Data analysis

Interviews and focus groups were summarized into topline reports by the community health interviewer; focus groups were also transcribed by a professional transcription service for
coding purposes. Data were thematically analyzed using grounded theory in Atlas.ti version 8.0. One-fourth of the data were coded by two independent coders in Atlas.ti 8.0. Demographics were only collected for focus group participants to anonymize key informants’ responses.

Strengths and Limitations

Strengths of this study include the use of an experienced community health interviewer and the use of grounded theory for coding rather than ad hoc theme specification. The inclusion of information from more affluent key informants as well as more representative residents of the community added to the representativeness of the sample and the data, as this model allows community members to provide unfiltered information about their personal experiences. However, key informants and community members may not be representative of the whole community, possibly biasing the results. Assumptions of this study are as follows: Focus group participants and key informants understood the questions, focus group participants and key informants answered questions honestly, and focus group participants and key informants were representative of the community.

Project 2: A process evaluation of the first four weeks of a social media-based, tailored translation of the national Diabetes Prevention Program (nDPP)

Aim 2: Understand the acceptability and feasibility of the first four weeks of a social media-based, community-informed adaptation of the nDPP (HealthyLIFE).

Study design

Project 2 was a process evaluation of the first four weeks of a social media-based adaptation and implementation of the national Diabetes Prevention Program, supplemented with health information which members of the target population indicated that they do not yet receive
The target population was predominantly African-American women of childbearing age living in federally qualified disadvantaged zip codes in west central Florida. REACHUP, Inc., recruited all participants and identified locations for in-person sessions. This process evaluation sought to recruit 12-15 minority women residing in federally-qualified, disadvantaged zip codes in Tampa, Florida: 33602, 33603, 33605, 33607, and 33610. Women qualified for this study if they were 18 years of age or older, lived in the target area, were at least 8 weeks postpartum, had a Facebook page, and had a smartphone. Sample size was calculated using mean differences established by a previous study which implemented the NDPP in an underserved population (26). SAS version 9.4 was used to calculate sample size resulting in a suggested sample size of 12 for pre/post intervention calculations. To account for a 25% attrition rate, as was predicted based on a review of technologically-based diabetes prevention interventions (24), REACHUP, Inc., sought to recruit 15 participants.

Procedures

Participants met in person at baseline and 4-week Evaluation. Baseline served as an information and orientation session and 4-week Evaluation will consisted of a social and breathing activity and concluded with a focus group on the HealthyLIFE program. The content of each of the four weeks of the program (Appendix 5) was based on the national Diabetes Prevention Program’s Prevent T2 Curriculum: 1) Get Active, 2) Track your Activity, 3) Eat Well to Prevent T2, and 4) Track Your Food.

We created an online social support system via the HealthyLIFE secret Facebook page. Participants and coaches joined a “secret” Facebook group. A secret group is only available to people who are invited, visible by only those in the group, and is not searchable by anyone outside the group, maintaining the confidentiality of subjects. At baseline, biometric
measurements were taken and participants were given guidance on how to use Fitbits and a smartphone application-based calorie recorder (MyFitnessPal), as well as what to expect from the program and how to interact with their fellow participants throughout the HealthyLIFE program. Using app-based calorie and activity trackers made tracking easier, increasing adherence; Fitbit activity trackers were used to record exercise and sleeping patterns and MyFitnessPal was used to help participants track their food intake and to see how many calories they earned through exercise throughout the day.

Participants were encouraged to interact with one another to share their successes and struggles to increase knowledge gained from one another. This interaction was further encouraged by Sessions 0 and 4, during which participants were able to socialize, share their successes and challenges, and provide process-based qualitative feedback on the program; the creation of social support was evaluated by social network analysis and the Duke Social Support Index (53). The page administrator also facilitated knowledge change by posting videos about nDPP content, exercise suggestions, and recipe suggestions three times per week. “Healthful Hints” were posted daily to reinforce the content presented each week, and there was a social and fitness-related activity on the fourth Saturday to reinforce the feeling of community as well as consistent data collection. The social support aspect of the online community was reinforced during in-person monthly data collection points at which participants’ biometric measurements (weight, blood pressure, waist circumference) were collected, though the meetings were centered around an engaging mindful breathing activity. Showing participants how to breathe to reduce stress and be mindful of self-care contributes to the theoretical foundations of the intervention, as these are exemplary of observational learning and increasing self-efficacy.
Questionnaires and anthropometric measures

Participants were asked to complete the CDC Healthy Days (CDCHD) (45), Duke Social Support Index (DSSI)(53), Patient Health Questionnaire-2 (PHQ-2)(248), Physical Activity Readiness Questionnaire (PAR-Q)(249), and Perceived Stress Scale (PSS)(61) measures at baseline and 4-week Evaluation to determine change in quality of life and stress over the course of the program (Appendix 6). Throughout the 4-week program, participants were encouraged to provide feedback on what they liked and what could be improved in the program. A focus group guide was created by USF researchers, REACHUP, Inc., staff, and the community health interviewer, to ensure that feedback at the end of the program addresses the acceptability and appropriateness of the program. Demographics, weight, waist circumference, and height were collected at baseline. Anthropometric measures were conducted using a standard protocol. Weight was measured at baseline and 4-week Evaluation using the same digital scale. The scale was zeroed out between each participant and each individual was weighed twice. If both values were within 0.5 lbs, then the first value was retained for data analysis. Height was also be measured twice; if both values were within 0.25in, the first value was retained for data analysis. Waist circumference was measured once each by two study staff; if the values were within 1 in of one another, the first value was retained for analysis.

Data quality and control

Data quality was assessed after each data collection point to ensure completeness of data. After data entered on paper forms was entered and scanned into a database, the digital data were stored on Box, an encrypted digital warehouse for documentation. Data were accessible only to research staff who are approved by the University of South Florida’s Institutional Review Board.
Missing data

If data were missing because a participant unintentionally did not answer a question, a study staff member contacted them to attempt to obtain their response so that the participant’s data was not lost. As a result, less than 1% of all data were missing, solely due to refusal to answer. None of these values affects the ability to analyze the data.

Data analysis

Analyses consisted of qualitative and quantitative procedures. Process evaluation included tracking the number of participants, preferred method of content delivery (video, messaging, text), participant-generated Facebook posts, comments, and likes, ease of use of the technology, overall satisfaction with the program, validity (is the content delivered as intended?), and the potential for social network analysis. Impact evaluation (knowledge, attitudes and beliefs toward healthy living) and reinforcing factors were assessed using focus groups. As described in Paper 1, a trained interviewer conducted the focus groups, data were transcribed and analyzed using Atlas.ti 8.4. Reinforcing factors were measured through pre- and post-questionnaires (PHQ-2, CDC Healthy Days, DSSI, PSS). Weight, waist circumference, and height were measured pre and post intervention. Data were analyzed after each data collection point. Paired t-tests were conducted to determine statistical differences between the baseline weight and quality of life items and their values 4 weeks into the program. Qualitative data were transcribed and imported into Atlas.ti version 8.4 for thematic analysis.

Strengths and Limitations

This study was strengthened by the use of an evidence-based program, validated instruments, and use of the same scale and measurement materials for valid reporting of biometric data. The study also employed grounded theory, allowing the results of a previous
study to dictate the design of the program. Similarly, qualitative themes were determined by the data rather than imposed by the investigators. Since participants were selected by REACHUP, Inc, participants may not be representative of the whole community. Small sample size may contribute to this lack of representativeness and may prove problematic if there is a high attrition rate. There is also the chance that participants imposed social desirability bias in process evaluation, telling the investigators that they liked the program more than they did. The use of Fitbits and MyFitnessPal for activity and food consumption tracking allowed investigators to objectively assess the effectiveness of the program as it pertains to activity and food tracking.

Assumptions for this project were as follows: Focus group participants understood the questions, answered questions honestly, and were representative of women in the community. HealthyLIFE participants who were lost to follow up were not systematically different from those who remained in the study.

Project 3: A geospatial analysis of chronic disease risk factors by census tract and spatial autocorrelation with federally qualified health centers (FQHCs)

People of minority background and those who are uninsured or underinsured are more likely to experience risk factors for chronic disease, to develop chronic disease, and to experience unmanaged chronic disease (35,36,116). These populations also experience significant barriers to health care, including lack of access to primary care services, cultural, social, and linguistic barriers, high copays, and low health literacy and education (250). One of the most significant barriers to healthcare is transportation, with 10-51% of patients reporting that inconsistent public or private transportation is a barrier to obtaining healthcare, particularly for those who are uninsured, underinsured, or Medicaid insured (251). Proximity to healthcare services and accessibility to transportation to healthcare services negatively affect healthcare
utilization, with less efficient transportation and further commutes resulting in lower healthcare access (252).

As such, it is important to understand the spatial relationship between census tract-level chronic disease risk factors and federally qualified health centers (FQHCs). Formative research shows that census tracts in Tampa with the highest density of minority populations are within the census tracts with the highest diabetes prevalence, hypertension prevalence, and obesity prevalence (253). In 2014, 7% of Americans were served at FQHCs compared with 5% in 2005, resulting in 8.7 million more Americans receiving care at these facilities. Persons who were uninsured or on Medicaid comprised the greatest proportion of people seeking care at FQHCs (13.5%-17.3% and 14.7%-17.2%, respectively (254)). Similarly, the rate of increased use of FQHCs was greatest among the underinsured and Medicaid insured compared with privately insured and Medicare populations. Disparities of FQHC use also differed based on socioeconomic status, with more than 25% of people living in poverty accessing care at FQHCs compared with 0.6% of people with incomes that were 200% of the federal poverty level or higher. People ages 0-19 and people of minority background, particularly African American and American Indian people, used FQHCs at consistently higher rates compared with their older and white populations (254).

Understanding the spatial autocorrelation between small area estimates of chronic disease risk factors and federally qualified health centers can inform the magnitude of influence of a chronic disease risk factor reduction program on health care access and determine potential geographic areas for implementation of chronic disease risk factor reduction programs. Inverse distance methods of spatial relationship assume that areas that are closest to each other are most
similar; the formative research indicates that this assumption is valid based on the co-occurrence of statistically significantly high prevalence of obesity, hypertension, and diabetes (253).

Aim 3: Identify census tracts in Florida with statistically significantly high prevalence of chronic disease risk factors and describe the spatial correlation of high-risk census tracts and federally qualified health centers (FQHCs).

Study design

This geospatial analysis of sub-county level data will identify census tracts in Florida that would benefit from implementation of the nDPP or our social media- and evidence-based behavior change intervention and will determine the correlation of chronic disease risk factors with FQHCs in urban areas in Florida to assess healthcare accessibility in economically disadvantaged and medically underserved areas.

Data sources

The Robert Wood Johnson Foundation/ Centers for Disease Control and Prevention (CDC) 500 Cities data was downloaded from the CDC website and enriched with an existing ArcGIS layer that identifies active FQHCs in Florida. The CDC, in conjunction with the Robert Wood Johnson Foundation, has released census tract-level data on the most populous 500 cities in the United States, called the 500 Cities Project, releasing the first iteration of data (year 2014) in 2016. Data for 2016 were recently released in data analysis format and a GIS-friendly format. These data included information on hypertension, obesity, chronic heart disease, mental health, and strokes, all of which were visually represented with a different transparency level to identify hotspots of chronic disease risk factors in the 20 largest Florida cities. Census tracts identified as hot spots were be compared with the locations of FQHCs via the ArcGIS Summarize Within tool. The FHQC data layer accessed via ArcGIS utilized data from the Department of Health and
Human Services (USDHHS), displaying the geographic locations of FQHCs in the United States. Census tract data were enriched using the ArcGIS GeoEnrichment tool to map minority populations, household income, and educational attainment by census tract.

Data analysis

Chronic disease risk factor data were geospatially analyzed via the hotspots tool in ArcGIS to determine census tracts with the highest prevalence of chronic disease risk factors and for spatial correlation of census tract with high prevalence of risk factors and FQHCs. Correlation was considered 100% if census tracts are up to 0.5 miles in a straight line from census tracts identified as hot spots (255). FQHC locations were analyzed using autocorrelation to determine geographic distribution of FQHCs throughout the state. Spatial autocorrelation was determined in ArcGIS. The ArcGIS autocorrelation tool includes five values, including the Moran’s I Index and p-value. Moran’s I is a correlation coefficient that evaluated the total spatial correlation of the data set to determine how similar each observation is to the ones surrounding them (256). This tool evaluated whether the pattern detected was clustered, dispersed, or random. If the Moran’s I was positive and the p-value was statistically significant, this indicated a tendency toward clustering, with the null hypothesis being that chronic disease risk factors and FQHCs are independently randomly distributed without regard for areas with high prevalence of risk factors for chronic disease (257). Inverse distance methods of spatial relationship were used, as all of the census tracts influence one another but those closest together interact the most (258).

Strengths, limitations, and assumptions

This study was strengthened by the quality of data used; 500 Cities Project data and FQHC location data were systematically collected to ensure fidelity and quality of the data. 500 Cities data are available for 2014, 2015, and 2016. The same data were collected for each year by
the 500 Cities Project for easy comparability. FQHC data were collected and released by the US DHHS to ArcGIS.

Due to the nature of the 500 Cities Project data only addressing the 500 largest cities in the United States, conclusions drawn from cities’ data may not be representative of the whole state. Likewise, high risk census tracts identified as needing greater access to preventive services were in metropolitan areas and draw no conclusions about the health service needs of rural census tracts in Florida. The data from some census tracts in the 500 Cities Project data were censored due to low numbers of surveyed individuals; this may have reduced the visual appearance of hot spots of chronic disease risk factors. The most recent year for which 500 Cities Data was available is 2016, so census tract-level risk may have changed since the last survey. FQHC data from HHS were last updated in 2018, so they may not reflect current FQHCs.

Assumptions of this project are as follows: The 500 Cities Project small area estimates of prevalence and incidence were calculated correctly and the 500 Cities Project data were representative of the population in each census tract. The FQHC data layer in ArcGIS accurately represents the open FQHCs in the state of Florida. All FQHCs provide chronic disease prevention programming. ArcGIS estimation of time from high risk census tract to FQHC is an accurate estimate for public transportation. Neither FQHC presence nor census tract-level risk for chronic disease change substantially year to year.
CHAPTER 4: STOPPING THE CYCLE OF CHRONIC DISEASE: A QUALITATIVE STUDY OF BARRIERS TO THE HEALTHY BEHAVIORS AND INTERGENERATIONAL CHRONIC DISEASE PREVENTION IN FEDERALLY-QUALIFIED DISADVANTAGED ZIP CODES IN WEST CENTRAL FLORIDA

Introduction

In total, more than 30 million people in the United States have diabetes, one-third of adults are obese, and 133 million adults have at least one chronic disease. The incidence of diabetes and prevalence of hypertension are 66% and 40% higher in minority populations, respectively (7,99). Since 38% of the American population are persons of minority background and 15% of Americans live in poverty (259), many Americans likely face multiple obstacles to participating in a behavior change program targeting risk factors for chronic disease. African-Americans and Hispanics experience poverty at more than double the rate of their white counterparts, and while 57.8% of white Americans have health insurance, 49.5% and 36.3% of African-Americans and Hispanics have the same benefit (191).

