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## An Examination of the Impact of the COVID-19 Health Threat, Stress, and Social Isolation on Lifestyle Habits as Analyzed through the Protection Motivation Theory

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AN EXAMINATION OF THE IMPACT OF THE COVID-19 HEALTH THREAT, STRESS, AND SOCIAL  
ISOLATION ON LIFESTYLE HABITS AS ANALYZED THROUGH THE PROTECTION MOTIVATION  
THEORY

by

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A dissertation submitted to the Department of Nutrition and Dietetics in partial fulfillment of

the requirements for the degree of

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BROOKS COLLEGE OF HEALTH

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## Dedication

I dedicate this work to my mother, Haydee Adib. Her support and patience throughout this process kept me moving forward and believing this would be possible. We have arrived, mom.

## Acknowledgments

I would like to thank Dr. Andrea Arikawa for her constant support throughout this process; thank you for always being there for me. Many thanks to Dr. Lauri Wright for her invaluable input and Dr. Paul Fuglestad for his attention. To the three of them, my deepest appreciation. Thank you to my friend Cheryl Marsland, with whom I had the joy to share so many special moments during this journey.

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## Abstract

The COVID-19 emerged in China in 2019 and quickly spread to other countries, leading to mandated lockdowns and social isolation. This cross-sectional study examined the impact of the COVID-19-generated stress, health threat, and social isolation on dietary, physical activity, and self-care habits of adults in Florida, utilizing the PMT as a framework. Participants ( $n = 478$ ) completed online surveys about demographics, perceived stress, and changes in lifestyle habits. Significant positive changes were reported in cooking at home ( $p < .001$ ) frequency, sweets ( $p < .001$ ), and breakfast ( $p = .009$ ) consumption, outdoors physical activity ( $p = .005$ ), self-care ( $p < .001$ ), relaxation ( $p < .001$ ), and rest ( $p < .001$ ) habits. Significant negative changes were reported in fast food ( $p = .004$ ) and snack ( $p < .001$ ) consumption. A significant relationship existed between self-reported stress, perceived threat, ( $r = .33, p < .001$ ), and perceived efficacy, ( $r = -.15, p = .002$ ). Perceived threat was the most important predictor of changes in dietary habits ( $R^2 = .13$ ); stress was the main predictor of physical activity ( $R^2 = .60$ ) and self-care ( $R^2 = .18$ ) changes. Perceived threat and stress predicted changes in dietary ( $\beta = .255, p < .001$ ;  $\beta = .253, p < .001$ ) and physical activity ( $\beta = .177, p < .001$ ;  $\beta = .152, p < .001$ ) scores, and both with perceived efficacy predicted changes in self-care ( $\beta = .184, p < .001$ ,  $\beta = .375, p < .001$ ,  $\beta = .098, p < .05$ ) scores. Protection-motivation seems to influence behavior change in times of distress and may support effective interventions to promote lifestyle changes. To our knowledge, this is the first study to examine the impact of COVID-19 generated stress, health threat, and social isolation on lifestyle habits of adults in Florida utilizing PMT constructs.

## Chapter 1

### Introduction/Background

The Corona Virus Disease 2019 (COVID-19), a highly contagious condition caused by the SARS-CoV-2 coronavirus, emerged in Wuhan, China, in 2019.<sup>1,2</sup> It quickly extended to other countries by the start of 2020.<sup>1</sup> This threat appeared in the United States (U.S.) in December 2019; by June 1, 2021, the country had witnessed more than 33,300,000 cases and 590,000 deaths.<sup>2</sup> The virus seems to spread mostly from person to person through respiratory droplets within close contact.<sup>2,3</sup> In order to control the rapid contagion, governments have recommended lockdown processes and social isolation, and whole countries and populations have had to adapt to stay at home orders. However, human beings are social beings; therefore, social isolation may promote significant psychological effects and stimulate severe stress and anxiety.<sup>4,5</sup> Events such as COVID-19 are characterized by intense stress because of the magnitude of impact and adjustment required to cope effectively with the stress derived from the health threat and lockdown measures. Social isolation has also been shown to produce physiological responses, such as decreased inflammatory control and immunity, which contributes towards higher rates of morbidity and mortality in adults.<sup>4,5</sup>

While countries and populations were placed in lockdown, terms such as social distancing and quarantine became part of people's routines. Businesses closed for undetermined amounts of time to support the isolation mandate; unemployment galloped.<sup>2,3</sup> Face masks and gloves became part of people's wardrobe and fashion displays. The fear of contagion and social isolation turned into a daily experience, increasing stress and anxiety.<sup>6,7</sup> Life stressors such as job loss, economic insecurity, health threat, and lockdown measures may

have promoted resilience and change under specific conditions, which may have been positive or negative.<sup>8</sup> In this way, the COVID-19 pandemic certainly brought enormous changes and acute stress on our social, economic, and psychological global scenes. Initial findings have shown that more than 25% of the Chinese population has experienced moderate to severe levels of stress and/or anxiety related to COVID-19.<sup>1,9</sup> As the pandemic continues, it was noted that as worry with outcomes increased, so did mental health and anxiety disorders.<sup>10-12</sup>

All of COVID-19 derived transformations were also reflected on the availability of and access to food, which could potentially have affected dietary habits. Economic and social adaptations could have had an immediate impact on dietary habits and on the ability of providing meals.<sup>2,3,8,13,14</sup> These new routines could have affected consumers' dietary and lifestyle practices in different ways, leading to a decline or improvement in the nutritional, mental, psychological, and overall health status of groups and individuals.<sup>14,15</sup> Hence, the stress and anxiety created by the social isolation and consequent management of fear of contamination, health threat, job loss, and insecurity urgently promote the need to quickly adapt. So, how did people adapt to the new routines demanded by social isolation and the need to remain mentally and physically healthy to prevent contagion or severe health outcomes?

Outcomes from severe life events are an important area of research. Understanding the COVID-19 generated social, psychological, and physical lifestyle adaptations is imperative to assist our societies as we move forward. While there have been studies on the clinical aspects of the virus and also studies assessing the anxiety, fear, and stress associated with COVID-19, there is little research on the impact of social isolation on stress and anxiety and dietary,

physical activity, and self-care habits.<sup>16</sup> Amid the social anxiety that a pandemic brings, research on this topic is important to understand how individuals react and adapt to social isolation and to generate effective interventions to support the basic mental and physical health needs of the population.<sup>8</sup> Therefore, the purpose of this study was to examine the relationship between the COVID-19 generated health threat, stress, and imposed social isolation with the dietary, physical activity, and self-care habits of adults. This study aimed to explore whether and how individuals have made modifications to their routines in order to adapt and cope with the new reality and what has motivated behavior change.