Due to the unique circumstances affecting people of minority background, it is imperative to appreciate the health priorities of the target population to facilitate meaningful engagement and prolonged risk factor reductions. People with chronic diseases suffer increased morbidity, mortality, and decreased quality of life; these sequelae also impact future generations (37,145,171,173,177). Women who are overweight before and during pregnancy are more likely to give birth to an overweight infant, who is in turn more likely to be an overweight or obese
adult (2,18,112). This leads to a cyclical, intergenerational continuation of obesity and obesity-related illnesses in minority populations across the lifespan. However, recent research shows that behavioral interventions that include healthy eating, exercise, and addressing weight loss and addressing weight management prior to, between, and during pregnancies decrease risk for gestational diabetes (2,112,169,170) and overweight in infants (112) and increases fat free mass and lean mass in infants (170), indicating that the intergenerational effects of obesity and obesity-related disease can be mitigated.

While there are evidence-based interventions that effectively mitigate chronic disease risk factors and manage chronic disease, these interventions are not as effective in minority or disadvantaged populations (26,112), and are notably less effective for African American women (7). This decreased effectiveness is exceptionally detrimental because of their disproportionately higher rates of chronic diseases and chronic disease risk factors like obesity, pre-diabetes, diabetes, hypertension, and heart disease, compared with white and higher socioeconomic status individuals (3,95,193). A systematic review of 66 diet and physical activity promotion programs to prevent type 2 diabetes and other chronic diseases found that persons participating in such interventions were largely female (65.3%), prediabetic (57%), overweight or obese (28.1-33.6 kg/m²), white (74%), and middle aged ((average 53.6 years (260)). Of the interventions analyzed, 64% had specific weight loss goals, 61% were health care system-based interventions, 92% lasted at least six months, and 41% were based on the national Diabetes Prevention Program (nDPP). Several studies sought to improve chronic disease risk factors in high risk populations, including disadvantaged populations, using the nDPP with some success (6,25,39,110). However, one study that translated the nDPP from the clinical setting to a disadvantaged community setting included very few minorities (26), and most other studies translating this
program faced similar issues regarding generalizability (6,22,25,203). Another study found that while the nDPP is effective in reducing weight and BMI among whites and Hispanics, African-Americans, in particular, African-American females, lost less weight and did not retain their weight loss compared with all other race-gender pairs (7). Research suggests that barriers to healthcare including lack of time, lack of transportation, lack of paid time off, and cost of participation, may be responsible for this decreased effectiveness (6,26,40,204). To overcome these obstacles, many researchers have translated the nDPP to technology-based interventions with varying levels of success (24,205). The most successful interventions were those that sought meaningful engagement from participants rather than simply completion of modules or lessons using more traditional didactic methods (24,32).

The purpose of this study was to determine the health issues that are most important to predominantly African-American residents of federally-qualified disadvantaged zip codes in west central Florida, to facilitate appropriate adaptation of the nDPP; to determine the barriers to healthy behaviors that exist in their lives or community so that the program can be tailored to meet the needs of the population; and how the target population receives their health information so that researchers can effectively disseminate a tailored program to this community once it is developed.

Methods

Study design

This was a qualitative study conducted among African-American residents of federally-qualified disadvantaged zip codes in west central Florida. This study consisted of key informant interviews and focus group discussions guided by an interview guide. REACHUP, Inc., recruited all participants. The interview guide was designed by University of South Florida (USF)
researchers and students, with the guidance of REACHUP, Inc., and an experienced community health interviewer. REACHUP, Inc., is a community organization that has had a continual partnership with USF researchers since its establishment in 2006 as a non-profit agency serving federally-qualified disadvantaged areas of west central Florida. Their mission is to collaborate with other non-profits to connect minorities and low-income families with resources to improve health outcomes. The interview/focus group questions were intentionally open-ended to give participants the opportunity to address themes and community issues most relevant to them.

Recruitment

Participants were required to be at least 18 years of age, not pregnant, willing to participate in a focus group or interview, and a resident of the federally qualified zip codes which REACHUP, Inc., serves. REACHUP, Inc., recruited focus group participants by contacting current and former clients who met the eligibility criteria. Target recruitment was 6-10 participants per focus group and 10 key informants. The goal sample size for each focus group was relatively small for the purposes of reducing costs and facilitating an engaging and informative focus group to answer the research questions, increasing the qualitative power of the study by ensuring that each participant has the opportunity to share their knowledge and beliefs (247).

REACHUP, Inc., clients were informed about the topic of the focus groups, and once an adequate number of participants were recruited, the group was scheduled at a time convenient for everyone. REACHUP, Inc., identified participants for four focus groups (n=35): postpartum women (n=7), older women (n=12), postpartum women and their support partners(n=8), and men who serve as support partners to postpartum women (n=8). These groups were selected to collect information on the factors affecting maternal and family health from community members who
currently have children or serve as resources to current parents. In this community, older women are considered wise advisers, so it was imperative to include their perspectives in this study. Before implementation, the Institutional Review Board at the University of South Florida designated this project as non-human subjects research.

Procedure

Data were collected by REACHUP, Inc., and a contracted community health worker. As shown in Table 5, all interviews and focus groups followed a similar structure, as they were conducted using the same interview guide of open-ended questions to generate conversation regarding how environment and community factors affect health, health beliefs, and participation in healthy behaviors. At the end of each interview or focus group, participants were compensated for their time, effort, and travel costs with a $25 gift card.

Focus Groups

Focus groups averaged 8.75 participants per session (range 6-12). All focus groups were conducted by a trained community health interviewer in a conference room at REACHUP, Inc., where food and beverages were provided. Prior to data collection, the community health interviewer read the informed consent, asked participants to choose a pseudonym for use during the focus group, discussed the purpose of the focus group, obtained consent to audio record the discussion, and emphasized that participation was voluntary. During each focus group, the community health interviewer asked each question aloud, probed participants’ responses, and encouraged all members to participate, calling them by their pseudonyms. The interviewer’s assistant took notes and provided a verbal summary at the end of the focus group to ensure that participants felt that their responses were recorded correctly. The interviewer prompted answers from all participants to ensure qualitative power.
Key Informant Interviews

Key informants were leaders in the community with which REACHUP, Inc., had a partnership and individual interviews were scheduled at participants’ convenience. REACHUP, Inc., identified key informants (n=9) in the community to be interviewed. Key informant interviews were conducted in participants’ business offices at times specified by interviewees to ensure ample time for the interview. The community health interviewer read all questions aloud during the interviews.

Table 5. Selected questions from the interview/focus group guide (Full guide in Appendix 4)

<table>
<thead>
<tr>
<th>Health Questions</th>
<th>Community Questions</th>
<th>Health Information Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do you believe healthy is to you? What helped shaped your thoughts about that?</td>
<td>How does your (community/staff/others you serve) think about “being healthy” or “getting healthy”?</td>
<td></td>
</tr>
<tr>
<td>What are some diseases that run in your family? Do you think you’ll have those same diseases? Diabetes, Hypertension, Cancer and Heart Disease?</td>
<td>In your (community/clinic/other), what do most of the families feel about getting or being healthy?</td>
<td></td>
</tr>
<tr>
<td>What do you consider to be healthy food?</td>
<td>Does your community have good access to health care?</td>
<td></td>
</tr>
<tr>
<td>Do you see sleep as related to health? What typically keeps you from getting a good night sleep?</td>
<td>Does your community have health care insurance coverage? Is it good enough?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other than being pregnant, are the women in your community able to go to the doctors/clinics? If no, why not? If yes, where do they go?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have you heard of reproductive life planning?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, what does it mean to you? How is reproductive life planning approached in your community?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are there places in your community for exercise or physical activity?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is there access to fruits and vegetables in your community?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do the men in your community play a significant role in the health decisions of women in your community? If yes, how so?</td>
<td></td>
</tr>
</tbody>
</table>
Table 5. (Continued)

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How do you share health information in your community? What’s the best place to share health information?</td>
<td></td>
</tr>
<tr>
<td>What information do you want to hear more of about health?</td>
<td></td>
</tr>
<tr>
<td>Where would you prefer to hear about health information?</td>
<td></td>
</tr>
<tr>
<td>If you could change one thing to improve the health of your community, what would it be?</td>
<td></td>
</tr>
</tbody>
</table>

Data Analysis

Interviews and focus groups were summarized into topline reports by the community health interviewer; focus groups were transcribed by a professional transcription service for coding purposes. Data were thematically analyzed using grounded theory in Atlas.ti version 8.0. One-fourth of the data were coded by two independent coders in Atlas.ti, resulting in a Cohen’s kappa of 0.73, indicating good agreement. No individual-level demographic data were collected for key informant interviews to ensure anonymity. Frequencies were determined by the number of times each condition was mentioned in the focus group transcripts excluding repetitions by the interviewer.

Results

A total of 35 people participated in the focus groups and nine key informants were interviewed; demographics of focus group participants are presented in Table 6. Participants were predominantly female and African American. Mean age, sex, ethnicity, and the average number of children varied statistically significantly by group. Despite statistically significant demographic differences between the focus groups, several major themes emerged across all groups.
Table 6. Demographics by focus group and differences between groups

<table>
<thead>
<tr>
<th></th>
<th>Postpartum (n=7)</th>
<th>Couples (n=8)</th>
<th>Men (n=8)</th>
<th>Seniors (n=12)</th>
<th>Overall (n=35)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Female</td>
<td>100</td>
<td>62.5</td>
<td>0</td>
<td>100</td>
<td>71.4</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.865</td>
</tr>
<tr>
<td>African American</td>
<td>85.70</td>
<td>100.00</td>
<td>75.00</td>
<td>91.60</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>0.00</td>
<td>0.00</td>
<td>12.50</td>
<td>0.00</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>14.30</td>
<td>0.00</td>
<td>12.50</td>
<td>0.00</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>8.40</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.036</td>
</tr>
<tr>
<td>Hispanic</td>
<td>14.3</td>
<td>12.5</td>
<td>0</td>
<td>0</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Age (Mean(StDev)</td>
<td>27.86 (4.61)</td>
<td>39.38 (10.81)</td>
<td>40.38 (14.31)</td>
<td>72.25 (6.4)</td>
<td>48.57 (20.11)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.489</td>
</tr>
<tr>
<td>Less than HS</td>
<td>0.00</td>
<td>12.50</td>
<td>0.00</td>
<td>8.40</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>HS or above</td>
<td>100.00</td>
<td>87.50</td>
<td>100.00</td>
<td>91.60</td>
<td>0.91</td>
<td></td>
</tr>
<tr>
<td>% Parents</td>
<td>100.00</td>
<td>100.00</td>
<td>62.50</td>
<td>100.00</td>
<td>0.91</td>
<td>0.057</td>
</tr>
<tr>
<td>Avg Children</td>
<td>3.14</td>
<td>3.75</td>
<td>0.86</td>
<td>3.10</td>
<td>2.78</td>
<td>0.037</td>
</tr>
</tbody>
</table>

As seen in Figure 4, diabetes (n=16), hypertension (n=11), and cancer (n=10) were the most frequently mentioned chronic conditions, followed by lack of sleep (n=8) and stress (n=7). Health beliefs, the financial costs of accessing care, lack of recreational areas, and lack of access to fresh produce, coupled with lack of time and distrust of physicians were consistently cited as barriers to participating in healthy behaviors. All key informant and focus group participants identified healthy behaviors, but many commented that they did not participate in them due to one of the aforementioned barriers or a lack of self-efficacy: “obesity just run in my family” (female, postpartum group). This fatalistic health belief was common:

"I think in different ethnic backgrounds, we’re more predisposed to high blood pressure and diabetes mainly due to our upbringing from different types of foods in our dietary lifestyle that’s passed from generation to generation." (female, postpartum group)
“I got a natural pre-term labor body.” (female, postpartum group).

Figure 4. Important chronic diseases as identified by participants

Figure 5 shows interrelated barriers to healthy behaviors identified by participants. While key informants and focus group participants both cited stress as a concern, key informants stated that their stress resulted from work-related pressure whereas focus group participants’ stress was attributable to limited resources and using those limited resources to provide the necessities of life for their families. Community resources were also limited; there was a paucity of safe outdoor recreation areas, with one park in the area identified as a hangout for drug dealers. There was a consensus that stress and emotional health are mismanaged or unmanaged in this community, as is reproductive planning:

“In the community, you don't see planning. We don't have planned pregnancies anymore”

(senior group)
Focus group participants also cited transportation as a barrier to health care, while key informants more often cited personal motivation as the key factor affecting health care access and healthy behaviors. At the time of the focus groups, city bus routes had recently changed, reducing the number of bus stops in the area. Focus group participants noted that increased walking time to a bus stop was not the only barrier; oftentimes bus drivers did not stop on routes known to have “problem riders” (multiple, couples group) or when it was raining.

Key informants and focus group participants also noted that there was a lack of readily available information in the community on how to prevent chronic diseases, particularly obesity-related chronic diseases, and on reproductive life planning. Focus group participants largely viewed medical professionals with skepticism due to both cost and distrust of physicians, though most people indicated that they would take their child to the doctor before they themselves
would go. One participant also noted that she had to declare that she was living separately from
her partner to ensure that their children qualified for Medicaid. Pharmaceuticals were viewed
very negatively, with birth control seen as “population control” (female, couples group) and all
drugs seen as:

“taking another drug to fix the side effects of the first drug that messed you up in the first
place” (female, couples group)

Home remedies, however, were viewed positively by all participants, with participants eager to
share what did and did not work for them. Key informants did not perceive pharmaceuticals or
over the counter drugs as negatively as focus group participants and were more likely to
regularly visit their physician and to see a physician when they are ill.

While the focus group with older women indicated that they get most of their health
information from the newspaper, television-based news, and community centers, they thought
that social media was a better way to contact the target population of women of childbearing age.
Most key informants and all other focus groups agreed with this opinion, with the postpartum
women’s group and the couples’ group indicating that most of their health information comes
from social media, specifically Facebook.

Discussion

This study sought to determine which health issues were most important, which barriers
to healthcare and healthy behaviors were most pervasive, and how to best disseminate health
information to predominantly African-American residents of federally-qualified disadvantaged
zip codes in Tampa, Florida. Demographically the sample of focus group participants were
representative of the target community, with the average age of the postpartum, couples, and
men’s group all having mean ages in the established childbearing age range (173.261). Nearly 90% of focus group participants were African-American and 95% of focus group participants were of minority background. The statistically significant differences between the groups based on sex and age were by design: sex-specific groups were recruited to reduce social desirability bias within the focus groups and senior group was meant to be comprised of older women, seen as community advisors to women of childbearing age in this population. Differences in ethnicity and average number of children enrich the data rather than limit it: focus group participants were able to provide their perspective based on diverse lived experiences to contribute to a holistic perspective of daily life in the target community.

The health issues identified by key informants and focus group participants aligned with the most prevalent chronic disease risk factors in this area as identified by available census tract-level quantitative data (16) supporting the need for interventions that address chronic disease prevention and management in this population. Moreover, participants also identified systemic issues that prevent people in the target disadvantaged community from accessing healthcare and living a healthier lifestyle.

The barriers to healthcare and healthy behaviors were typical of a disadvantaged area(112), though the anecdotes regarding these barriers deeply personalized the reality of how these barriers affect daily living in the target population. Researchers were aware that transportation was a barrier but were unaware that this was not because there were too few buses; rather, it was because bus drivers drive by bus stops with “problem riders,” leaving all potential riders at a disadvantage. Researchers were aware that there is a “donut hole” where people make too much money to qualify for government assistance (177) and too little to purchase it themselves, but researchers did not know that families had to feign separation and place actively
engaged fathers on child support to qualify for government assistance. While there were parks near the target areas, one of them was well-known in this community to be a hangout for drug dealers, preventing families from accessing this resource even if they chose to leave the community for recreational activity. This lack of outdoor resources is common in disadvantaged urban areas throughout the United States (171).