#### The COVID-19 Threat

As of June 1, 2021, COVID-19 has infected more than 170 million people and caused over 3.5 million deaths worldwide.<sup>2,17</sup> Coronaviruses (HCoVs) are not a new threat, but these viruses have normally been considered minor. This scenario has changed in the last 100 years with severe acute respiratory syndrome coronavirus (SARS-CoV) and the Middle East respiratory syndrome coronavirus (MERS-CoV).<sup>18</sup>

The SARS-CoV appeared in China and then spread to other countries.<sup>18,19</sup> It caused issues at a different scale than COVID-19, as during SARS-CoV, approximately 20% to 30% of infected patients needed mechanical ventilation, while 10% died.<sup>18</sup> A 2020 study conducted with COVID-19 patients, showed that from 1818 patients, 36% had orders for full treatment, while 64% had orders for limited interventions or comfort measures, from which 18% were placed on mechanical ventilation.<sup>20</sup> Similar to COVID-19, though, with SARS-CoV, transmission was seen human to human and greater fatality noted in the elderly and those with comorbidities.<sup>18</sup> The SARS-CoV showed that coronaviruses originating from animals could

affect other species and increase the risk for future pandemics.<sup>18</sup> In 2012, the world came to know the MERS. <sup>18,21</sup> Different than SARS, the spread of MERS limited, and it presented some differences such as gastrointestinal and kidney issues. <sup>18</sup> As with COVID-19, these serious large events brought deaths and economic challenges were also causes of global distress and anxiety.<sup>17</sup>

## Literature Review

### The Social Isolation Impact on Individuals with Comorbidities

The COVID-19 has a more intense and concerning effect on vulnerable populations, such as the elderly and individuals with severe underlying chronic health conditions. <sup>2,3</sup> Chronic conditions are defined as those presenting for one or more years, which limit activities of daily living or require continuous medical care, or both.<sup>2</sup> Heart disease, cancer, and diabetes are chronic conditions and the main causes of death and disability in the country.<sup>2</sup> Considering that in the U.S. 6 in 10 adults have one chronic condition and 4 in 10 present with two or more, this is a very relevant issue to consider when assessing risk, health, and the impact of COVID-19. <sup>2</sup> It is important for the most susceptible populations to be supplied of adequate information and clear guidelines on how to prevent contagion or worsening of any conditions. It was also imperative that these individuals refrained from contact with many people to prevent possible contamination. Therefore, contact guidelines and social isolation measures were particularly recommended for these populations. Of concern, however, is that studies have shown that the stress generated by social isolation may promote or worsen chronic health conditions.<sup>5,22-24</sup>

Stress is a common experience for living beings; after contact with a stressor, the activation of the hypothalamic-pituitary-adrenal (HPA) axis is a biological part of an adaptive

response, which creates a reaction.<sup>25,26</sup> However, if the cause of stress persists, or the organism does not resist, a chronic activation of the HPA axis may generate maladaptation, creating disorders, both psychological and physiological.<sup>26,27</sup> Hence, the relevance of the social environment influence on the physical and mental health of humans.<sup>26</sup> As Meek et al<sup>28</sup> adequately state, social engagement is key to health and quality of life. Therefore, health initiatives generally aim towards increasing engagement among older adults to prevent social isolation and, in that way, prevent emotional and psychological issues that could aggravate physical conditions.<sup>28</sup> Consequently, the actual circumstances presented a challenge, especially for this population, as social isolation was required to prevent contamination, but that brought about a risk of possible psychological and physical consequences.

Stuller et al<sup>29</sup> have shown that stress generated by social isolation appears to promote stroke outcomes through the activation of the neuroimmune system. Stress is one of several potential triggers of ischemic stroke, as exposure to major life events has been associated with increased stroke incidence.<sup>29</sup> Evidence from clinical and animal studies suggests the presence of a causal relationship among stress, the HPA axis activity, and stroke outcome.<sup>29-36</sup> This becomes especially troubling, as for stroke survivors, inflammation could damage cognitive function and compromise quality of life, impacting further social interaction.<sup>29</sup> A better understanding of the impact of social environment and stress is imperative for better health initiatives.<sup>29</sup>

Those presenting with poor glycemic control may have aggravated symptoms if infected with COVID-19.<sup>37</sup> Achieving and maintaining a good glycemic control, with HbA1c <7.0% is one of the main necessities to reduce diabetes related complications.<sup>38</sup> This became difficult during

the pandemic, as there have been restrictions that prevented regular medical check-ups for patients with chronic conditions.<sup>39</sup> To look into that, Ghosal et al<sup>39</sup> promoted a simulation to examine the social isolation effects on glycemic control in India. They created a model using HbA1c and diabetes-related complications data from previous disasters and mimicked the current lockdown to predict the adverse impact of that on diabetes and related complications. Results showed a moderate correlation between the post-disaster HbA1c and the duration of the disaster and a strong correlation with the baseline HbA1c.<sup>39</sup> The duration of the lockdown was directly proportional to the worsening of glycemic control and diabetes complications; post-lockdown HbA1c increased from baseline as lockdown got lengthy - HbA1c of +2.26% (30 days lockdown) and +3.68% (90 days lockdown).<sup>39,40</sup> Since diabetes type 2 tends to be managed through lifestyle habits such as diet, exercise, and glucose monitoring together with medications, results could have been due to limited engagement in a healthy lifestyle, including exercise, and reduced access to medication and doctors' offices, with care mostly done by telehealthcare.<sup>39-41</sup>

The present study looked at whether limitations imposed by social isolation, such as all-time access to various kinds of food, limited access to areas for physical activity, travel restrictions, have prompted individuals to adapt and create new routines to promote wellbeing. For example, outdoor exercise was discouraged during the COVID-19 isolation, unless required precautionary measures were followed. Nonetheless, there were crowds of people without face masks while exercising outside in the United States and globally. This demonstrated the need of campaigns to encourage and promote lifestyle modifications that can be done at home, motivating wellbeing during social isolation.

## Fear, Stress, and Anxiety on Times of Pandemic

There has been evidence that COVID-19 promoted moderate to severe levels of stress and anxiety similar to what has been observed in other major health threats, such as during the SARS outbreak and H1N1 pandemic.<sup>1,42,43</sup> According to previous studies, survivors of viral infectious diseases are prone to depression, anxiety, post-traumatic disorder, and other psychological conditions.<sup>44-48</sup> During the SARS outbreak in China, 25% of survivors faced significant depression.<sup>49-52</sup> Similarly, during SARS, a strong psychological impact was observed on those not infected, due to younger age and self-blame.<sup>53,54</sup> During H1N1, for those with intolerance for uncertainty or those who find uncertain life events as stressful, the threat presented high levels of anxiety.<sup>55</sup>

As stated by Wang et al,<sup>53</sup> the COVID-19 pandemic, besides constituting a global public health emergency, also represents a major challenge to resilience as demonstrated by previous studies on outbreaks and pandemics. During these events, with the closing of common areas, places, and businesses, individuals experienced negative emotions for various reasons, such as job loss, economic adversities, and required changes in habits.<sup>53,56</sup> Overall, several psychological issues, including panic disorders, anxiety, insecurity, and depression, have been observed during pandemics because of the fear and changes that come with and from those.<sup>1</sup>

Qiu et al<sup>1</sup> conducted the first Chinese nationwide large-scale survey to measure prevalence and severity of the psychological distress caused by COVID-19. They measured the mental health impact on the Chinese society to provide facts to assist in the implementation of efficient mental health interventions to cope with COVID-19.<sup>1</sup> Data collection started in January 31, 2020 and QR codes of an online questionnaire, which contained diagnostic questions on

phobias and stress based on the International Classification of Diseases, 11<sup>th</sup> revision, ICD-11,<sup>57</sup> were distributed to the public.<sup>1,58</sup> Questions included demographic data and a questionnaire developed for COVID-19, the COVID-19 Peritraumatic Distress Index (CPDI), which included questions about anxiety, depression, specific phobias, cognitive change, avoidance and compulsive behavior, physical symptoms and loss of social functioning frequency.<sup>1</sup> Reading scale ranged from 0 to 100; a score between 28 and 51 indicated mild to moderate distress and scores  $\geq 52$  indicated severe distress.<sup>1</sup> Participants were 35.27% males and 64.73% females; mean score was 23.65 (15.45).<sup>1</sup> Almost 35% of the respondents experienced psychological distress.<sup>1</sup> Female participants showed significantly higher psychological distress than male participants; previous research addressed female vulnerability and tendency to stress and post-traumatic stress disorder.<sup>1,59</sup> Participants 18 years had the lowest CPDI scores and those between 18 and 30 years of age or above 60 presented the highest CPDI scores.<sup>1</sup> Additionally, those with higher education showed more stress attributed to more health self-awareness.<sup>1,60</sup> Qiu et al<sup>1</sup> suggested that attention be paid to vulnerable groups and to the processes described above. They reinforced that a nationwide strategic plan for psychological aid is important during disasters, as well as a comprehensive crisis prevention system to reduce psychological distress and prevent further mental health problems.<sup>1</sup>

In a cross-sectional study, Wang et al<sup>53</sup> also examined the levels of psychological impact, anxiety, depression, and stress of the Chinese population living in China at the start of the COVID-19 epidemic. Data were collected via an online survey from 31 January to 2 February 2020 using snowball sampling techniques first among university students who were encouraged to send the survey to others.<sup>53</sup> As in other studies, previous surveys on SARS were modified to

address COVID-19.<sup>53,61–63</sup> The resulting questionnaire consisted of questions on demographics, physical symptoms in the last 14 days, contact history with COVID-19 in the last 14 days, knowledge and concerns about COVID-19, precautionary measures against COVID-19 in the last 14 days, other information required on COVID-19, psychological effect of COVID-19, and mental health conditions.<sup>53</sup> The psychological impact of COVID-19 on the Chinese population when subjected to grave public health events was measured using the Impact of Event Scale-Revised (IES-R), a 22 question validate self-report questionnaire , and the Depression, Anxiety and Stress Scale (DASS-21) was used to measure mental health status.<sup>53,64,65</sup> The study included 1210 respondents from 194 cities in China.<sup>53</sup> In total, 53.8% of respondents rated the psychological impact of the outbreak as moderate or severe; 16.5% reported moderate to severe depressive symptoms; 28.8% reported moderate to severe anxiety symptoms; and 8.1% reported moderate to severe stress levels.<sup>53</sup> Most respondents spent 20–24 hours per day at home (84.7%); were worried about their family members contracting COVID-19 (75.2%); the Internet (93.5%) was the primary health information channel and the majority of participants were satisfied with the available health information (75.1%).<sup>53</sup> Female students with physical symptoms and poor health status showed significantly higher levels of stress, anxiety, and depression.<sup>53</sup> Accurate health information and preventive measures were related to lower psychological impact of COVID-19 and reduced stress, anxiety, and depression levels.<sup>53</sup> This study had some limitations such as the use snowball sampling due to the timeliness of the issue, but it did propose that factors associated with a reduced COVID-19 psychological impact and better mental health status could be used to generate psychological interventions to improve the mental health of vulnerable groups during the COVID-19 pandemic.<sup>53</sup> They

suggested that psychological support to patients is important during the pandemic, and interventions should be suited to meet the needs of a population.<sup>53</sup> Another point was that governments should aim to provide accurate information to reduce anecdotes and prevent fear, anxiety, and panic.<sup>53</sup> Anxiety and stress have been shown as important predictors of behavior, which led us to investigate whether COVID-19 generated psychological and emotional impact promoted changes in behavior related to eating, physical activity, and lifestyle habits.

Looking at COVID-19's impact from yet another perspective, Guo et al<sup>66</sup> analyzed the mental status of patients with COVID-19 who had been quarantined and the interactions between their distress and levels of inflammation. Utilizing a mixed-method design on 103 patients hospitalized with mild symptoms and who tested positive for COVID-19, Guo et al<sup>66</sup> compared mental status and inflammatory markers against 103 matched controls who were COVID-19 negative. The severity of depression, anxiety, and post-traumatic stress symptoms (PTSS) was measured via an online survey and a semi-structured interview among five patients with COVID-19.<sup>66</sup> Peripheral inflammatory markers were also collected in patients, at baseline and within three days of completing the survey. The COVID-19 patients manifested higher levels of depression, anxiety, and post-traumatic stress symptoms than controls, and female patients showed higher scores than males and male controls.<sup>66</sup> Levels of c-reactive protein (CRP) correlated positively with the patient health questionnaire-9 (PHQ-9), a depression scale; total score on those presenting depression and change of CRP level from baseline was inversely correlated with the PHQ-9 total score, indicating improvement of depression symptoms.<sup>66,67</sup> Qualitative analysis mirrored these results on patients' negative feelings, as well as the stigma and uncertainty of the viral disease.<sup>66</sup> Noted psychological distress was experienced by

hospitalized COVID-19 patients, which could be related to inflammation markers.<sup>66</sup> This points to the need of providing appropriate measures to address depression and other psychiatric symptoms for COVID-19 patients; additionally, it is very important to find ways to address perceived stigma and coping strategies when delivering psychological interventions to those surviving COVID-19.

This study examined the relationships between COVID-19 and the pandemic generated stress and anxiety in the adult population, hoping to contribute data for use in the implementation of future efficient initiatives of mental health support in times of distress.

#### COVID-19 and The Immune System

Immunity is the capability to protect the body against infection and disease.<sup>68</sup> The immune system is composed of cells, tissues, and molecules, generally classified into the innate (non-specific) and the adaptive (specific) immunity.<sup>68,69</sup> The innate immunity is the one people are born with, acting as a first line of defense, promoting adaptive immune responses.<sup>68-72</sup> Acute respiratory infections, such as COVID-19, have a great impact on the immune system, being one of the topics most studied on this subject.<sup>68,73</sup> Acute respiratory infections are frequently presented to doctors and may be a major cause of sepsis and death globally.<sup>68,73,74</sup> When discussing a viral infection that may affect, at first, the upper respiratory system of millions of people, such as the current pandemic, it is imperative to discuss all strategies that may be useful to prevent contamination, as well as to support the immune system, such as diet and positive lifestyle changes. All public health actions that are in place, such as handwashing and gel alcohol, surface cleaning, mask wearing, and social distancing are important and effective. However, strengthening the immune system is important not only to assist with

contamination prevention, but also to ensure the body is ready to fight the severity of contamination as well as possible complications. This becomes even more relevant for the vulnerable populations of elderly and those presenting with chronic conditions.