Overall participants were motivated to lead healthier lives, with parents putting their children’s health before their own when a choice was necessary; this situationally-forced choice between the parents’ and children’s health must be changed to decrease the prevalence of chronic disease and to mitigate the negative impact of chronic disease in minority populations. Participants were forthcoming about the desired topics for more information, and, while reproductive planning and emotional health are not extensively covered in widely disseminated chronic disease preventions programs (110,203), this information could easily be included by supplementing an existing program. Inclusion of all topics which the population finds relevant has the potential to increase engagement and decrease attrition during an extended chronic disease prevention program (6,26,32,169,203).

Researchers were not expecting social media to be a prevalent source of health information, though nearly all key informants and all focus groups emphasized the importance of this mode of delivery of health information. While social media is used for behavior change, there is little literature on this medium and even less on implementing behavior change programs through existing social media platforms (27,32). One smoking cessation program conducted through Facebook showed some success, with positive behavior change linked to meaningful engagement of participants with the program page via “likes” and “shares” (32). Pagoto, et al., (2016) asserted that social media, particularly Facebook, can be used to reach a diverse audience,
since 68% of all online Americans have a Facebook account and whites, blacks, and Hispanics use Facebook at similar rates. Likewise, 99% of American adults own a mobile phone and 95% of those are smartphones (30), evincing the potential for use of social media-based and smartphone application-based disease prevention programs.

The moderately differential perspectives of the key informants and focus group participants was a strength of this study, diversifying the information collected across lived experiences. The use of grounded theory was also an asset, allowing the data to tell this community’s story rather than making it fit into researchers’ expectations of the data. While this study is limited by sample size and by the number of focus groups, there was considerable overlap between themes, indicating that saturation of perspectives on the investigated topics was reached (247,262). Participation bias may be present, as persons who chose to participate in the interviews and focus groups may differ from those who chose not to participate. Further, due to the in-depth, qualitative nature of this research, results from this study may not be generalizable to the population at large or to all minority groups, though it may be transferable to individuals with similar race/ethnic, socioeconomic, and geographic circumstances (263). Additionally, perspectives of these focus group participants may not align with those of participants in a behavioral intervention.

Implications

To address chronic disease disparities between non-Hispanic whites and persons of minority background and to disrupt the intergenerational cycle of obesity and obesity-related diseases, public health practitioners must first adapt chronic disease prevention interventions to meet the needs of people of minority backgrounds within the context of their daily lives. Evidence-based interventions are consistently effective across clinical trials and community-
based interventions, though they are also consistently less effective for people of minority backgrounds (7). The results of this study indicate that simply addressing the target population’s knowledge and intended behaviors is not enough; there are systemic barriers which prevent residents from being healthy and active. To effectively address the needs of this community, researchers must tailor evidence-based health interventions, supplement them with information on the topics relevant to the target population (i.e. reproductive planning, stress management, emotional health), and work with leaders in the community who can assist in modifying the infrastructure to better serve the target population. The only way to truly understand the needs of the community is to utilize community-engaged research methods, allowing members and representatives of the target community to identify areas of need and potential solutions for their community (197,200,201) Further, researchers and public health practitioners should ensure that the fidelity of an evidence-based intervention is maintained when the intervention is translated to the preferred method of delivery of the target population. This study population identified social media as their ideal method of health communication; this method allows for an intervention to be easily scaled up to reach a large, diverse audience and can be efficiently sustained. Targeting interventions toward mothers or at the family level is particularly important because mothers pass their habits to their children, so if healthy behaviors become a habit for mothers, this can interrupt the intergenerational cycle of chronic diseases (37,145,171,173).

Given the widespread need for effective, cost-efficient prevention of chronic disease across diverse audiences, future chronic disease prevention programs should seek to continually and sustainably recruit members of all race groups and to deliver culturally appropriate programs to emphasize viable healthy behaviors during the childbearing years, before chronic disease risk factors develop into chronic conditions.
References


CHAPTER 5: STEPS TOWARD A HEALTHYLIFE: THE FEASIBILITY AND ACCEPTABILITY EVALUATION OF A SOCIAL MEDIA-BASED ADAPTATION OF AN EVIDENCE-BASED CHRONIC DISEASE PREVENTION PROGRAM

Introduction

More than 10% of American adults have diabetes, one-third are obese, and 133 million have at least one chronic disease. Incidence of diabetes and prevalence of hypertension are 66% and 40% higher in minority populations, respectively (7,99), resulting in over $1 trillion in health care spending per year in the United States (73). People with chronic diseases suffer increased morbidity and mortality and decreased quality of life; these sequelae impact future generations, with overweight and obese mothers giving birth to overweight and glucose intolerant infants who are at risk for overweight/obesity and diabetes as adults (37,145,171,173,177). This leads to a cyclical, intergenerational continuation of obesity and obesity-related illnesses. Since 38% of the American population are persons of minority background and 15% of Americans live in poverty (259), many Americans likely face multiple institutional and financial obstacles to participating in behavior change programs targeting risk factors for chronic disease. African-Americans and Hispanics experience poverty at more than double the rate of their white counterparts, and while 57.8% of white Americans have health insurance, only 49.5% and 36.3% of African-Americans and Hispanics have the same benefit, respectively (191), meaning that barriers to participating in chronic disease prevention and mitigation programs (CDPPs) disproportionately affect people of minority background.
Due to the unique socioeconomic and socioecological circumstances unduly affecting people of minority background, it is imperative to understand the priorities of the target population to facilitate meaningful engagement and prolonged risk factor reductions during and following CDPPs. Recent research shows that behavioral interventions that include healthy eating and exercise and addressing weight loss and weight management prior to, between, and during pregnancies decrease risk for gestational diabetes (2,112,169,170) and overweight in infants (112) and increases fat free mass and lean mass in infants (170), indicating that the intergenerational effects of obesity and obesity-related disease can be mitigated by culturally appropriate CDPPs. While there are existing evidence-based interventions that effectively mitigate chronic disease risk factors and manage chronic disease, these interventions are not as effective in minority or disadvantaged populations (26,112), and are notably less effective for African American women (7). This decreased effectiveness is exceptionally detrimental because of African Americans’ and low-income Americans’ disproportionately higher rates of chronic diseases and chronic disease risk factors like obesity, pre-diabetes, diabetes, hypertension, and heart disease, compared with white and higher socioeconomic status individuals (3,95,193).

In the state of Florida, 37% of women of childbearing age have at least one chronic disease risk factor(16); in federally-qualified disadvantaged zip codes (FQDZC) in west central Florida, 75% of women have at least one chronic disease risk factor(17). Prior research with residents of FQDZCs (Chapter 4) showed that the community’s perceived major health concerns were diabetes, heart disease, hypertension, cancer, and how to prevent chronic disease. Many of these health concerns identified by the target community are addressed by the national Diabetes Prevention Program (nDPP), though this program is traditionally presented in 16-week, in-class presentation format. Research suggests that barriers to healthcare and participation in in-person disease prevention programs including lack of time, lack of transportation, lack of paid time off, and cost of participation,
may reduce effectiveness of chronic disease prevention programs (6,26,40,204). To overcome these obstacles, many researchers have translated the nDPP to technology-based interventions with varying levels of success (24,205,218,220). The most successful interventions were those that sought meaningful engagement from participants rather than simply completion of modules or lessons using more traditional didactic methods (24,32).

Residents’ preferred methods of communication were via the local television news and, most frequently, via social media. Facebook was the primary platform of social media used, identified as preferable by all focus groups and key informants. Despite the fact that 68% of all Americans use Facebook, with nearly equal proportions of whites, blacks, and Hispanics having active accounts (27), there is a paucity of research on how to design and evaluate a social media-based intervention. Social media, and Facebook in particular, have the potential to be accessible, effective mode for behavior modification because of the ethnic makeup of its users (28) (29). While Facebook-based behavior change programs have demonstrated promise (32,133), the nDPP has yet to be adapted to this social media platform.

The purpose of this study was to implement the first four weeks of the nDPP to Facebook to meet the stated needs of federally-qualified disadvantaged zip codes in west central Florida and to evaluate the acceptability and feasibility of the social media-based program, called HealthyLIFE.

Methods

Study design

This study is a feasibility and acceptability evaluation of the first four weeks of a social media-based implementation of the 16-week nDPP, supplemented with health information which members of the target population indicated that they do not yet receive as outlined in Chapter 4. This study was deemed exempt from USF IRB review because it was considered program evaluation. Despite the
exempt status, informed consent was obtained at the baseline visit to ensure that participants were aware of their right not to participate or to discontinue participation at any time.

Inclusion criteria and recruitment

Women were eligible to participate in this study if they were 18 years of age or older, lived in west central Florida, were at least 8 weeks postpartum, had a smartphone, had a Facebook account during the time of the study, and consented to participate in the study. The community partner, REACHUP, Inc., recruited participants from current and previous clients; one client recruited her friend to participate in the program (n=10). Participants received a $25 gift card for participating in each in-person session (baseline and 4-week Evaluation) and were eligible to participate in a focus group following 4-week Evaluation to earn an additional $25 gift card.

Questionnaires

Participants completed the CDC Healthy Days (CDCHD) (45), Duke Social Support Index (DSSI)(53), Patient Health Questionnaire-2 (PHQ-2)(248), and Perceived Stress Scale (PSS)(61) measures at baseline and at the 4-week evaluation to determine change in quality of life, social support, and stress over the course of the program (Appendix 6). Demographics, weight, waist circumference, and height were collected at baseline following a standardized protocol; weight and waist circumference were reassessed at the 4-week evaluation. Participant satisfaction with the HealthyLIFE program was also assessed at the 4-week evaluation via a Likert-based satisfaction survey of each aspect of the program.

Qualitative assessments

At baseline, freelisting exercises were completed to ascertain why participants thought someone would join a health behavior change program and what would help someone be successful. Another freelisting exercise was conducted at the 4-week evaluation to ascertain the major themes that participants recalled from the program. Additionally, throughout the 4-week program participants
were encouraged to provide feedback via Facebook posts, comments, and messages about aspects of the program that they liked and aspects that could be improved in the program. Following the 4-week evaluation, a semi-structured focus group was facilitated by an independent, experienced community health interviewer so that participants could provide feedback on their satisfaction with the program, the technology used, and how HealthyLIFE could be improved for future implementations. The focus group guide was created via a collaborative effort between researchers, REACHUP, Inc., and the community health interviewer, to ensure that feedback at the end of the program addressed the acceptability and appropriateness of the program to meet the needs of participants (Appendix 7). Researchers and study staff were not present at the focus group.

Procedure for anthropometric measures

Anthropometric measures were assessed using a standard protocol at baseline and the 4-week evaluation. Participants were individually escorted by study staff from the group room to a private room for measures. At baseline, the consent form was checked for signature and the participant was invited to ask any remaining questions. Prior to assessing weight, waist circumference, and height, the procedure for assessment was explained in detail and the participant was invited to ask questions about the procedures. To assess height, a cloth tape measure was attached to the wall with each end of the tape measure adhered to the wall with 2 inch tape. Participants were asked to place their back on the tape measure. A flat surface (participant’s study folder) was lightly placed on top of the participants head to align with the appropriate measure on the tape. The participant stepped aside and the reading was taken; only one reading was taken and recorded. To assess weight, a digital scale was placed on a flat non-carpeted surface. Participants were asked to remove shoes if possible; if shoes could not be removed due to the complexity of shoe closure, participants were asked to wear the same shoes at the follow-up. If shoes were heavy (athletic shoes or boots) they were removed. Once the digital scale came to zero, participants stepped on the scale. Once the numbers stopped moving, the
reading was taken. The participant stepped off, the scale was zeroed and the process was repeated. The readings were averaged to determine final weight used for data entry. Waist circumference was assessed by asking participants to identify the umbilicus. Once identified the tape measure was placed at the level of the umbilicus and wrapped around the participants waist. The tape measure was checked for twists and levelness. Once this was verified the end of the tape was overlapped and the reading was taken. The process was repeated. If the measures were more than 0.5 inches different a third measure was taken. The mean of waist circumference measures was used for data entry. The participant was walked back to the group room by study staff and the next participant was walked back to the measurement room.

Data quality and control

Data quality were assessed after each data collection point to ensure completeness of data. All data were entered by two independent researchers and discrepancies were assessed in Microsoft Excel. Entries with disparate values were compared with the original data form completed by participants to ascertain the actual value. Once each disparate entry was corrected, that data set was considered the final data set and named after the session at which the data were collected. These files were uploaded to Box, a secure online file storage site with restricted access, so that all members of the study staff had access to the data as well as the data agreement file.

Missing data

Questionnaires were assessed for completeness after the baseline session and during the 4-week Evaluation. Data which were missing following baseline were obtained by contacting participants by their preferred contact method (text, phone call, email) to ascertain their answers to questionnaires. All missing data from baseline were obtained from participants via telephone call prior to 4-week Evaluation.
Procedure

Baseline

Participants were asked to attend two in-person meetings, baseline and 4-week Evaluation. During the in-person sessions, participants were able to socialize and to share their successes and challenges. At baseline, participants were provided information on the study and informed consent procedures were conducted as a group. Consent included information on the study purpose, expectations, and procedures. Participants were then walked to a private room where participants could ask questions about the study prior to signing the consent form. Anthropometric measures were assessed in the private room following signing of the consent form. Participants were also asked to complete a freelisting exercise to determine the reasons why a person might join a health behavior change program and what might help them be successful.

After informed consent, anthropometric measures, and freelisting were completed, participants were asked to search for the closed Facebook group and to request to be added to the group; one participant requested to join the group a day later. A study staff member approved all study participants to join the Facebook group and did not add anyone who was not a part of the HealthyLIFE program as either study staff or program participant. Study staff demonstrated how and when program content would be delivered via the closed Facebook group. The content of each of the four weeks of the program (Appendix 5) were based on the nDPP’s Prevent T2 Curriculum: 1) Get Active, 2) Track your Activity, 3) Eat Well to Prevent T2, and 4) Track Your Food. After showing participants how to access the program via the Facebook page, participants were oriented to Fitbit. Each participant received a Fitbit Flex 2. Researchers demonstrated how to download the Fitbit smartphone application, how to sync the Flex 2 to their smartphone, and how to use the application to track their activity and water intake. After a short break, researchers proceeded to introduce the
MyFitnessPal application. Due to time constraints the MyFitnessPal orientation was abbreviated and some resources were posted to the Facebook page for participants’ reference.

Social media-based adaptation

To ensure fidelity of the nDPP in adapting it to social media, two members of the study staff, including the certified nDPP Lifestyle Coach, assessed the content presented via videos, Healthful Hints, and “homework” to determine the degree to which the nDPP content was represented in HealthyLIFE. Using a standard tool (Appendix 8), each member independently rated each week’s content, then study staff came to a consensus on the activities and topics that needed to be expanded or added to appropriately reflect nDPP content. Weekly content was then updated and supplemented to correct any deficiencies in informational or skill-building content.

As seen in Table 7, on each Sunday at 8:15 am, a “Prep Day,” video was posted to introduce the topic for the week and to give the participants hints on how to be successful regarding the topic of the week.