Nutrients play an essential role in the prevention of infections and support of immunity. Many vitamins and minerals, including vitamin A, B, C, D, E, zinc, iron, selenium, magnesium, copper, all play major roles in strengthening the immune system.<sup>74</sup> Malnutrition and undernutrition. are associated with impaired immune system and increased mortality and morbidity risks.<sup>74</sup> Protein and micronutrient deficiencies, specifically, may impact immune system and its responses.<sup>74,75</sup> That makes sense, as the immune function is dependent on rapid cell replication and production of immune system proteins; therefore, an inadequate protein intake may be associated with compromised immune defense and vulnerability to infection.<sup>74</sup>

Recently, Calder<sup>74</sup> and Wu<sup>76</sup> analyzed the importance of proper nutrition as protection from viral infections, as well as to reduce lung damage from COVID-19 and other infections. They reiterated the fact that nutritional deficiency can impact the immune system, and a balanced dietary intake may prevent that.<sup>68</sup> Emphasis was given on adequate supplementation of vitamins, minerals, nutraceuticals, and probiotics, in addition to a healthy overall balanced diet for strengthening the immune system.<sup>74</sup> Therefore, changes towards healthier eating, both to provide the body with nutrients as well as to prevent nutritional deficiencies, seem to be a positive way to support the immune system. This is especially true when facing a health threat and coping with social isolation and social distancing, both of which could have an emotional and psychological impact on communities. Utilizing the social isolation time to make positive

behavior changes in diet and physical activity would seem like a good approach to get through the COVID-19 era.

#### Effect of Lifestyle Changes on Chronic Conditions

Lifestyle changes during social isolation have been recommended by governments and healthcare practitioners to enhance immunity and prevent the onset or development of chronic diseases, lessening the incidence and risks and effects of COVID-19 contamination. Therefore, it became imperative to investigate whether lifestyle changes affect the three most prevalent chronic diseases in the U.S., heart disease, cancer, and diabetes, to assess the impact those changes could have on health and risk of contamination or complications from COVID-19.

Cancer is the second leading cause of death globally, being responsible for an estimated 9.6 million deaths in 2018; globally, about 1 in 6 deaths is due to cancer.<sup>77</sup> Lifestyle factors such as smoking, alcohol use, obesity, and physical inactivity have been recognized as potential increasing influences on cancer risk.<sup>78,79</sup> It seems that indicating positive change lifestyle habits changes can assist on cancer prevention. In contrast, though, a study by Tomasetti and Vogelstein<sup>80</sup> suggested that cancer incidence is related to the number of random stem cells division on a particular tissue, much attributing cancer risk to a type of “bad luck.”<sup>78,80</sup> To debate that assertion and examine the effect of lifestyle factors on cancer incidence, Song et al<sup>78</sup> conducted a prospective cohort study on 16,531 women and 11,731 men with a healthy lifestyle pattern (low-risk group) and 73,040 women and 34,608 men with a common lifestyle pattern (high-risk group). Healthy lifestyle was defined as never or less than 5 years of smoking, no or moderate alcohol drinking, body mass index  $\geq 18.5$  and  $< 27.5$  kg/m<sup>2</sup>, and weekly aerobic physical activity of at least 75 vigorous-intensity or 150 moderate-intensity minutes.<sup>78</sup> Height,

body weight, smoking, and physical activity were self-reported.<sup>78</sup> Physical activity was calculated by adding time spent on a variety of leisure-time activities with average metabolic equivalent (MET) for that activity.<sup>78</sup> Alcohol use was self-reported.<sup>78,81</sup> Overall dietary score used the Alternate Healthy Eating Index (AHEI), with food choices and macronutrient associated with reduced chronic disease risk.<sup>78,82</sup> They projected contributions of common lifestyle factors to cancer burden by comparing cancer incidence and mortality between the participants who had a healthy lifestyle (low-risk group) to those who did not (high-risk group).<sup>78</sup> They estimated overall 20–40% of carcinoma cases and about half of deaths could be possibly prevented through lifestyle modification.<sup>78</sup> Even higher figures were seen when that was assessed towards the general US population, which presents with a much inferior lifestyle habits than the groups.<sup>78</sup> Risk factors such as obesity and physical inactivity may influence survival by causing more aggressive cancers, increasing cancer progression, or making it harder to diagnose and treat cancer.<sup>83</sup> Furthermore, appropriate lifestyle behaviors have been noted to lower incidence of comorbidities, such as cardiovascular disease and diabetes, which may affect cancer prognosis.<sup>84</sup> These findings reinforce the predominant importance of lifestyle factors in determining cancer risk and the importance of primary prevention for cancer control.

Cardiovascular disease (CVD) is the number 1 cause of death globally, causing an estimated 17.9 deaths per year, which represents 31% of world deaths.<sup>85</sup> The term CVD encompasses a group of conditions, such as coronary heart disease, cerebrovascular disease, and others.<sup>85</sup> Individuals at risk of CVD may demonstrate raised blood pressure, glucose, and lipids as well as overweight and obesity.<sup>85</sup> The underlying cause of most CVD is atherosclerosis, a process associated with aging and influenced by lifestyle factors, such as smoking, physical

inactivity, and diet. Therefore, cases of CVD may be preventable by altering diet and lifestyle behaviors; estimates suggest this could be around half of all CVD deaths.<sup>86</sup> As atherosclerosis starts early in life as do the onset of lifestyle habits, Staudt et al<sup>87</sup> conducted the EVA-Tyrol cohort study, with 1573 adolescents with a mean age of 16 years, prospectively followed-up. Cardiovascular risk and lifestyle factors were evaluated by interviews, physical examination, and blood analyses.<sup>87</sup> Researchers found that several vascular risk factors like elevated blood pressure, overweight, and smoking were already prevalent at this age, which is concerning as it sets up the stage for future complications.<sup>87,88</sup> It becomes imperative to understand how to educate these young adults as they move to adulthood on the importance of healthy lifestyle habits to prevent CVD or metabolic syndrome development and complications.

Epidemiological studies have provided knowledge to our understanding of the major modifiable risk factors for CVD progression, including elevated blood pressure, obesity, smoking, type 2 diabetes and physical inactivity.<sup>87-91</sup> Benefits of physical activity and physical fitness have been documented, and both offered 15%-35% reduced CVD risk.<sup>88</sup> Slow increase in physical activity levels seem to offer significant public health benefit; hence, less time should be spent in sedentary activities.<sup>88</sup> Additionally, sleep time and quality have also been linked to an increased risk of CVD, type 2 diabetes, hypertension and obesity.<sup>88,92</sup>

Diabetes is yet another condition of concern for the American population. Not much evidence exists regarding the impact of healthy lifestyle practices on the risk of cardiovascular occurrences among patients presenting with diabetes. Hence, Liu et al<sup>93</sup> conducted a prospective analysis on 11,527 individuals diagnosed with type 2 diabetes, free of cancer or CVD. Diet and lifestyle were assessed via questionnaire, before and after diabetes diagnosis.<sup>93</sup>

Authors examined cardiovascular outcomes pertinent to low-risk lifestyle factors, including a high-quality diet, nonsmoking, moderate to vigorous physical activity (~150 min/week), and moderate alcohol consumption (5 to 15 g/day for women and 5 to 30 g/day for men).<sup>93</sup> Low-risk lifestyle factors were linked to a lower risk of CVD incidence and CVD mortality.<sup>93</sup> As improvements in lifestyle were made from pre-diabetes to post-diabetes diagnosis, these were also significantly associated with a lower risk of CVD incidence and CVD mortality.<sup>93</sup> For each increase in low-risk lifestyle factors there was a 14% lower risk of incident total CVD, a 12% lower risk of coronary heart disease, a 21% lower risk of stroke, and a 27% lower risk of CVD mortality.<sup>93</sup> Therefore, practice and adherence to a healthy lifestyle is associated with a lower risk of CVD incidence and CVD mortality among adults with type 2 diabetes. Liu et al<sup>93</sup> reinforces the benefits of a healthy lifestyle as a positive modifying factor for chronic conditions and comorbidities complications.