Table 7. Outline of Facebook content presentation by day of the week

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:15 am: Prep Day</td>
<td>8:15 am: Content video and homework prompt for a chance to win Tool for Health</td>
<td>8:15 am: Healthful Hint 2:00 pm: Healthful Hint</td>
<td>8:15 am: Content video or article 5:00pm: Announcement of winner of Tool for Health</td>
<td>8:15 am: Healthful Hint 2:00 pm: Healthful Hint</td>
<td>8:15 am: Recipe video 2:00-3:00: Post to wrap up the week's content and extra credit</td>
</tr>
</tbody>
</table>

Weekly content videos were posted at 8:15 am each Monday and included a prompt to complete “homework” which would earn them a chance to be randomly selected to receive a “Tool for Health.” Tools included a foam roller, measuring cups, a food scale, and a yoga mat, to reinforce
behaviors learned throughout the program. On Tuesdays and Thursdays, Healthful Hints were posted at 8:15 am and 2:00 pm. Wednesday’s content consisted of an nDPP-based content video or article at 8:15 am a reminder of “homework” at 9:30 am, and an announcement of who earned the Tool for Health 5:00 pm. On Friday, a recipe video was posted at 8:15 am and a wrap up of the week’s content was posted between 2:00 pm and 3:00 pm to reinforce the lessons of the week. All of the Facebook posts were scheduled ahead of time to ensure they were delivered at consistent times. Study staff kept track of whether participants viewed posts, participated in activities and homework, and posted in the Facebook group as a measure of meaningful engagement throughout the program. Homework consisted of activities relevant to the topic of the week. Participants who completed the homework by noon on Wednesday were eligible to earn a Tool for Health. Tools for Health during this program included measuring cups, a food scale, a yoga mat, and a foam roller. Participants who had not viewed or interacted with the Facebook in several days were contacted to reduce the likelihood of loss to follow up.

4-week Evaluation

At 4-week Evaluation, anthropometric measures were assessed as participants arrived to increase the time available for socializing and program evaluation, as many participants had limited time due to family obligations. Following anthropometric assessment, participants completed the validated questionnaires along with a Likert scale-based survey of participants’ satisfaction with elements of HealthyLIFE, the program overall, and their self-reported participation on the Facebook page. Participants were then asked to list the top three things they learned from the program. Due to limited space, a physical activity demonstration was not feasible, so a yoga instructor instead led the group through a breathing activity to increase mindfulness and reduce anxiety. The social support aspect of the online community was reinforced during the in-person monthly data collection points, and participants created a texting group to keep in touch with one another following the program.
Data analysis

Analyses consisted of qualitative and quantitative procedures. Weight, waist circumference, and height were measured pre and post intervention. Data were analyzed for frequencies and means after each data collection point. Paired t-tests were conducted to determine statistical differences between the weight and questionnaire-based data (PHQ-2, PAR-Q, CDC Healthy Days, DSSI, PSS) at baseline (Baseline) and 4 weeks into the program (4-week Evaluation) using SAS version 9.4 (264). Process evaluation allowed for tracking the number of active participants, acceptability, and feasibility, including preferred method of content delivery (video, messaging, text), ease of use of the technology, overall satisfaction with the program, and the potential for social network analysis. Freelist data were analyzed using Visual Anthropac version 1.0 (265) for salience following baseline and 4-week Evaluation. Impact evaluation (knowledge, attitudes and beliefs toward healthy living) and reinforcing factors were assessed using focus groups. As described in Paper 1, a trained community health interviewer conducted the focus group following 4-week Evaluation; data were professionally transcribed and analyzed using Atlas.ti version 8.4 for thematic analysis (266).

Results

Participants

Participants (n=10) were female, with an average age of 29.8 years (range 21-40). Seventy percent of baseline participants identified as Hispanic, 20% were African American, and 10% were Native American. Mean BMI was 30.01 (range 20.30-45.87). All participants had graduated high school and 40% of participants had an associate degree. Forty percent of participants were out of work and looking for work, twenty percent were homemakers, and 10% each were employed, self-employed, or students. Seventy percent of participants were married or in a significant relationship, 10% were divorced and 20% were never married. Nearly all participants accessed the internet at home, with 10% accessing the internet elsewhere, identified as the library.
Feasibility

Ten participants attended baseline and nine attended 4-week Evaluation, resulting in 10% attrition rate. Figure 6 shows participant and interventionist engagement by week. Participant views and comments as well as interventionist comments decreased as the program progressed, while participant likes and posts and interventionist ‘likes’ fluctuated during the program. Participants generated 2.67 original posts on average over the course of the program (range 0-14.25). On average, 6.25 participants completed “homework” activities to take steps toward healthier behaviors and to earn Tools for Health weekly (range 5-8). Participants self-reported that they accessed the Facebook page an average of 6.11 days (range 2-7) per week and 3.8 times (range 1-5) per day. Participants reported wearing the Fitbit Flex 2 an average of 6.22 days (range 2-7) per week and wearing it to sleep 5.11 days (range 0-7). MyFitnessPal received the lowest satisfaction score at 3.89 (range 2-5).

![Participant and Interventionist Interactions by Week](image)

Figure 6. Measures of participant engagement and interventionist interaction

Acceptability

An overall program satisfaction score was calculated by averaging participants’ satisfaction with program content videos, recipe videos, Healthful Hints, Fitbit, MyFitnessPal, resources and
articles posted on the closed Facebook page. On a Likert scale of 1-5 (1 was very dissatisfied and 5 was highly satisfied), participants rated HealthyLIFE and its tools an average of 4.76 (standard deviation of 0.26; Table 8). Participants rated the HealthyLIFE program and Facebook page 4.89 out of 5 (range 4-5). Fitbit and MyFitnessPal satisfaction were lower at 4.56 and 3.89, respectively. The Prep Day videos and recipe videos were also rated highly, receiving a 4.89 and 4.78, respectively.

Qualitative results

The freelisting activity at baseline sought to determine participants’ perspectives on two questions: 1) why would someone join a healthy lifestyle program? and 2) what would help someone be successful in a healthy lifestyle program? Salience of a response is a function of the number of participants who mentioned the response and where the response appears on participants’ list; Table 8 lists the salience of all participants’ responses to the freelisting activity. The most salient reason that a person would join a healthy lifestyle program was “to get healthy,” followed by a desire to build social support, feel better, and to eat better. The most salient responses identified to help participants reach their goals were learning new skills, support from other participants, participants’ own effort and commitment, and following the HealthyLIFE recommendations.

<table>
<thead>
<tr>
<th>Average Rating (1-5)</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Score</strong></td>
<td><strong>4.76</strong></td>
</tr>
<tr>
<td>HealthyLIFE Program</td>
<td>4.89</td>
</tr>
<tr>
<td>Facebook Page</td>
<td>4.89</td>
</tr>
<tr>
<td>Fitbit</td>
<td>4.56</td>
</tr>
<tr>
<td>MyFitnessPal</td>
<td>3.89</td>
</tr>
<tr>
<td>Baseline Materials</td>
<td>4.89</td>
</tr>
<tr>
<td>Electronic Resources</td>
<td>4.52</td>
</tr>
</tbody>
</table>
Table 9. Frequency, rank, and salience of responses to freelist questions at Baseline

Why would someone join a healthy lifestyle program?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency (%)</th>
<th>Average Rank</th>
<th>Salience</th>
</tr>
</thead>
<tbody>
<tr>
<td>To get healthy</td>
<td>66.7</td>
<td>1.33</td>
<td>0.583</td>
</tr>
<tr>
<td>To gain social support</td>
<td>22.2</td>
<td>3.5</td>
<td>0.143</td>
</tr>
<tr>
<td>To be happy</td>
<td>22.2</td>
<td>6.5</td>
<td>0.057</td>
</tr>
<tr>
<td>To learn about health</td>
<td>22.2</td>
<td>3</td>
<td>0.138</td>
</tr>
<tr>
<td>To gain skills</td>
<td>22.2</td>
<td>4</td>
<td>0.085</td>
</tr>
<tr>
<td>To feel better</td>
<td>22.2</td>
<td>2.5</td>
<td>0.185</td>
</tr>
<tr>
<td>To stay healthy</td>
<td>22.2</td>
<td>3</td>
<td>0.122</td>
</tr>
<tr>
<td>To eat better</td>
<td>22.2</td>
<td>1.5</td>
<td>0.167</td>
</tr>
<tr>
<td>To take care of myself</td>
<td>11.1</td>
<td>5</td>
<td>0.022</td>
</tr>
<tr>
<td>To take responsibility</td>
<td>11.1</td>
<td>4</td>
<td>0.028</td>
</tr>
<tr>
<td>To reach my goals</td>
<td>11.1</td>
<td>7</td>
<td>0.037</td>
</tr>
<tr>
<td>To improve self-esteem</td>
<td>11.1</td>
<td>2</td>
<td>0.089</td>
</tr>
<tr>
<td>To be successful</td>
<td>11.1</td>
<td>6</td>
<td>0.049</td>
</tr>
<tr>
<td>Own wellbeing</td>
<td>11.1</td>
<td>2</td>
<td>0.099</td>
</tr>
<tr>
<td>Improve depression</td>
<td>11.1</td>
<td>2</td>
<td>0.095</td>
</tr>
<tr>
<td>To get active</td>
<td>11.1</td>
<td>8</td>
<td>0.025</td>
</tr>
<tr>
<td>To make a change</td>
<td>11.1</td>
<td>1</td>
<td>0.111</td>
</tr>
<tr>
<td>Improve quality of life</td>
<td>11.1</td>
<td>3</td>
<td>0.086</td>
</tr>
<tr>
<td>Reduce physical discomfort</td>
<td>11.1</td>
<td>3</td>
<td>0.079</td>
</tr>
<tr>
<td>To look better</td>
<td>11.1</td>
<td>5</td>
<td>0.062</td>
</tr>
<tr>
<td>For a new experience</td>
<td>11.1</td>
<td>7</td>
<td>0.016</td>
</tr>
<tr>
<td>To lose weight</td>
<td>11.1</td>
<td>1</td>
<td>0.111</td>
</tr>
</tbody>
</table>

What things will help you reach these goals?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency (%)</th>
<th>Average Rank</th>
<th>Salience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning new skills</td>
<td>44.4</td>
<td>1.75</td>
<td>0.352</td>
</tr>
<tr>
<td>Support from HealthyLIFE</td>
<td>44.4</td>
<td>3</td>
<td>0.215</td>
</tr>
<tr>
<td>My commitment</td>
<td>33.3</td>
<td>2.67</td>
<td>0.237</td>
</tr>
<tr>
<td>My effort</td>
<td>33.3</td>
<td>2</td>
<td>0.25</td>
</tr>
<tr>
<td>Following the program</td>
<td>33.3</td>
<td>2</td>
<td>0.241</td>
</tr>
<tr>
<td>Learning about health</td>
<td>22.2</td>
<td>2.5</td>
<td>0.156</td>
</tr>
<tr>
<td>Being optimistic/positive</td>
<td>22.2</td>
<td>4</td>
<td>0.059</td>
</tr>
<tr>
<td>Being held accountable</td>
<td>22.2</td>
<td>1</td>
<td>0.222</td>
</tr>
<tr>
<td>Seeing my progress</td>
<td>11.1</td>
<td>2</td>
<td>0.056</td>
</tr>
<tr>
<td>Videos on health behavior</td>
<td>11.1</td>
<td>6</td>
<td>0.019</td>
</tr>
<tr>
<td>Healthy food swaps</td>
<td>11.1</td>
<td>2</td>
<td>0.083</td>
</tr>
<tr>
<td>Getting active</td>
<td>11.1</td>
<td>3</td>
<td>0.056</td>
</tr>
</tbody>
</table>
At the 4-week evaluation, an additional qualitative exercise was conducted. Participants (n=7) were asked to list their key takeaways from the program (Table 9). Due to two participants arriving late, only seven of the nine attendees completed this activity. The most salient responses were linked to one another and were healthy food swaps as depicted in Healthful Hints, weekly recipe videos, and overall how to eat healthier, as was emphasized throughout the HealthyLIFE program.

Focus Group Results

The results of the focus group reflected the participants’ quantitative assessment of the program at the 4-week evaluation. Participants viewed the HealthyLIFE program favorably, with two participants saying,

“I think it was really good. It helped me a lot to improve my health life, how to be more active and how to like put a pressure on myself to do better because I need to…. Because if I want something I need to work for it. And if I want to lose weight I need to work for it.”

“They outdid them themselves so it was like really creative and like…like it made me want to watch them because of the way they looked.”

Table 10. Frequency, rank, and salience of responses to qualitative exercises at 4-week Evaluation

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency (%)</th>
<th>Average Rank</th>
<th>Salience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy food swaps</td>
<td>57.1</td>
<td>1.5</td>
<td>0.476</td>
</tr>
<tr>
<td>How to eat healthier</td>
<td>71.4</td>
<td>2.4</td>
<td>0.381</td>
</tr>
<tr>
<td>The importance of being healthy</td>
<td>28.6</td>
<td>2</td>
<td>0.19</td>
</tr>
<tr>
<td>How to track activity</td>
<td>28.6</td>
<td>2</td>
<td>0.19</td>
</tr>
<tr>
<td>How to use Fitbit</td>
<td>28.6</td>
<td>2.5</td>
<td>0.143</td>
</tr>
<tr>
<td>How to stay healthy</td>
<td>14.3</td>
<td>1</td>
<td>0.143</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>14.3</td>
<td>1</td>
<td>0.143</td>
</tr>
<tr>
<td>Food tracking</td>
<td>14.3</td>
<td>1</td>
<td>0.143</td>
</tr>
<tr>
<td>How to stay motivated</td>
<td>28.6</td>
<td>3</td>
<td>0.095</td>
</tr>
<tr>
<td>How to stress less</td>
<td>14.3</td>
<td>2</td>
<td>0.095</td>
</tr>
</tbody>
</table>

The exercise and recipe videos were also viewed favorably:
“I like that they put like videos on social media to, you know, uh, to like what kind of exercise to do…. Oh, the recipe that they put up on the, what is the, uh?....Yeah. That’s some good ideas. I didn’t get a chance to make it but I see that how to make it.”

Overall participants appreciated that the videos were short and information-packed and that they were captioned so sound was not required to receive the information presented. Most of the participants were native Spanish speakers, so participants also requested that materials be made available in Spanish as well as English.

As indicated by the satisfaction survey, participants found the use of multiple smartphone applications to be confusing and onerous, requesting that only one app be used in the future.

Participants preferred the Fitbit application to the MyFitnessPal application:

“I like Fitbit the most, because mostly of the steps. Because if I will see like on the app that I didn’t have enough steps, that would motivated me to do something so I could get some steps.”

MyFitnessPal was considered to be confusing and it was sometimes difficult to get it to sync with the Fitbit application to accurately represent the amount of calories burned throughout the day.

Participants also appreciated the ability to interact with other participants in the program:

“I loved it. And I did, I’m… I’m going to say I went through group effort. I’ve lost weight before in the past. I did it all by myself but I realize I’m a little more successful with things when I have like somebody else, even if they’re not just pushing me seeing like they’re pushing somebody else is a motivator.”

However, one participant lamented the fact that physical activity and support-building was not a part of baseline. The photo-based Healthful Hints were not memorable to participants, though participants did appreciate the list of healthy spices that was posted as a Healthful Hint. Participants
said a future program could further engage with participants by calling participants periodically or creating a WhatsApp messaging group to increase interaction with the nDPP Lifestyle Coach and with one another. They would also like weekly meetings or outings to local parks or green spaces to be physically active together and appreciated having child care available at baseline and 4-week evaluation so they could concentrate on the information and activities during these sessions. Finally, many participants regretted the fact that the program was over because of the loss of their new support system:

“Because I had the support of a [makes a sound of being tongue-tied] support group behind me, but I’ll also be sad when Facebook would end and then I won’t have like no support group or nothing, and I go back in my bad habit.”

Quantitative Results

As shown in Table 10, there were no statistically significant differences in anthropometric measures, though average waist circumference decreased by 0.39 inches (p=0.517). Self-rated overall health (CDC-Healthy Days) improved by 0.44 points (p=0.104) and average poor health days in the past month decreased from 13.00 to 8.94 (p=0.548). PSS scores improved most significantly, decreasing by an average of 3.22 points (p=0.098). Participants’ scores on the PHQ-2 also decreased from 1.56 to 1.00, though not statistically significantly (p=0.195).

Table 11. Differences in anthropometric measures and questionnaire scores from Baseline to 4-week Evaluation

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>4-week Evaluation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (St Dev)</td>
<td>185.19 (58.97)</td>
<td>185.71 (59.69)</td>
<td>0.506</td>
</tr>
<tr>
<td>BMI (St Dev)</td>
<td>30.01 (6.78)</td>
<td>30.09 (6.93)</td>
<td>0.5794</td>
</tr>
<tr>
<td>Waist circumference (St Dev)</td>
<td>42.14 (9.73)</td>
<td>41.75 (8.31)</td>
<td>0.517</td>
</tr>
</tbody>
</table>
Discussion

The purpose of this study was to evaluate the feasibility and acceptability of HealthyLIFE, the social media adaptation of the national Diabetes Prevention Program. The majority of program participants self-identified as Hispanic and several participants requested that program materials be translated into Spanish. The nDPP is currently available in Spanish and English, so this request is not only possible but is also a CDC-recognized variation of the program (59). Just two of the participants were African American, corroborating previous evidence that African Americans and African American women are more difficult to recruit into chronic disease prevention programs (117,267). All participants had at least a high school education and 90% of initial participants had access to the internet at home, indicating that literacy and access to the internet would be minimal barriers if the program were translated into participants’ preferred language.

Feasibility of HealthyLIFE was assessed by determining the amount of missing data researchers can expect, the amount of activities and information that can be effectively presented at baseline and the 4-week evaluation, and the amount of participant engagement to expect and interventionist engagement to aim for throughout HealthyLIFE. One participant was lost to follow-up, resulting in 10% attrition, approximately half that of other in-person, online, or text-based interventions (24,31,209,217,228). Since data were checked after baseline and during the 4-week evaluation, there was no missing data and a minimal amount of questions that participants refused to

### Table 11. (Continued)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Days Overall Health (St Dev)</td>
<td>3.22 (0.63)</td>
<td>2.78 (0.63)</td>
<td>0.104</td>
</tr>
<tr>
<td>Poor Health Days (St Dev)</td>
<td>13.00 (9.50)</td>
<td>8.94 (6.73)</td>
<td>0.548</td>
</tr>
<tr>
<td>Duke Social Support Index (DSSI)</td>
<td>29.22 (5.39)</td>
<td>26.00 (4.67)</td>
<td>0.098</td>
</tr>
<tr>
<td>Perceived Stress Scale (PSS)</td>
<td>18.83 (7.68)</td>
<td>16.00 (5.99)</td>
<td>0.0964</td>
</tr>
<tr>
<td>Patient Health Questionnaire-2 (PHQ-2)</td>
<td>1.56(1.50)</td>
<td>1.00 (0.89)</td>
<td>0.195</td>
</tr>
</tbody>
</table>
answer (<1%). Given the effectiveness of this strategy, future implementations should ensure that questionnaires are assessed for completeness during each in-person session to ensure data quality. Participant and interventionist interactions with the HealthyLIFE Facebook page were highest in weeks 1 and 3, with an overall decline as the program progressed. This indicates a need for continuous encouragement of participant engagement and more systematic interventionist involvement in the implementation of HealthyLIFE (32,58).

The completeness of data and participant engagement allowed for meaningful data analysis of anthropometric measures and questionnaire responses. While there were no statistically significant changes at the p=0.05 level in anthropometric measures or questionnaire responses, PSS scores dropped on average 3.22 points from baseline to 4-week evaluation (p=0.096) and PHQ-2 score dropped from 1.56 to 1.00 (p=0.195). These improvements in indicators of perceived stress and depressive symptoms in just four weeks are encouraging and indicate the potential for further improvement over the course of a longer program. A prior study of a 12-week wellness coaching program found statistically significant improvements in quality of life, perceived stress, and depressive symptoms immediately following the program; these results were largely unchanged 3 months following the program, indicating that wellness programs may have long-lasting impacts on participants’ mental and physical wellbeing (268).

Acceptability of HealthyLIFE was assessed via Likert-based satisfaction survey questions, with 1 being “very dissatisfied” and 5 being “highly satisfied” (Table 8; Appendix 9) and via a focus group following the 4-week Evaluation. The overall score (4.76) was based on an average of the ratings of all aspects of the program and indicated high acceptability. The least favorable rating was for MyFitnessPal, though this may be due to the abbreviated nature of the MyFitnessPal orientation at baseline which resulted from participants’ time constraints and the quality of available MyFitnessPal
orientation videos available. The HealthyLIFE program itself as delivered via Facebook received a rating of 4.89, indicating that the adaptation of nDPP content was highly acceptable to participants and adding to the evidence that Facebook is a plausible delivery mechanism for the nDPP (221). Focus group results supported the results of the satisfaction survey, also identifying MyFitnessPal as confusing and preferring the Fitbit application. The Fitbit application now includes the food tracking capability that researchers sought to capture so it is possible to use solely the Fitbit smartphone application in the future, eliminating issues syncing between the two applications and practical issues for participants in navigating two health monitoring applications (269). Based on the results of the freelisting activities, when recruiting for future studies researchers should articulate the program’s emphasis on overall being healthier and learning new skills to be healthy, including how to make comfort foods healthier.

Strengths and Limitations

This study was strengthened by its foundations of an evidence-based program, validated instruments, and use of the same digital weight scale and measurement materials for valid reporting of biometric data. The study also employed community-engaged research, allowing the results of a previous study to dictate the design of the program. Similarly, qualitative themes were determined via emergent coding data rather than imposed by the investigators. Since participants were selected by REACHUP, Inc, participants may not be representative of the whole community and may systematically differ from persons who chose not to participate. Small sample size may contribute to this lack of generalizability, though the conclusions of this analysis may be transferable to similar populations. There is also the chance that participants imposed social desirability bias in process evaluation, telling the interviewer that they liked the program more than they did, though the use of an independent, experienced community health interviewer and absence of all researchers may have mitigated this bias. Further, fidelity of the nDPP as assessed in HealthyLIFE was assessed by two
study staff who were invested in the outcome of the program, potentially biasing the scoring of the fidelity of HealthyLIFE. However, one of the fidelity assessment staff was a certified nDPP lifestyle coach and fidelity was assessed using a standardized tool comparing the program to nDPP objectives, potentially mitigating personal bias in the assessment.

Implications

To date there is little research on how social media platforms like Facebook can be used to reach diverse audiences and to effectively improve health outcomes (28,133,208). This study, while small, shows that a Facebook-based intervention has the potential to continually engage participants, to improve perceived stress and depressive symptoms, and to facilitate a sense of community from which the participants are unwilling to depart. The scalability of this intervention makes it cost-effective and the researchers’ commitment to the fidelity of the nDPP content ensures that participants are receiving the same information in a more compact and time-efficient manner. Though four weeks was too short a time to ascertain HealthyLIFE’s effect on anthropometric measures, the improvements in perceived stress and depressive symptoms are a strong indication that this program should be expanded to cover all 16 weeks of content of the nDPP and those results should be compared with traditional delivery of the nDPP to determine whether this social media-based adaptation is equivalently effective.

References

4. Battista M-C, Hivert M-F, Duval K, Baillargeon J-P. Intergenerational Cycle of Obesity and Diabetes: How Can We Reduce the Burdens of These Conditions on the Health of Future


CHAPTER 6: A GEOSPATIAL ANALYSIS OF RISK FACTORS FOR CHRONIC DISEASE BY CENSUS TRACT AND SPATIAL CORRELATION WITH FEDERALLY QUALIFIED HEALTH CENTERS (FQHCS)

Introduction

In 2014, 60% of American adults had at least one chronic disease and 42% had two or more chronic diseases (1,70); these proportions continue to increase given the development of chronic disease management and life-extending technologies (1,70). Of the top ten leading causes of death in the United States, seven are chronic conditions and three of those are obesity-related illnesses: diseases of the heart, cerebrovascular diseases, and diabetes mellitus (71). People with multiple chronic conditions have poorer overall health and access more health services, spending more on healthcare compared to individuals with no chronic conditions due to the complexity of balancing their conditions with appropriate treatment regimens (1–3,70). As such, chronic disease treatment and management costs over $1 trillion per year in the United States (73), with the Centers for Disease Control and Prevention (CDC) identifying chronic diseases as, “the most common, costly, and preventable of all health problems in the United States (74),” further emphasizing the need for effective prevention strategies among populations experiencing chronic diseases at higher levels.

People of minority background and those who are uninsured or underinsured are more likely to experience risk factors for chronic disease compared with non-Hispanic whites and persons with private healthcare, and are likewise more likely to develop chronic disease and to experience unmanaged chronic disease (35,36,116). These populations also experience significant barriers to health care, including lack of access to primary care services, cultural, social, and linguistic barriers,
high copays, and low health literacy and education (250). One of the most significant barriers to healthcare is transportation, with 10-51% of patients reporting that inconsistent public or private transportation is a barrier to obtaining healthcare, particularly for those who are uninsured, underinsured, or Medicaid insured (251).

In 2014, 7% of Americans were served at federally qualified health centers (FQHCs) compared with 5% in 2005, resulting in 8.7 million more Americans receiving care at these facilities. FQHCs are community-based organizations that provide comprehensive primary and preventative care including physical, oral, and mental health and substance abuse services (270). These centers receive higher reimbursement from Medicare and Medicaid, offer a sliding fee scale, and serve either an underserved area or population (254). Persons who were uninsured or on Medicaid comprised the greatest proportion of people seeking care at FQHCs (13.5%-17.3% and 14.7%-17.2%, respectively (254)). Similarly, the rate of increased use of FQHCs was greatest among the underinsured and Medicaid insured compared with privately insured and Medicare populations. Disparities of FQHC use also differed based on socioeconomic status, with more than 25% of people living in poverty accessing care at FQHCs compared with 0.6% of people with incomes that were 200% of the federal poverty level or higher. People ages 0-19 and people of minority background, particularly African American and American Indian people, used FQHCs at consistently higher rates compared with older and white populations (254).

For all Americans, proximity to healthcare services and accessibility to transportation to healthcare services affect healthcare utilization, with less efficient transportation and further commutes resulting in lower healthcare access (35,250,252). The optimal distance to a health clinic is 0.5 miles; people living within 0.5 miles of an FQHC were 38% less likely to access a local emergency department for nonemergent services (255) and were 5 times more likely to access preventive services at the FQHC near their residence (271). However, most Americans do not live
within 0.5 miles of an FQHC or other health clinic, so it is imperative to identify communities with high prevalence of chronic disease and underinsurance with inadequate access to FQHCs. These communities can then be targeted for accessible, evidence-based, culturally appropriate healthy lifestyle programs aimed at meeting local community health needs.

The comprehensive preventive health services provided by FQHCs serve to improve quality of life and health outcomes within medically underserved, under-resourced, and socially and economically disadvantaged populations. These populations are also more likely to experience chronic disease and associated risk factors at disproportionately higher levels compared with people who are not socioeconomically or medically disadvantaged. While these health disparities exist in the general population, studies show that health disparities do not exist among people who access healthcare as FQHCs, indicating that the social determinants of health experienced by persons accessing FQHC services are similar in their influence on health outcomes. It is estimated that current preventive services at FQHCs save $24 billion per year in healthcare associated costs and communities served by FQHCs had 10% lower infant mortality compared with similar areas that are not served by an FQHC (270). Since FQHCs already provide primary and secondary prevention services which are cost effective and improve health outcomes, it is feasible to expand FQHC services to include and emphasize chronic disease prevention programs (270,271).

The national Diabetes Prevention Program (nDPP) is an evidence-based healthy lifestyle program that was adapted from traditional weekly in-person delivery (59) to community implementation (23,26) and telephone-, web- (24), and smartphone application-based (216,218,220) implementation to expand access to more diverse populations and to overcome known barriers to participating in chronic disease prevention programs. The nDPP is not only effective in mitigating chronic disease risk factors, including reduced weight, reduced blood glucose, and increased physical activity, by the end of the 16-week program and through 1 year of follow-up (59); ten years post-
intervention, diabetes incidence in the nDPP and metformin groups were 34% and 18% less, respectively, than the placebo group (38), and fifteen years post-intervention, the lifestyle intervention and metformin groups continued to have reduced diabetes incidence compared with the placebo group (27% and 18% reductions, respectively) (39). Given this extended success in reducing the incidence of diabetes, the nDPP has the potential to mitigate risk factors present in any target population if tailored and delivered effectively. If an evidence-based program like the nDPP was tailored to address the specific needs and concerns of the target community and was delivered via an accessible platform for that community, it is possible that the long-term positive health outcomes could be achieved in an area with high prevalence of chronic disease and associated risk factors (141,267).

Formative research shows that census tracts in Florida with the highest density of minority populations are among the census tracts with the highest diabetes prevalence, hypertension prevalence, obesity prevalence, and highest prevalence of under- and uninsured people (253). As such, it is important to understand the spatial relationship between census tract-level chronic disease and FQHCs. Understanding the spatial correlation between census tract-level estimates of chronic disease risk factors and federally qualified health centers can inform the magnitude of influence of a chronic disease risk factor reduction program on health care access and determine potential geographic areas to be targeted for implementation of tailored chronic disease risk factor reduction programs (272,273).

The purpose of this study was to identify high-risk census tracts in Florida based on prevalence of chronic disease and associated risk factors and to determine the correlation of those census tracts with FQHCs in urban areas in Florida to could benefit from a community-appropriate adaptation of the nDPP such as HealthyLIFE (Chapter 5).
Methods

Study design

This study was a geospatial analysis of census tract-level data, including hotspot analysis of chronic disease and associated risk factors, spatial autocorrelation of FQHCs to determine their distribution pattern within Florida, and correlation of census tracts with high prevalence of chronic disease and associated risk factors with current locations of FQHCs in urban areas in Florida.

Data sources

The Robert Wood Johnson Foundation/CDC 500 Cities data from the CDC website were joined with an existing ArcGIS layer published by the US Department of Health and Human Services (USDHHS) that identified active FQHCs in Florida in 2018. The CDC, in conjunction with the Robert Wood Johnson Foundation, have released census tract-level data on the most populous 500 cities in the United States, called the 500 Cities Project, released in data analysis format and a GIS-friendly format. This analysis is based on 2016 500 Cities Project data, the most recent year for which data are available. These data include information on hypertension, obesity, chronic heart disease, mental health, and strokes in the 20 largest Florida cities. Demographic data from 2018 on race, median household income, and level of educational attainment by census tract were obtained from the ArcGIS GeoEnrichment tool.