Metabolic syndrome is a collection of metabolic disorders where chronic conditions, such as high blood pressure, high cholesterol, abdominal obesity, and high blood sugar, are present and may interact.<sup>86</sup> Metabolic syndrome is a serious health condition that affects about 23% of adults.<sup>86</sup> These conditions, when presented together, increase the risk for cardiovascular disease rather than when those are presenting alone. Underlying causes of metabolic syndrome include overweight and obesity, physical inactivity, genetic factors and age, with an emphasis on the importance of lifestyle factors as promoters of these conditions. Understanding the impact of lifestyle habits on predictors of weight and physical activity is of benefit for metabolic syndrome prevention and enforces the interest in our research on

whether lifestyle modifications towards healthier habits could support better health during the COVID-19 threat.

### Physical Activity and Its Benefits to the Immune System

Inflammation is a generally temporary condition that presents with characteristics such as redness, swelling, and pain, associated with the activation of the innate immune system in response to tissue injury or infection.<sup>22</sup> It tends to decrease as a result of a series of complex regulatory signals.<sup>22</sup> The goal of an inflammatory response is to constrain infection, separate injured tissue from other tissues, clean up debris, and stimulate healing.<sup>22</sup> Therefore, inflammation is a necessary function of the immune system; however, problems appear once it becomes amplified or chronic, as mentioned above.<sup>22</sup> Amplified inflammation can lead to death as in sepsis, and chronic inflammation is associated with disease risk, poor physical status, and mortality.<sup>69</sup> Chronic inflammation is much discussed in nutrition as it is associated with conditions such cardiovascular disease, cancer, Alzheimer's disease, and obesity.<sup>22</sup> This is a key area of research, as exercise and diet may present an anti-inflammatory effect, hence influencing chronic disease statuses.<sup>22,69</sup>

The influence of physical activity on the change in the immune system takes place at the cellular level; increase in cells or improved cell function have been demonstrated from exercise.<sup>94-96</sup> Biochemically, exercise and physical activity promote anti-inflammatory actions; during exercise, brief elevations in IL-6 emerging from exercising skeletal muscle acts in an anti-inflammatory way and also stimulates cortisol, an anti-inflammatory hormone.<sup>97,98</sup> Therefore, IL-6 seems to raise in response to inflammatory incitement and contribute to modulation of inflammatory reactions.<sup>98</sup> Physical inactivity seems to be a risk factor for the development of

overweight and obesity.<sup>99</sup> Even though cross-sectional studies have just found moderate relationships between physical activity and weight status, prospective studies have associated low levels of physical activity with high weight gain over time.<sup>99</sup> Additionally, physical activity has been shown to lower blood pressure in those with high blood pressure and reduce triglyceride levels, while increasing HDL concentrations.<sup>99</sup> Studies have also shown that physical activity may improve insulin resistance and glucose tolerance.<sup>99</sup> Establishing regular physical activity habits during social isolation seems to provide a positive impact on immune system support as well as for prevention of complications derived from existing chronic conditions.

#### Post COVID-19 Change in Habits and Lifestyle

Ouhsine et al<sup>100</sup> analyzed the change in waste residue produced by people from Khenifra and Tighassaline, Morocco, during COVID-19, to assess change in habits, as household waste is a result of people's consumption of merchandises and services. It is possible that a change in behaviors, as in the crisis generated by COVID-19 pandemic and social isolation, should be reflected in the waste production and composition.<sup>100</sup> Lockdown has changed the habits of the population, starting by the shopping frequency, which has decreased. Authors found that those 56% used to shop pre-lockdown, percentage that decreased to 34.5%; those shopping once a week increased from 30% to 54.8%.<sup>100</sup> A small increase was seen in the consumption of fruits and vegetables and a decrease was noticed in meat and canned products consumption.<sup>100-103</sup> An increase in disinfectant and cleaning products was also noted together with the presence of masks and gloves in trash cans.<sup>100</sup> Additionally, 87% of participants mixed protective equipment with household waste, which could contribute to virus spread and presents a hazard

for collection workers.<sup>100</sup> Once again, information and education are vital in times of global stress, to assist populations towards proper actions for safety and well-being.

Di Renzo et al<sup>16</sup> examined the impact of COVID-19 on eating habits and lifestyle changes amidst the Italian population due to the reduced socialization and social isolation, as well as the stress derived from those.<sup>16</sup> Some of the cited reasons for changes in dietary habits are boredom, comfort foods, stress derived consumption, changes in shopping habits and food access, and confinement.<sup>16</sup> The authors also cited the need to boost the immune system in times of health threats and the benefits of a healthy anti-inflammatory diet.<sup>16</sup> They used a questionnaire, disseminated through institutional and social media, that included demographic information, anthropometrics, dietary habits based on the Mediterranean diet, and lifestyle habits.<sup>16</sup> The questionnaire was created for this study and included personal data, anthropometrics, dietary habits – using a MEDAS screener, and a daily consumption questionnaire.<sup>16,104</sup> Physical activity questions modified from an Italian Health Department survey were added to the questionnaire. Participants were divided into three classes of adherence to the Mediterranean diet.<sup>16</sup> As in this study, lifestyle habits included shopping, sleeping, physical activity, in addition to smoking. There were 3533 participants, and weight gain perception was observed in 48.6%, 3.3% of smokers decided to quit, 38.3% of respondents reported a small increase in physical activity and there was no significant difference between those who trained before (37.7%) and during (37.4%) COVID-19, 15% started to consume farmers' or organic items, and those between 18 and 30 years reported an increase in adherence to the Mediterranean diet.<sup>16</sup> Also, more than half of respondents reported a change in hunger and satiety perception, with 16.7% having less and 34.4% having more appetite, but

57.8% reported not changing number of daily meals.<sup>16</sup> As far as changing lifestyle habits, 46.1% of the population reported not changing those, and 16.7% and 37.2% felt as they have improved or worsened habits, respectively.<sup>16</sup>

Di Renzo also conducted a follow-up online survey among 602 participants from the Italian population, from April to May of 2020, to examine the relationship between eating habits, mental, and emotional mood.<sup>105</sup> A high percentage of respondents reported depressed mood, anxious feelings, hypochondria, and insomnia (61.3%, 70.4%, 46.2% and 52.2%). Almost half of the participants stated feeling anxious due eating habits, consumed comfort foods, and were prone to increase food intake to make them feel better.<sup>105</sup> They found that age was inversely related to dietary control (OR = 0.971,  $p = 0.005$ ), with females being more prone to comfort food intake and using food when feeling anxious more than males ( $p < 0.001$ ;  $p < 0.001$ ).<sup>105</sup> A strength of the study was that it was timely on the most critical period of Italian lockdown; limitations include the lack of test scoring and the fact that COVID-19 may have had some psychological impact on participants during the study.<sup>105</sup> Both studies by Di Renzo et al.<sup>16,105</sup> are relevant and timely, as they assessed the response of part of the Italian population to COVID-19.