Data analysis

Chronic disease risk factor data were geospatially analyzed via the hotspots tool in ArcGIS to determine census tracts with the highest and lowest prevalence of chronic disease risk factors within 20 cities across the state of Florida at the p=0.10, 0.05, and 0.01 levels. Spatial autocorrelation of FQHCs was calculated using ArcGIS to determine how FQHCs were spatially distributed across the state. The ArcGIS autocorrelation tool includes five values, including the Moran’s Index and p-value.
Moran’s I is a correlation coefficient that evaluated the total spatial correlation of the data set to determine how similar each observation is to the ones surrounding them (256). Inverse distance methods of spatial relationship assume that areas that are closest to each other are most similar; the formative research (Chapter 4) indicates that this assumption is valid based on the co-occurrence of statistically significantly high prevalence of obesity, hypertension, and diabetes (253). Spatial correlation between census tracts with high prevalence of chronic disease risk factors and current FQHCs was calculated via the Summarize Within tool in ArcGIS. Correlation was considered to be 100% if census tracts were up to 0.5 miles in a straight line from census tracts identified as hot spots (255). Data were then exported to CSV files and analyzed using SAS version 9.4 to determine the presence and magnitude of the spatial relationship between high risk census tracts and FQHC location, assessed via Pearson Correlation Coefficients and p-values (target significance 0.05 or less)

Results

According to USDHHS data, there were 394 FQHCs in Florida (274); the RWJF/CDC 500 Cities data were available for 475 Florida census tracts located in urban areas (275). Of the 475 census tracts, 224 reported the prevalence of high blood pressure; 113 of these census tracts were hotspots at the p=0.01 level (Table 11). Thirty-one FQHCs were located within census tracts for which the RWJF/CDC 500 Cities data were available, within 0.5 miles of 79 census tracts. Tampa, St.

Table 12. Number of census tracts in 500 Cities data with statistically significant hot and cold spots by standard deviation and chronic disease

<table>
<thead>
<tr>
<th>Condition</th>
<th>Standard deviation from the mean</th>
<th>Total census tracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3</td>
<td>-2</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Diabetes</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>42</td>
<td>4</td>
</tr>
<tr>
<td>Stroke</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Obesity</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 12. (Continued)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>1</th>
<th>459</th>
<th>4</th>
<th>0</th>
<th>0</th>
<th>475</th>
</tr>
</thead>
<tbody>
<tr>
<td>On HBP Meds</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>459</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>475</td>
</tr>
<tr>
<td>Poor Physical Health on 14+ days of previous month</td>
<td>12</td>
<td>2</td>
<td>5</td>
<td>384</td>
<td>15</td>
<td>13</td>
<td>44</td>
<td>475</td>
</tr>
<tr>
<td>Less than 7 hours of sleep on average</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>388</td>
<td>14</td>
<td>23</td>
<td>37</td>
<td>475</td>
</tr>
<tr>
<td>Poor Mental Health on 14+ days of previous month</td>
<td>9</td>
<td>6</td>
<td>2</td>
<td>386</td>
<td>13</td>
<td>22</td>
<td>37</td>
<td>475</td>
</tr>
<tr>
<td>Low Physical Activity</td>
<td>13</td>
<td>22</td>
<td>12</td>
<td>332</td>
<td>18</td>
<td>27</td>
<td>51</td>
<td>475</td>
</tr>
<tr>
<td>Underinsured</td>
<td>6</td>
<td>25</td>
<td>14</td>
<td>313</td>
<td>16</td>
<td>31</td>
<td>70</td>
<td>475</td>
</tr>
</tbody>
</table>

Petersburg, Lakeland, and Jacksonville had the greatest proportion of census tracts identified as hot spots of chronic disease and associated risk factors overall; these hotspots were largely contiguous (Figures 7-13; statewide view in Appendix 10). Likewise, Tampa, St. Petersburg, and Lakeland had the greatest number of hot spots which were greater than 0.5 miles away from an FQHC.

Figure 7. Hotspots of diabetes in urban areas of Florida by census tract
Figure 8. Hotpots of high blood pressure in urban areas of Florida by census tract

Figure 9. Hotspots of people lacking health insurance in urban areas of FL by census tract
Figure 10. Hotspots of obesity in urban areas of Florida by census tract

Figure 11. Hotspots of minority residents in urban areas of Florida by census tract
Figure 12. Hotspots of poverty in urban areas of Florida by census tract

Figure 13. Hotspots of low educational attainment (less than a high school diploma) in urban areas of Florida by census tract
Of the FQHCs located in areas for which 500 Cities data were available (n=79; Table 12), less than half of the census tracts served were those with statistically significantly high-risk factor prevalence for seven of the eight examined indicators of chronic disease. Less than 25% of census tracts with high prevalence of coronary heart disease, poor physical health, persons on medications for hypertension, inadequate sleep, poor mental health, and low physical activity were within 0.5 miles of an FQHC. As seen in Table 12, there were no FQHCs located in census tracts identified as statistically significant cold spots for coronary heart disease, diabetes, stroke, poor physical health, inadequate sleep, poor mental health, low physical activity, or lack of insurance. Over two-thirds of census tracts which were hotspots for high blood pressure were within 0.5 miles of an FQHC, though none of the census tracts with statistically significant hotspots for use of medicines to treat high blood pressure were near an FQHC. Census tracts with high prevalence of obesity, low physical activity, diabetes, and poor physical health were highly spatially correlated with one another (r=0.85).

Overall, FQHCs were spatially randomly distributed throughout the state (Moran’s I=0.8503). Census tracts with higher rates of diabetes, stroke, self-reported poor physical health on 14 or more days in the previous month, self-reported low physical activity, and underinsured or uninsured people were statistically significantly more likely to have an FQHC located within 0.5 miles compared with those with high rates of high blood pressure, obesity, persons on medicines to treat high blood pressure, persons getting less than seven hours of sleep per night, and persons self-reporting poor mental health on 14 or more days in the previous month (Table 13).
Table 13. Number of census tracts within 0.5 miles of an FQHC that had statistically significant hot and cold spots by standard deviation and risk factor

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Standard deviation from the mean</th>
<th>Total tracts</th>
<th>% Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-3</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stroke</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Obesity</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>On HBP Meds</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Poor Physical Health on 14+ days of previous month</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Less than 7 hours of sleep on average</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Poor Mental Health on 14+ days of previous month</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Low Physical Activity</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Underinsured</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Low Educational Attainment*</td>
<td>456</td>
<td>69</td>
<td>39</td>
</tr>
<tr>
<td>Poverty*</td>
<td>61</td>
<td>126</td>
<td>68</td>
</tr>
<tr>
<td>Minority Background*</td>
<td>471</td>
<td>135</td>
<td>90</td>
</tr>
</tbody>
</table>

*Indicates data were obtained from the ESRI GeoEnrichment Service

Table 14. Relationship between crude rate of chronic disease/associated risk factor and presence of FQHCs

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Census Tracts (n)</th>
<th>Pearson Correlation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Heart Disease</td>
<td>475</td>
<td>0.08977</td>
<td>0.0506</td>
</tr>
<tr>
<td>Diabetes</td>
<td>475</td>
<td>0.22481</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td>224</td>
<td>0.11649</td>
<td>0.0819</td>
</tr>
<tr>
<td>Stroke</td>
<td>475</td>
<td>0.12852</td>
<td>0.005</td>
</tr>
<tr>
<td>Obesity</td>
<td>475</td>
<td>0.06</td>
<td>0.1584</td>
</tr>
<tr>
<td>On HBP Meds</td>
<td>475</td>
<td>0.03003</td>
<td>0.5139</td>
</tr>
<tr>
<td>Poor Physical Health on 14+ days of previous month</td>
<td>475</td>
<td>0.10359</td>
<td>0.024</td>
</tr>
<tr>
<td>Less than 7 hours of sleep on average</td>
<td>475</td>
<td>0.04809</td>
<td>0.2956</td>
</tr>
<tr>
<td>Poor Mental Health on 14+ days of previous month</td>
<td>475</td>
<td>0.07323</td>
<td>0.1109</td>
</tr>
<tr>
<td>Low Physical Activity</td>
<td>475</td>
<td>0.11173</td>
<td>0.0148</td>
</tr>
<tr>
<td>Underinsured</td>
<td>475</td>
<td>0.09098</td>
<td>0.0475</td>
</tr>
</tbody>
</table>
**Table 14. (Continued)**

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Educational Attainment*</td>
<td>1621</td>
<td>0.04760</td>
<td>0.0571</td>
</tr>
<tr>
<td>Poverty*</td>
<td>1598</td>
<td>0.10521</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Minority Background*</td>
<td>1621</td>
<td>0.06184</td>
<td>0.0128</td>
</tr>
</tbody>
</table>

*Indicates data were obtained from the ESRI GeoEnrichment Service

**Discussion**

This study sought to determine the geospatial relationship between census tracts with high prevalence of chronic disease and the presence of FQHCs and to identify census tracts with high prevalence of disease without access to an FQHC. The contiguous nature of the hotspots suggests that these census tracts are affected by the same determinants of health driving high prevalence of chronic disease (68,153). Given that most census tracts with statistically significantly high prevalence of chronic disease and risk factors for chronic disease were not within 0.5 miles of an FQHC, there are many census tracts which would benefit from community health outreach and accessible healthy lifestyle programs, particularly in Jacksonville, Lakeland, Tampa, and St. Petersburg (255,260). Due to the high level of co-occurrence of obesity, low physical activity, poor physical health, and diabetes, census tracts with statistically significantly high levels of these factors that are not within 0.5 miles of an FQHC should be considered priority areas when implementing a targeted and tailored healthy lifestyle program appropriate to the needs of the community (235,236,276). Just over 20% of census tracts with high prevalence of coronary heart disease, poor physical health, inadequate sleep, poor mental health, and low physical activity, were within 0.5 miles of an FQHC, indicating that these risk factors and chronic diseases are inadequately addressed in most of these urban census tracts (236,276).

The statistically random distribution of FQHCs throughout the state indicates that these health resources are not clustered together geographically, though there is not a strong geospatial relationship between individual chronic disease risk factors and FQHCs, so it is unclear how locations of FQHCs were selected based on the available data (237,252,277). In examining the relationship between
prevalence of individual risk factors and the presence of FQHCs, this study showed that areas with low insurance, low physical activity, poor physical health, high levels of poverty, high concentration of people of minority background, and high prevalence of stroke and diabetes were statistically significantly more likely to be within 0.5 miles of an FQHC, indicating that preventive services are available in these areas and that public health resources were appropriately allocated to address these health concerns (236,272,273). However, areas with high prevalence of obesity, poor mental health, inadequate sleep, and high blood pressure were less likely to be close to an FQHC, indicating that these common health concerns are not currently adequately addressed by current locations of FQHCs (272,273).

While areas already exhibiting poor health outcomes are statistically significantly more likely to have an FQHC close by(255), the focus of public health and preventive services should also include lesser-known and less frequently addressed risk factors for chronic disease. Poor mental health (240), inadequate sleep (278), and high blood pressure (279) are related to chronic disease development, including heart disease, diabetes, and stroke (147,240,278,279). Notably, persons living just 2.4 miles away from an FQHC were 80% less likely to access preventive health services from an FQHC compared with people who lived 0.5 miles from an FQHC. The lack of consistent access to FQHCs in economically disadvantaged and medically underserved areas as found in this study is consistent with the literature(26,35,225,250,277), emphasizing the need to expand preventive healthcare services to reach census tracts that are not geographically close to an FQHC in an effective and cost-efficient manner to improve access and health outcomes. Further, poverty is recognized by the World Health Organization (WHO(240)) as an important risk factor for poor mental health outcomes, highlighting the importance of addressing social determinants of health to improve health outcomes.

While these results are informative, this study is limited by the type of data available: to RWJF/CDC 500 Cities data are only available for census tracts within the 500 largest cities in the
United States for which there are at least 50 observations per census tract (275). This sample size-based censoring may have reduced the visual appearance of hot spots of chronic disease risk factors and may account for the reduced number of census tracts with available data on the prevalence of high blood pressure. Due to the low response rate for self-reported previous diagnosis of high blood pressure, data were available for just 224 census tracts compared with 475 census tracts for all other chronic diseases and associated risk factors. If all census tracts had reported this value, that may have affected the results of the spatial correlation of high blood pressure and current FQHC locations.

Due to the nature of the 500 Cities Project data only addressing the 500 largest cities in the United States, conclusions drawn from cities’ data may not be representative of the whole state. Likewise, high risk census tracts identified as needing greater access to preventive services are in metropolitan areas and draw no conclusions about the health service needs of rural census tracts in Florida. The most recent year for which 500 Cities Data is available is 2016, so census tract-level risk factor prevalence may have changed since the last survey. Similarly, FQHC data from USDHHS were last updated in 2018, so they may not reflect current FQHC locations. Just 79 of the 394 existing FQHCs in Florida were included in this analysis; other FQHCs’ proximity to census tracts with high prevalence of chronic disease risk factors may differ substantially compared with the studied sample.

Implications

It is encouraging that FQHCs in Florida are currently serving areas with low insurance, low physical activity, poor physical health, and high prevalence of stroke and diabetes. However, since obesity, inadequate sleep, poor mental health, and high blood pressure are all risk factors for chronic disease, it is necessary to expand services to areas where prevalence of these risk factors are high. Most census tracts with high prevalence of these risk factors are not within 0.5 miles of current FQHCs in Florida, so these census tracts should be targeted for community- or technology-based adaptations of healthy lifestyle programs such as the nDPP to address these risk factors for chronic
disease to reduced barriers to preventive health services, such as transportation and financial barriers resulting from increased distance to a health clinic. Census tracts with high prevalence of multiple chronic diseases and associated risk factors should be prioritized for targeted for healthy lifestyle program implementation to mitigate the effects of multiple risk factors simultaneously. Future research should consist of qualitative studies to assess community perception of health needs, health beliefs, and barriers to health services to adequately tailor a healthy lifestyle program to the needs of these communities and implementation of that program within communities with comparable needs lacking access to FQHCs and other healthcare resources.

References


9. Centers for Disease Control and Prevention. Racial and Ethnic Approaches to Community Health (REACH) | At A Glance Reports | Publications | Chronic Disease Prevention and Health


36. Social and community context as social determinants of health - Faculty of Medicine and Life Sciences [Internet]. [cited 2018 Sep 5]. Available from: http://www.uta.fi/med/tacc-gh/sdh/key_areas/social_context.html

37. Balk EM, Earley A, Raman G, Avendano EA, Pittas AG, Remington PL. Combined Diet and Physical Activity Promotion Programs to Prevent Type 2 Diabetes Among Persons at Increased Risk:


CHAPTER 7: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

Stopping the cycle of chronic disease: A qualitative study of barriers to healthy behaviors and intergenerational chronic disease prevention in federally-qualified disadvantaged zip codes in west central Florida

In the first study, residents and community leaders in west central Florida participated in interviews and focus groups to explore and identify which health issues were most important to the community, which barriers to healthcare and healthy behaviors were most pervasive, and how to best disseminate health information within the target community. Diabetes, hypertension, cancer, and heart disease were the most frequently identified health concerns among interviewees and focus group participants. The most prevalent barriers to healthcare and healthy behaviors were financial cost, lack of time, lack of reliable transportation, lack of paid time off, distrust of pharmaceuticals, and distrust of medical professionals. Social media was the most frequently cited method of disseminating health information for people of childbearing age, though the senior group reported getting their health information from the local news television station, the newspaper, and senior centers.

Steps toward a HealthyLIFE: The feasibility and acceptability evaluation of a social media-based adaptation of an evidence-based chronic disease prevention program

The second study used the community-specific needs and preferences identified in the first study to adapt the national Diabetes Prevention Program (nDPP) to social media, the preferred method of health information dissemination of the target community. Ten participants began and participated in the program, called HealthyLIFE, and nine participants attended the follow up evaluation four
weeks later, resulting in 10% attrition. Participants consistently created Facebook posts, completed homework, and interacted with Facebook posts. This low attrition rate and high participation indicated that HealthyLIFE was feasible. While there was no statistically significant improvement in weight or waist circumference, there were encouraging improvements in perceived stress and depressive symptoms over the four weeks of the program, indicating the potential for further quality of life improvement for those who complete a 16-week social media-based adaptation in the future. Overall, participants attending the follow up evaluation were satisfied with the program, though they were least satisfied with the MyFitnessPal smartphone application of all materials and technology used in the program.

Geospatial analysis of risk factors for chronic disease by census tract and spatial correlation with federally qualified health centers (FQHCs)

The final study sought to identify census tracts with high prevalence of chronic disease and associated risk factors and to determine whether existing FQHCs are located within 0.5 miles of these census tracts, as is the optimal distance to encourage utilization of preventive services at an FQHC (255). Tampa, St. Petersburg, Lakeland, and Jacksonville had the greatest proportion of census tracts identified as hot spots of chronic disease risk factors overall; these hotspots were largely contiguous. Likewise, Tampa, St. Petersburg, and Lakeland had the greatest number of hot spots which were greater than 0.5 miles away from an FQHC. Overall, FQHCs were spatially randomly distributed throughout the state (Moran’s I=0.8503). Census tracts with higher rates of diabetes, stroke, self-reported poor physical health on 14 or more days in the previous month, self-reported low physical activity, and underinsured or uninsured people were statistically significantly more likely to have an FQHC located within 0.5 miles compared with those with high rates of high blood pressure, obesity, persons on medicines to treat high blood pressure, persons getting less than seven hours of sleep per night, and persons self-reporting poor mental health on 14 or more days in the previous month.
Contribution to Literature

The results of this dissertation provide information to address gaps in the literature regarding the need for a scalable healthy lifestyle program that can be delivered via a mechanism that reaches populations at high risk for chronic disease that have historically low participation rates in traditional in-class delivery of healthy lifestyle programs. At the outset of this dissertation, there was little information about how people of minority background perceive their health, health professionals, the health beliefs that formed these perceptions, and how to best communicate health information to this subpopulation. The first study addressed this gap by identifying the major health concerns, health barriers, and preferred methods of health communication among minority residents of central Florida to inform the content, structure, and delivery of healthy lifestyle programs tailored and targeted to African-Americans in census tracts with low socioeconomic status and high prevalence of chronic disease and associated risk factors.

Based on the results of the first study, the researcher reviewed the literature to find theory-driven, effective, social media-based health education programs. At the time there were few studies incorporating an established social media platform to facilitate behavior change (32,133,208,232); none of these addressed chronic disease prevention via an evidence-based program and none targeted minorities or people of childbearing age. The second study showed that a social media-based delivery of an evidence-based chronic disease like HealthyLIFE could be feasibly conducted among minority women in an urban area with high prevalence of chronic disease. The high participant satisfaction with the HealthyLIFE program indicated that a social media-based delivery of an evidence-based program was also highly acceptable to the target population despite the barriers faced by this population.

While proximity to healthcare facilities is a determinant of healthcare access (252,273,277), there was little information on how FQHCs were geospatially related to areas with high prevalence of...
chronic disease and associated risk factors in Florida at the sub-county level. The final study identified census tracts in Florida, particularly in Tampa, St. Petersburg, Lakeland, and Jacksonville, with high prevalence of chronic disease and associated risk factors that are not within 0.5 miles of an FQHC. These high-risk census tracts have the least amount of healthcare resources and should be targeted for healthy lifestyle interventions that meet the needs and preferences of the community to ensure acceptability within these census tracts.

**Strengths**

This dissertation is strengthened by its mixed method, grounded theory approach to address the multifaceted issue of barriers to chronic disease prevention. The first study identified health priorities, health beliefs, barriers to healthy behaviors, and preferred methods of health communication among residents and key informants of a medically, socially, and financially disadvantaged area in Tampa, FL. These data directly informed the HealthyLIFE program to increase acceptability and cultural appropriateness among the target population. The use of Facebook as a delivery mechanism for HealthyLIFE is another asset to this study, with all racial/ethnic groups accessing Facebook in similar proportions (30). The high satisfaction rating among participants who completed the HealthyLIFE program indicates that the information collected during the first study was appropriately applied to the adaptation of the national Diabetes Prevention Program to engage the target population. The third study is strengthened by the use of census-tract level data to identify urban areas at high risk for and with high prevalence of chronic disease and associated risk factors. The study is further strengthened through the use of a geospatial analysis layer containing the locations of federally qualified health centers that were active in Florida in 2018, the most recent year for which data are available.
Limitations

While the results of the first study are not generalizable due to the nature of qualitative research, the results may be transferable to people of minority background living in medically underserved urban areas in the United States. Further, the quantity of focus groups and key informant interviews may not have achieved saturation in assessing barriers to healthy behaviors and health beliefs of the target population. The second study is limited by the number of participants and the ethnic background of participants in the study. While the ten participants in the study were very active, they may differ systematically from people who chose not to participate in the study, resulting in selection bias. Most participants were Hispanic so culture may have affected the results of the study, affecting the generalizability of the findings. In the third study, small area estimates as calculated by the CDC and Robert Wood Johnson Foundation were examined, though these estimates were only available for 475 census tracts in the state. Most census tracts were in the Tampa Bay, Lakeland, and Jacksonville areas, so the results may not accurately reflect the relationship between FQHCs and census tracts with high prevalence of chronic disease and associated risk factors in other urban areas in Florida. This dissertation sought to understand the barriers to healthy behaviors for people of minority background. This term can be used to encompass all non-Hispanics white persons or can specify racial/ethnic groups. As such, further research should specifically identify and characterize the needs of individual racial/ethnic groups to ensure transferability to other geographic areas. This would ensure that a program like HealthyLIFE could be appropriately adapted and implemented to best meet the needs of the population being served.

Public Health Implications

Altogether the results of this dissertation have significant public health implications. Qualitative research can be used to validate conclusions drawn from quantitative data about health priorities in a target population and can inform how social determinants of health interact to impede or
facilitate participation in healthy behaviors. That data can then be effectively applied to an existing chronic disease prevention program to ensure participant engagement and acceptability while increasing self-efficacy. This program can then be targeted toward census tracts with high prevalence of chronic disease and associated risk factors, as less than 25% of high prevalence census tracts are currently served by FQHCs in Florida. Prior to implementation of an adapted chronic disease prevention program, qualitative formative research should be conducted to inform the adaptation and implementation of evidence-based interventions in areas of need.

Future Directions

Based on the results of this dissertation, future research should focus on adapting the remainder of the nDPP to Facebook and piloting the 16-week HealthyLIFE program, again assessing feasibility and acceptability, but also determining how HealthyLIFE affects weight loss and other anthropometric measures, comparing them to the CDC-recognized effectiveness measures for the traditional delivery of the nDPP. Once the effectiveness of the 16-week HealthyLIFE program is known, a three-armed clinical trial can be conducted to demonstrate equivalence of HealthyLIFE to the traditional delivery of the nDPP and Noom, the smartphone application-based, CDC-recognized adaptation of the nDPP. After equivalence is determined, HealthyLIFE can be scaled up further to reach residents of census tracts with high prevalence of chronic disease and associated risk factors that are not within 0.5 miles of an FQHC, the ideal distance to increase utilization of preventive healthcare services.

Conclusions

The results of this dissertation demonstrate the need for qualitative research to inform interventions to disrupt the etiology of chronic disease at the population level, particularly for people of minority background and low socioeconomic status who may experience greater barriers to participating in healthy behaviors and accessing preventive healthcare services. Integrating this type
of data into the design and implementation of chronic disease prevention programs can increase uptake by populations with historically low participation in these programs. With FQHCs serving less than 25% of urban census tracts with high prevalence of chronic disease and associated risk factors, there is a need for cost-efficient, effective, scalable, and accessible chronic disease prevention programs like HealthyLIFE to improve population health and reduce health disparities between racial and socioeconomic groups.
REFERENCES


94. Chronic Obstructive Pulmonary Disease Among Adults — United States, 2011 [Internet]. [cited 2018 Aug 21]. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/mm6146a2.htm


116. Centers for Disease Control and Prevention. Racial and Ethnic Approaches to Community Health (REACH) | At A Glance Reports | Publications | Chronic Disease Prevention and Health


153. Social and community context as social determinants of health - Faculty of Medicine and Life Sciences [Internet]. [cited 2018 Sep 5]. Available from: http://www.uta.fi/med/tacc-gh/sdh/key_areas/social_context.html


177. Five Take-Aways on Breaking the Cycle of Poverty [Internet]. [cited 2018 Sep 6]. Available from: https://sff.org/five-take-aways-on-breaking-the-cycle-of-poverty/


190. Dolan K, Carr JL. The Alarming Spread of the Criminalization of Poverty. 2015;


199. Pavao CAO. Community Engagement efforts at NIH: examining best practices to bridge community and research agendas. :29.


211. An Interactive Text Message Intervention to Reduce Binge Drinking in Young Adults: A Randomized Controlled Trial with 9-Month Outcomes [Internet]. [cited 2018 Sep 12]. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0142877


274. Federally Qualified Health Centers [Internet]. [cited 2019 May 1]. Available from: https://www.arcgis.com/home/item.html?id=09a11bce96c04f16bcb196dd2c521b71


APPENDICES
Appendix 1. IRB Determination that Study 1 is not Research

Study: AHNT (Pro00028273)

Description: This study is a formative research project which serves as a community needs assessment in regard to health beliefs, access to care, reproductive life planning, nutrition, safety, physical activity, and information sharing in order to facilitate wellness in women of childbearing age. Data will be collected via interview from key community informants identified by REACHUP, Inc., and via focus groups with persons in the REACHUP, Inc. service area.

Principal Investigator: Janice Zgibor

Study Type: Social-Behavioral

Funding Sources: Investigator's USF Department

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8 Reviewer Notes Logged. If you have questions you can contact me at vmenzel@usf.edu. Please include your Pro# in the subject line. In order to send back your application once you have addressed all concerns you will have to click on 'submit requested revisions'. Thank you.

Department Approved

Schwartz, Skai

1/27/2016 8:28 PM
June 18, 2018

Janice Zgibor, RPh, Ph.D., MPH
Epidemiology and Biostatistics
College of Public Health 13201 Bruce B. Downs
Tampa, FL 33612

RE: Not Human Subjects Research Determination
IRB#: Pro00034431
Title: A Healthy Lifestyle Intervention for Women of Childbearing Age (HealthyLIFE)

Dear Dr. Zgibor:

The Institutional Review Board (IRB) has reviewed your application. The activities presented in the application involve methods of program evaluation, quality improvement, and/or needs analysis. While potentially informative to others outside of the university community, study results would not appear to contribute to generalizable knowledge. As such, the activities do not meet the definition of human subject research under USF IRB policy, and USF IRB approval and oversight are therefore not required.

While not requiring USF IRB approval and oversight, your study activities should be conducted in a manner that is consistent with the ethical principles of your profession. If the scope of your project changes in the future, please contact the IRB for further guidance.

If you will be obtaining consent to conduct your study activities, please remove any references to "research" and do not include the assigned Protocol Number or USF IRB contact information.

If your study activities involve collection or use of health information, please note that there may be requirements under the HIPAA Privacy Rule that apply. For further information, please contact a HIPAA Program administrator at (813) 974-5638.

Sincerely,

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board
8/28/2018

Krystina Johnson  
College of Public Health  
Tampa, FL 33620

RE:  Expedited Approval for Initial Review  
IRB#:  Pro00036100  
Title:  Healthy Neighborhoods, Healthy Families

Study Approval Period: 8/28/2018 to 8/28/2019

Dear Ms. Johnson:

On 8/28/2018, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol Document(s):
Healthy Families Protocol

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for nonresearch purposes (such as medical treatment or diagnosis).
Your study qualifies for a waiver of the requirements for the informed consent process for this retrospective record review as outlined in the federal regulations at 45CFR46.116 (d) which states that an IRB may approve a consent procedure which does not include, or which alters, some or all of the elements of informed consent, or waive the requirements to obtain informed consent provided the IRB finds and documents that (1) the research involves no more than
minimal risk to the subjects; (2) the waiver or alteration will not adversely affect the rights and welfare of the subjects; (3) the research could not practicably be carried out without the waiver or alteration; and (4) whenever appropriate, the subjects will be provided with additional pertinent information after participation.

The PI will enter into a data use agreement (DUA) with the Florida Department of Health before the limited data set is received. Once the fully executed DUA is received, the PI must submit a copy to the IRB via amendment.

This research involving pregnant women or fetuses meets the requirements for approval per 45 CFR §46.204.

This research involving neonates of uncertain viability/nonviable neonates was approved under 45 CFR 46.205

Per CFR 45 Part 46, Subpart D, this research involving children was approved under the minimal risk category 45 CFR §46.404: Research not involving greater than minimal risk.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) business days.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

E. Verena Jorgensen, M.D.,
Chairperson USF Institutional Review Board
Appendix 4. Guide for Key Informant Interviews and Focus Groups

Health Questions:

1. What do you believe healthy is to you? What helped shaped your thoughts about that?
2. What are some diseases that run in your family? Do you think you’ll have those same diseases? Diabetes, Hypertension, Cancer and Heart Disease?
   a) Under what circumstances would you wait or not wait to see a doctor for medical attention?
   b) What benefit do you see when going to the doctors?
   c) What are your thoughts about home remedies and herbal medicines/supplements?
   d) Do you use any home remedies or supplements? Why? When? Under what circumstances? Are they better or the same or not as effective?
   e) How do you feel about taking medicine?
   f) Would you take medicine given to you by someone other than your physician?
   g) What are some things you can do to get healthy? Let’s make a list of activities to improve health:
      - yoga
      - meditation
      - acupuncture
      - herbal medicine
      - prayer
      - other relaxation techniques
      - other

3. What do you consider to be healthy food?
4. Do you see sleep as related to health? What typically keeps you from getting a good night sleep?

Community Questions:

5. How does your (community/staff/others you serve) think about “being healthy” or “getting healthy”?
6. In your (community/clinic/other), what do most of the families feel about getting or being healthy?
7. Does your community have good access to health care?
   Examples/prompts:
   - Insurance
   - Transportation
   - Physical/financial/social (comfort) factors
8. Does your community have health care insurance coverage? Is it good enough?
9. Other than being pregnant, are the women in your community able to go to the doctors/clinics? If no, why not? If yes, where do they go?
10. Have you heard of reproductive life planning?
a. If yes, what does it mean to you? How is reproductive life planning approached in your community?
   b. If no, have you heard of family planning or birth control? What do those mean to you? How is (family planning/birth control) approached in your community?
11. Do you believe that safety is a factor in supporting health? If yes, how? If no, why not?
   a. How do you define safety?
   b. What is safe?
   c. What is unsafe?
12. Under what circumstances would you (or members of your community) call the police? What is the basis of your decision?
13. What, if any, transportation issues or challenges exist in your community?
14. Do you see sleep as related to health? What typically keeps you from getting a good night’s sleep?
15. Are there places in your community for exercise or physical activity?
16. Is there access to fruits and vegetables in your community?
17. Do the men in your community play a significant role in the health decisions of women in your community? If yes, how so?
18. How does having/not having a job affect health? How does having/not having a job affect safety?