Murphy et al.<sup>106</sup> investigated how COVID-19 restrictions have affected changes in consumers' food practices through a cross-sectional online survey including 2360 adults in Ireland, Great Britain, United States, and New Zealand. Questions included cooking, diet, and COVID-19 food-related practices.<sup>106</sup> Changes were seen in most regions, with less modifications noted in cooking practices in the United States.<sup>106</sup> Although an increase in fruit and vegetable was observed, so was an increase in saturated fat.<sup>106</sup> The authors highlight the importance of

planning and preparing for maintaining good eating habits during emergency times, as well as the need of balanced diet during times of stress.<sup>106</sup>

A recent cross-sectional study by Chopra et al.<sup>107</sup> assessed changes in lifestyle behaviors in 995 participants from the Indian population, during November and December of 2020. Researchers used a validated questionnaire to assess changes in lifestyle behavior before and during COVID-19.<sup>107</sup> An improvement in healthy meal consumption was noted, with a restriction in unhealthy food items.<sup>107</sup> Nevertheless, Chopra et al.<sup>107</sup> found an increase in weight gain on participants during the pandemic. An increase in stress and anxiety was observed, together with a decrease in physical activity and an surge in daily screen time.<sup>107</sup> Overall, authors noted that although there was an improvement in certain eating behaviors, those effects were somewhat outweighed by other lifestyle behaviors.<sup>107</sup>

#### COVID-19 Measurement Tools

As stated earlier, the COVID-19 era has brought fear in a variety of forms to many countries and populations worldwide. A period of such traumatic global event as the COVID-19, deserves additional studies and attention. Stress and anxiety in this era are related to fear; fear of contamination, either through someone, a contaminated area, or anxiety derived from different losses and more.<sup>108</sup> People have been reacting differently to this pandemic, as those with little anxiety seem less likely to engage in preventive behaviors and social distancing, while those with intense anxiety are more likely to engage in disordered behaviors.<sup>108</sup>

To better assess, understand, and measure COVID-19 related distress, Taylor et al<sup>9</sup> developed a 36-item COVID Stress Scale (CSS). A 5-factor solution was identified, corresponding to subscales on COVID-related stress and anxiety symptoms, including: (1)

danger and contamination fears, (2) fears about economic consequences, (3) xenophobia,(4) compulsive checking and reassurance seeking, and (5) traumatic stress symptoms about COVID-19.<sup>9</sup> Scales were intercorrelated for evidence of a COVID Stress Syndrome.<sup>9</sup> The CSS was developed and validated in population samples from Canada (N = 3479) and United States (N =3375), during the early stages of COVID-19.<sup>9</sup> Data were collected using an online self-reported survey between March 21 and April 1, 2020.<sup>9</sup> The survey also included measures on demographics, anxiety, depression, and other trait characteristics.<sup>9</sup> Respondents were aged 18–94 years (M = 49.8 years, SD = 16.2). Almost half (47 %) were female and most (52.3 %) were employed.<sup>9</sup> Most (78.8 %) had completed full or partial college, 17.6 % had only completed high school or equivalent, and 2.9 % did not graduate from high school.<sup>9</sup> Most (68.1 %) were Caucasian, with the remainder being Asian (11.5 %), African American/Black (9.4 %), Latino/Hispanic (6.4 %), Native American/Indigenous (1.4 %), or other.<sup>9</sup> Based on the cutoffs for the PHQ-4,<sup>109</sup> 28 % of the participants from Canada and the United States had high anxiety and 22 % were facing clinically significant depressive symptoms.<sup>9</sup> For the total Patient Health Questionnaire-4 (PHQ-4),<sup>109</sup> proportions were normal (54 %), mild symptoms (23%), moderate symptoms (13 %), and severe symptoms (10 %).<sup>9</sup> These findings agreed with responses to trauma, showing most people are resistant to stress.<sup>110</sup> The tool developed by Taylor et al<sup>9</sup> was promising to understand the distress associated with COVID-19 and future pandemics, as well as to identify those in need of mental health services. At the time, the CSS had not been validated against other COVID-related anxiety measurement tools, such as the Fear of COVID-19 Scale (FCV-19S), a seven item psychometric scale developed and validated by Ahorsu et al,<sup>7</sup> because that was not available yet.

Ahorsu et al.<sup>7</sup> developed the Fear of COVID-19 Scale (FCV-19S), a seven item scale, from a review of literature and similar scales, to assist in assessing feelings derived from the pandemic. The scale underwent measures for reliability and validity.<sup>7</sup> The study was conducted with 717 Iranian participants and demonstrated a 0.47 to 0.56 item-total correlation and a significant strong factor loadings, 0.66-0.74.<sup>7</sup> Reliability for internal consistency was at  $\alpha = .82$  and test-retest reliability was at ICC = .72.<sup>7</sup> Higher scores on FCV-19S indicated more severity of fear derived from COVID-19, with no differences seeing in age or gender, indicating usefulness of the tool to assess COVID-19 generated fear among the general population.<sup>7</sup> Some limitations of this study are the utilization of a general population with no previous formal mood disorders diagnostics, which restricts specificity and sensitivity, the use of a convenience sample population preventing generalization, and the need of further verification other than the single-factor based on EFA and Rasch analysis<sup>7</sup>.

The FCV-19S scale was further translated and psychometrically evaluated, in relation to sociodemographic, lockdown variables, and the Bangla Health Patient Questionnaire, and validated for use by Sakib et al.<sup>111</sup> in 8550 participants from the Bangladesh population.<sup>111</sup> Results showed a Cronbach- $\alpha$  of 0.87, indicating very good internal reliability, item to item correlation between 0.59 and 0.70, and a good fit for factor analysis.<sup>111</sup> Additionally, the FCV-19S was significantly associated with the Bangla Patient Health Questionnaire, and scores were significantly associated with higher worries concerning lockdown.<sup>111</sup> Therefore, authors concluded that the Bangladesh version of FCV-19S is a valid and reliable tool with strong psychometric properties, which may be utilized to assist in further research on COVID-19 effects on the Bangladesh population.<sup>111</sup>

Constantini and Mazzotti<sup>112</sup> examined the COVID-19 Peritraumatic Distress Index (CPDI), a quick and easily comprehensible compilation tool developed in China, on 191 females and 137 males during Phase-1 in Italy.<sup>1</sup> The CPDI showed internal consistency and content validity by two psychiatrists.<sup>112</sup> Constantini and Mazzotti<sup>112</sup> achieved similar results as those from Chinese studies, as follows: one third of participants experienced symptoms of mild/moderate and severe peritraumatic distress, females showing higher scores than males. Older people showed to be more resilient than younger ones, and those who had been in quarantine accounted for less distress than those who did not practice social isolation.<sup>112</sup> High distress was associated with use of psychotropic drugs, sleeping pills, worry about dying from COVID-19, being female, and having a religious belief; while lower distress was associated with being 51-71 years of age, having been in quarantine, and receiving some psychological support.<sup>112</sup> The measurements performed with the Italian version of the CPDI confirmed the tool as a quick, non-intrusive, online tool, safe to be administered during possibility of risk for contagion, which may be used for rapid detection of the needs of the population and to plan rapid interventions.<sup>112</sup>

These studies presented the relevance of proficient new or adapted measurement tools and questionnaires to efficiently assess and address pandemics such as COVID-19 and allow for the planning and implementation of effective and innovative interventions to support global populations. Our study aimed to develop and validate questionnaires that efficiently addressed and assessed the impact of COVID-19 on lifestyle habits.