Health Information Questions:

19. How do you share health information in your community? What’s the best place to share health information?
   a. What information do you want to hear more of about health?

   Prompts
   Primary care physician
   Obstetrician/gynecologist
   Family, friends
   Senior lady like Grandma or Auntie
   Entertainers like Beyonce
   Your husband/boyfriend/baby’s father
   Healthy Start worker
   Minister
   Other

   b. Where would you prefer to hear about health information? Make a list

   Prompts
   Television – what channels
   Radio – what stations
   Billboards
   Ads in grocery stores and other stores
   Bus wraps or bus benches or ads inside busses
   Text messages
   Internet
   Other
20. If you could change one thing to improve the health of your community, what would it be?

ENDING: Facilitator provides a summary of examples/answers heard, and asks:
Is there anything else you would like to talk about that we have not covered today? What else do we need to know?
## Appendix 5. Calendar of HealthyLIFE Content Delivery

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<th>Week 1: Get Active</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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<th>Week 2: Ready, Set, Track!</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
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<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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<table>
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<tr>
<th>Week 3: Eat Well to Prevent T2</th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
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</thead>
</table>
| Week 4: Track Your Food | Self care | Tasty video | 1. How do I remember to track my food?  
2. The importance of macros  
3. Commit to tracking all of your meals and snacks this week | 1. Tool for health: food scale  
2. Talk about serving sizes (meats)  
Time:  
Location: |
Appendix 6. Baseline and 4-week Evaluation Questionnaire

Participant survey for introduction session

Today’s Date (mm/dd/yyyy): ____ ____ / ____ ____ / ____ ____

Section 1: Demographic Information
Section 2: Healthy Days
Section 3: Perception of Stress
Section 4: Perceived Stress Scale
Section 5: Patient Health Questionnaire
Section 6: Physical Activity Readiness

Your responses are very important. Please make sure that you read and answer each of the questions on both sides of this survey.

Thank you very much in advance for completing this survey.
Section 1: Demographic Information
Please mark or fill in the blanks below.

1. What is your race/ethnicity?
   ☐ Asian/Pacific Islander     ☐ White
   ☐ Black or African American ☐ Other: ________________
   ☐ Hispanic or Latino        ☐ Prefer not to answer
   ☐ Native American or American Indian

2. What is your age? ________________

3. What is the highest level of education you’ve completed?
   ☐ Less than high school       ☐ Bachelor’s degree
   ☐ Some high school, no diploma ☐ Master’s degree
   ☐ High school graduate, diploma/GED ☐ Professional degree
   ☐ Some college credit, no degree ☐ Doctorate degree
   ☐ Trade/technical/vocational training ☐ Prefer not to answer
   ☐ Associate degree

4. Employment Status: Are you currently…?
   ☐ Employed for wages       ☐ A student
   ☐ Self-employed            ☐ Military
   ☐ Out of work and looking for work ☐ Retired
   ☐ Out of work but not currently looking for work ☐ Unable to work
   ☐ A homemaker              ☐ Prefer not to answer

5. Relationship status:
   ☐ Now married             ☐ Separated
   ☐ Widowed                 ☐ Never married
   ☐ Divorced                ☐ In a significant relationship/not married

6. Household income:
   ☐ 0-$9,999         ☐ $10,000-$19,999      ☐ $20,000-$29,999
   ☐ $30,000-$39,999  ☐ $40,000-$49,999  ☐ $50,000+
   ☐ Prefer not to answer

7. What zip code do you live in? ________________

8. How many children under 19 years old do you have/live with you? ________________
9. Where do you most frequently access the internet?
   ☐ Home  ☐ Work  ☐ Library
   ☐ School  ☐ Other (please write-in)_________________

10. How many times have you been pregnant? _____________________

11. How many live births have you had? _________________________

12. Have you ever been told you have gestational diabetes or diabetes during pregnancy?
   ☐ Yes  ☐ No  ☐ Unsure

13. How did you hear about HealthyLIFE? __________________________

---

Section 2: Healthy Days
The following questions will ask about your general health and healthy days in the past 30 days.

1. Would you say your general health is:
   ☐ Excellent  ☐ Very good  ☐ Good  ☐ Fair  ☐ Poor

2. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?

   __________________________________________________________

3. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

   __________________________________________________________

4. During the past 30 days, for about how many days did poor physical and mental health keep you from doing your usual activities, such as self-care, work, or recreation?

   __________________________________________________________
Section 3: Duke Social Support Index
The following questions are about your social networks and support.

1. Other than members of your family, how many persons in your local area do you feel you can depend on or feel very close to?
   - None
   - 1-2 people
   - More than 2 people

2. How many times during the past week did you spend time with someone who does not live with you, that is, you went to see them, or they came to visit you, or you went out together? ______________________

3. How many times did you talk to someone (friends, relatives, or others) on the telephone in the past week (either they called you, or you called them)?
   ______________________

4. About how often did you go to meetings of clubs, religious meetings, or other groups that you belong to in the past week?
   ______________________

5. Does it seem that your family and friends (people who are important to you) understand you?
   - Hardly ever
   - Sometimes
   - Most times

6. Do you feel useful to your family and friends (people important to you)?
   - Hardly ever
   - Sometimes
   - Most times

7. Do you know what is going on with your family and friends?
   - Hardly ever
   - Sometimes
   - Most times

8. When you are talking with your family and friends, do you feel you are being listened to?
   - Hardly ever
   - Sometimes
   - Most times

9. Do you feel you have a definite role (place) in your family and among your friends?
   - Hardly ever
   - Sometimes
   - Most times

10. Can you talk about your deepest problems with at least some of your family and friends?
    - Hardly ever
    - Some of the time
    - Most of the time

11. How satisfied are you with the kinds of relationships you have with your family and friends?
    - Very dissatisfied
    - Somewhat dissatisfied
    - Satisfied
Section 4: Perceived Stress Scale

The following questions ask about your feelings and thoughts **during the last month**.
Please check how often you felt or thought a certain way.

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<th>Almost never</th>
<th>Sometimes</th>
<th>Fairly often</th>
<th>Very often</th>
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In the **last month**, how often have you been upset because of something that happened unexpectedly?

In the **last month**, how often have you felt that you were unable to control the important things in your life?

In the **last month**, how often have you felt nervous and “stressed”?

In the **last month**, how often have you felt confident about your ability to handle your personal problems?

In the **last month**, how often have you felt things were going your way?

In the **last month**, how often have you found that you could not cope with all the things you had to do?

In the **last month**, how often have you been able to control irritations in your life?

In the **last month**, how often have you been able to control irritations in your life?

In the **last month**, how often have you felt you were on top of things?

In the **last month**, how often have you been angered because of things that were outside of your control?

In the **last month**, how often have you felt difficulties were piling up so high you could not overcome them?
Section 5: Patient Health Questionnaire

Over the **last 2 weeks**, how often have you been bothered by the following problems? Please check the one that best describes how often you feel this way.

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<th>Several days 2-6 days</th>
<th>More than half of the days 7-11 days</th>
<th>Nearly every day 12-14 days</th>
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Little interest or pleasure in doing things

Feeling down, depressed, or hopeless

Section 6: Physical Activity Readiness

The following questions are about your general health and physical activity readiness. Please check yes or no.

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<th>No</th>
</tr>
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<tbody>
<tr>
<td>Has your doctor ever said that you have a heart condition or high blood pressure?</td>
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<td></td>
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<tr>
<td>If yes, please list condition here:</td>
<td></td>
<td></td>
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<tr>
<td>Do you feel pain in your chest at rest, during your daily activities of living, or when you do physical activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you lose balance because of dizziness or have you lost consciousness in the last 12 months? (Please answer NO if your dizziness if associated with over-breathing including vigorous exercise)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, please list condition here:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are you currently taking prescribed medications for a chronic medical condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, please list condition(s) and medications here:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(Please answer NO if you had a problem in the past, but it does not limit your current ability to be physically active)

If yes, please list condition(s) here:

Has your doctor ever said you should only do medically supervised physical activity?

Thank you very much for completing this survey.
Appendix 7. Focus Group Guide

1. What did you think of the HealthyLIFE program overall?
   a. Probe: if they say they like it, probe for what was it that they liked. If they did not like it probe for what about it, they did not like. Ask for examples of what they liked or did not.

2. What did you think about the videos?

3. How relevant was the information in the videos?
   a. Probe: If they say it was relevant – what aspects were relevant.

4. What did you think about the photo-based Healthful Hints?

5. What did you think about the recipe videos?

6. Was there a better way for us to communicate with participants?
   a. Was there too much communication? Was there too little communication?

7. Did it help to have a number to text or call when you wanted clarification?
   a. Did they use it? What was the experience? What was helpful about it.

8. Thinking about Facebook, MyFitnessPal, and Fitbit, which was most helpful to you and why?
   a. Probe: Ask about what each added individually.

9. How did HealthyLIFE affect how connected you feel to other people?

10. How confident are you that you can make healthy choices for yourself and your family?
    a. What about the program makes you feel confident?

11. How can we improve the HealthyLIFE?
    a. Is there anything you would change, add or remove?
## Appendix 8. NDPP Fidelity Assessment Tool

### Baseline: Introduction to program

<table>
<thead>
<tr>
<th>Participation Guide</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediabetes basics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevent T2 Goals</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>- First 6 months, lose at least 5-7 percent of starting weight and get at least 150 minutes of physical activity each week</td>
<td></td>
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</tr>
<tr>
<td>T2 Diabetes basics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your six-month goals: activity and weight goals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss by the numbers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coaches Manual</td>
<td>Modified Y/N</td>
<td>Content Comparison (1-4 scale)</td>
<td>Comments</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------</td>
<td>-------------------------------</td>
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</tr>
<tr>
<td>Q&amp;A opportunity</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

### Objectives

- Program overview
- Basics of T2 diabetes

### Plan for success

**Week 1: Get Active to Prevent T2**

<table>
<thead>
<tr>
<th>Participant Guide</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Story/Background</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Implementation/Suggestions

<table>
<thead>
<tr>
<th>- Ways to get active</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Are you ready to get active?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Be active, be safe</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### How to cope with challenges

### Q&A opportunity

<table>
<thead>
<tr>
<th>Coaches Manual</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;A opportunity</td>
<td></td>
<td></td>
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</tbody>
</table>

### Objectives

<table>
<thead>
<tr>
<th>- Benefits of getting active</th>
<th></th>
<th></th>
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</thead>
</table>

- Ways to get active

Plan for success

**Week 2: Track Your Activity**

<table>
<thead>
<tr>
<th>Participant Guide</th>
<th>Modified Y/N</th>
<th>Content Comparisons (1-4 scale)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session focus:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The purpose of tracking and how to track your activity</td>
<td></td>
<td></td>
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</tbody>
</table>

| Implementation/Suggestions: | | | |
|-----------------------------| | | |
| - How to track your activity. You’ll want to record your minutes in your fitness log | | | |

How to cope with challenges
### Coaches Manual

<table>
<thead>
<tr>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;A opportunity</td>
<td></td>
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</tbody>
</table>

#### Objectives

- Purpose of tracking

- How to track your activity

#### Plan for success

---

**Week 3: Eat Well to Prevent T2**

<table>
<thead>
<tr>
<th>Participant Guide</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Session focus:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How to eat well, how to build a healthy meal, the items in each food group</td>
<td></td>
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</tr>
</tbody>
</table>
## Suggestions/Implementation

- **A Healthy Meal:** What you’ll want to make and what you can also have (with measurements)
- **Make your plate activity**
- **Lists of foods to choose and foods to limit**

### How to cope with challenges

<table>
<thead>
<tr>
<th>Coaches Manual</th>
<th>Modified Y/N</th>
<th>Content comparison (1-4 scale)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q&amp;A opportunity</td>
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### Objectives

- **How to eat well**
<table>
<thead>
<tr>
<th>- How to build a healthy meal</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Food groups</td>
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<td></td>
</tr>
<tr>
<td>Plan for success</td>
<td></td>
<td></td>
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</table>
### Week 4: Track your food

<table>
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<th>Participant Guide</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Story/Background</td>
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<tr>
<td>Implementation/Suggestions</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- How to track your food</td>
<td></td>
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<td></td>
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<tr>
<td>- Everyday objects and serving size examples</td>
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<td></td>
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<tr>
<td>- Hands and serving size</td>
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<td></td>
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<tr>
<td>- Make sense of food labels example</td>
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<tr>
<td>How to cope with challenges</td>
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</table>

<table>
<thead>
<tr>
<th>Coaches Manual</th>
<th>Modified Y/N</th>
<th>Content Comparison (1-4 scale)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Q&amp;A opportunity</td>
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</tr>
<tr>
<td>Objectives</td>
<td></td>
<td></td>
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<tr>
<td>- Purpose of tracking</td>
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<tr>
<td>- How to track your food</td>
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<td></td>
<td></td>
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<tr>
<td>- Make sense of food labels</td>
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<tr>
<td>Plan for success</td>
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Appendix 9. Satisfaction Survey at 4-week Evaluation

Participant survey for introduction session

Today’s Date (mm/dd/yyyy): ____ ____ / ____ ____ / ____ ____
Please mark or fill in the blanks below.

1. What is your age? ____________________

2. Overall, how satisfied were you with the HealthyLIFE program?
   Not satisfied                           Very satisfied
   1   2   3   4   5

3. Overall, how satisfied are you with the HealthyLIFE Facebook page?

4. On average, how many days per week did you access the Facebook page?
   1   2   3   4   5   6   7

5. On average, how many times per day did you access the Facebook page?
   1   2   3   4   5+

6. Overall, the Fitbit was easy to use.
   Strongly disagree                      Strongly agree
   1   2   3   4   5

7. Overall, the Fitbit app/website was easy to understand.
   Strongly disagree                      Strongly agree
   1   2   3   4   5

8. On average, how many days did you wear your Fitbit throughout the day?
   1   2   3   4   5   6   7

9. On average, how many days did you wear your Fitbit to sleep?
   1   2   3   4   5   6   7

10. Overall, the MyFitnessPal app/website was easy to understand.
    Strongly disagree                     Strongly agree
    1   2   3   4   5

11. The prep day videos (Sunday videos) were informative.
    Strongly disagree                     Strongly agree
    1   2   3   4   5

12. I liked the recipe videos.
    Strongly disagree                     Strongly agree
    1   2   3   4   5

Please check how much you agree with the following:
I found the following resources helpful.
<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Strongly agree</th>
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</thead>
<tbody>
<tr>
<td>Do you need extra support?</td>
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<tr>
<td>Let’s spice things up</td>
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<tr>
<td>Top parks in the city of Tampa</td>
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<tr>
<td>SMART goals</td>
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<tr>
<td>Helpful hands handout</td>
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<td>Healthful Tips</td>
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<td>Refrigerator magnets</td>
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<td>Healthy plate</td>
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<td>Tools for Health</td>
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Appendix 10. Florida statewide hotspots for chronic disease