Studies in this literature review examined anxiety, fear, and stress related to lockdown measures and epidemics, the impact of social isolation on chronic conditions, the benefits of

healthier lifestyle habits on the immune system, and the measurement tools created to assess the COVID-19 pandemic, all topics of interest to our study. To our knowledge, this is the first cross-sectional study to examine the COVID-19 impact on lifestyle habits utilizing PMT constructs as a framework. After completion of this literature review,<sup>106</sup> two studies have been published on COVID-19 and the Protection Motivation Theory; one examining COVID-19 prevention measures among Filipinos<sup>113</sup> and one among hospital staff in Iran.<sup>114</sup> At the time of the completion of this literature review, and included on it, one study was being published examining the impact of the COVID-19 created social isolation on stress and anxiety and dietary, physical activity, and wellbeing habits on an Italian population; a follow-up study on psychological aspects of eating habits was then released by the same authors.<sup>16,105</sup> Additionally, two studies were published on predicting COVID-19 preventive behaviors in light of the PMT, and have been mentioned in this study's literature review.<sup>114,115</sup> These studies reinforced the applicability of the PMT to assess COVID-19-related behaviors.

Recently, after this dissertation was completed, a study examining changes in consumers' food practices in Ireland, New Zealand, Great Britain, and the United States before and during lockdown has been published,<sup>106</sup> as well as a study on COVID-19's impact on lifestyle behaviors in India;<sup>107</sup> both are briefly noted in the literature review and included in the discussion chapter of this work. It was timely and important to further assess the same in the United States population, with questions designed to evaluate Americans' habits. This helped generate data to better create and implement effective interventions to support the basic mental and physical health needs of our population in times of distress and examine opportunities to successfully intervene to promote behavior change towards healthier practices

as prevention of chronic mental and physical conditions. The number of recent publications on COVID-19, with few on lifestyle habits, with only one in the U.S., and several on PMT and preventive behaviors, but none utilizing the PMT to examine lifestyle behavior changes, reinforced the importance of this study in the U.S. and the appropriateness of this theoretical framework to support this research. Additionally, these facts highlighted the opportunity for further research on populations' reactions and adaptations to times of distress for effectiveness of further public health assessments, evaluations, and interventions.

## Chapter 2

### Theoretical Framework

The Protection Motivation Theory (PMT) is a psychological and sociological concept that was introduced by Rogers in 1975 and used in recent years to predict individuals' intention to engage in protective behaviors.<sup>15,116-119</sup> The theory speaks to reasons and processes by which individuals are motivated to make behavior changes, trying to explain what motivates behavior change.<sup>117-120</sup> It is based on three main components of fear appeal: the extent of an event, the probability of its occurrence, and the effectiveness of a protective response.<sup>116</sup> The PMT model is based on the principle that these factors influence the intention to engage in any behavior, the main determinant of the behavior.<sup>120</sup> Intention brings about protection motivation, which guides activity for behavior change.<sup>119</sup> However, motivation is only the starting point for behavior change.<sup>119,121,122</sup> Adopting a behavior includes weighing the costs and benefits of the behavior and also developing techniques and plans to ensure to act on the intention.<sup>119,122,123</sup> This combination of motivation and strategies seems to be what promotes behavior changes.<sup>119</sup>

In PMT, behavior depends on two associated pathways, threat appraisal and coping appraisal: the threat appraisal is the assessment how threatened a person feels by certain situations, or the perceived risks that could prompt change; the coping appraisal pathway is the evaluation of factors of threat for a person's assessment of the recommended coping response, or reasons that need to be present for someone to make changes.<sup>117,118,120,124,125</sup> The way that someone responds to threat is determined by the coping appraisal.<sup>126</sup> The PMT has been extensively adopted as a framework for prediction and intervention in a series of health-related behaviors, such as skin cancer<sup>127,128</sup>, cancer screening,<sup>129,130</sup> physical activity,<sup>131</sup> tobacco use,<sup>132,133</sup> and sexual protective behaviors.<sup>134,135</sup>

As the theory was first formulated by Rodgers, the first variables said to promote protection motivation were the severity of an event (severity), the probability it would occur if no protective measure was taken (vulnerability), and the efficacy of performing a recommended behavior (response efficacy).<sup>116,136</sup> As Rogers later updated the theory, he included additional attributes to the existing constructs, the threat appraisal would consist of two attributes, with two sub-constructs in each attribute: the perceived threat, severity and vulnerability, and perceived rewards, intrinsic rewards and extrinsic rewards.<sup>118,120,136,137</sup> The coping appraisal pathway would consist of two attributes: perceived efficacy, including response efficacy and now self-efficacy, as well as perceived costs with one sub-construct, response costs.<sup>118</sup> Response-efficacy and self-efficacy are expected to promote coping appraisal, whereas response costs are expected to reduce it.<sup>116,138</sup>



Figure 1 - PMT Constructs Map as Applied to this Research.

The application of this theory to this study was based on the original approach to the theory: the degree of an event originates perceptions of severity, the probability of an event creates perceptions of vulnerability, the availability of an effective coping response initiates perceptions of response efficacy, and the ability of practicing the behavior, self-efficacy.<sup>125,137</sup> The PMT theory worked well for this research, as the COVID-19 pandemic presented challenges: stress, presence of a health risk, and imposed social isolation – which required efforts to strengthen response efficacy beliefs and actions to prevent the severity and susceptibility of a threat and reinforce self-efficacy.<sup>13,42,118,120,126,139</sup> The PMT approach to this research included looking into Roger’s original constructs in light of the COVID-19 threat and the social isolation experience, with the addition of self-efficacy, which is an interesting construct to examine in this scenario, as it indicates individuals’ ability to adapt to changes, an

important aspect of nutrition research. We did not include costs and rewards; those are constantly removed from models due to the difficulty found in distinguishing one concept from the other.<sup>136,137,140</sup> Therefore, our constructs to be examined in this study, as they relate to COVID-19, stress, and social isolation, were: vulnerability, severity as perceived threat, response efficacy (composed of social isolation and healthy habits) and self-efficacy, as perceived efficacy. (Figure 1)<sup>126,139</sup> The perceived threat appraisal component, vulnerability, referred to the risk of contagion, while severity addressed the perceived negative health consequences of being contaminated by the virus.<sup>139</sup> Response efficacy, as part of the perceived efficacy, addressed how behaviors during the COVID-19 were related to how effective social isolation was in preventing infection and whether that experience promoted changes towards healthier habits; self-efficacy referred to the ability to socially isolate and adapt to it.<sup>118,120,126</sup> We proposed new measurement tools for the particular situations examined in this research, as there was no generally accepted measurement instrument for assessing these constructs in this situation; the examination of our research's constructs followed examples of affirmations found in the literature.<sup>15,118,119,136,137</sup>

## Conceptual Framework

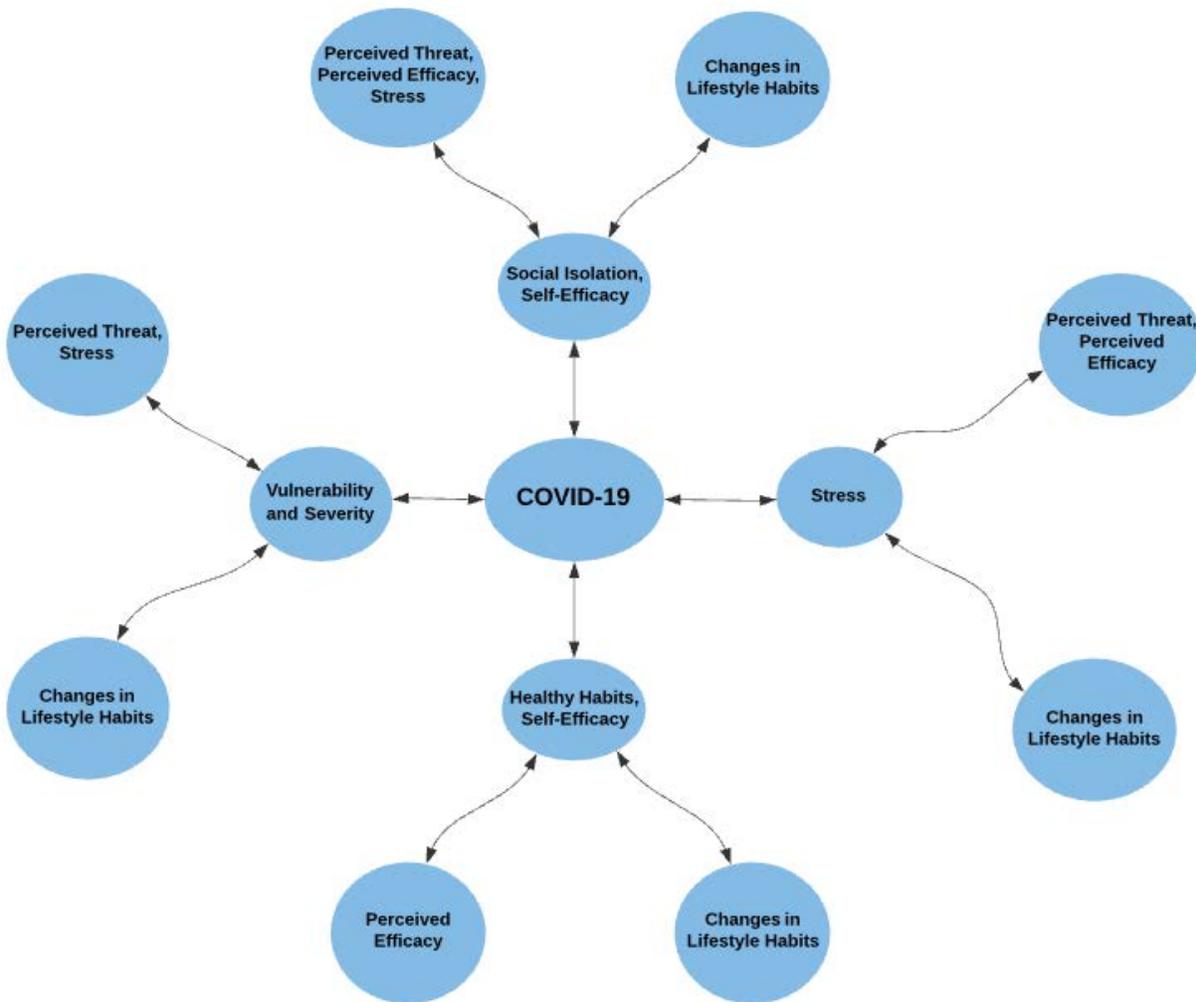


Figure 2 - COVID-19 and the PMT Constructs Conceptual Framework

Figure 2 displays the relationship between COVID-19's health threat and social isolation on stress, anxiety, and lifestyle habits changes and the PMT framework.

## Protection Motivation Theory (PMT) Utilization

For an overview of the usefulness of the PMT theory, a review of some studies that have applied PMT principles will follow. Milne et al<sup>119</sup> conducted a longitudinal study to compare a motivational intervention based on PMT with the same intervention with a volitional intervention based on intention of implementation.<sup>119,123</sup> Two hundred and forty-eight participants were placed in the control or one of two intervention groups, and two weeks of

data were collected.<sup>119</sup> Motivational intervention significantly increased threat and coping appraisal but did not promote change in exercise behavior.<sup>119</sup> The combined PMT and implementation intention intervention intensely changed exercise behavior.<sup>119</sup> Therefore, they found that supplementing PMT with implementation intentions supports the ability of the model to explain behavior and behavior change, relevant information for health educators to promote successful interventions.

Wang et al<sup>118</sup> illustrate how PMT constructs and qualitative interviews are utilized for questionnaire development, exploring travelers' self-protective behaviors against health risks through the application of PMT constructs. The authors aimed to understand individuals' health behavior during the threats presented while traveling and explain which health protective behaviors were enacted.<sup>118</sup> Semi-structured interviews were conducted with a purposive sample of sixteen Australian travelers from June 5 to June 29, 2017 to understand their attitudes and perceptions towards travel health risks, and an online survey was conducted in November 2017, with participants recruited from an online panel from a research company.<sup>118</sup> Results showed that approximate 50% the participants were female and the main reason for participants' latest trip was for holiday or leisure (83.5%), to visit friends or relatives (11.1%), for business (3.2%), and others (2.2%).<sup>118</sup> To measure PMT constructs, Likert-type measurement scales ((1 = strongly disagree, 5 = strongly agree) were developed using the literature and interview results. For example, to measure perceived vulnerability, the respondents were asked to rate the likelihood of experiencing rabies while travelling to Indonesia, Thailand and Vietnam,<sup>141</sup> to measure self-efficacy, the respondents were asked to evaluate their confidence in protecting themselves against rabies their travel to Indonesia,

Thailand and Vietnam;<sup>142</sup> to measure response efficacy, the participants were asked to evaluate the efficacy of how they protect themselves against risk, to measure costs, the participants were asked to indicate the extent to which they agreed with the list of disadvantages of protecting themselves against rabies.<sup>118,143,144</sup> Additionally, they measured maladaptive perception using six statements developed based on interview results and the literature.<sup>118,145,146</sup> Respondents had to rate the extent to which they agreed with those demonstrating types of maladaptive perceptions, such as, holiday spirit, avoidance, denial, wishful thinking, religious faith, and fatalism, on the same 5-point Likert scale.<sup>118</sup> This study emphasized the importance of understanding how individuals perceive risk, planning, and reducing behaviors, and the significance of turning intentions into actions.<sup>118</sup> Authors suggest education programs and campaigns to adequately inform the public and support informed behavior change.<sup>118</sup>

The COVID-19 is shown to be a particular threat for elderly in what concerns stronger consequences; therefore, it is important to explore how the PMT constructs apply to the aging population. Tehari-Kharameh et al<sup>138</sup> conducted a cross-sectional study in Qom, Iran, from May to October of 2018, utilizing the PMT to assess the predictors of fall behaviors among community-dwelling older adults. Three hundred older people were selected from retirement centers using a stratified sampling method for those age 60 years or older; living independently in the community; Persian speaking; ability to complete the survey, willing to participate in this study.<sup>138</sup> Data were collected through 6 months from face-to-face interviews lasting for about 20–30 mins.<sup>138</sup> Fall protective behaviors were measured using the Falls Behavioral (FaB) Scale, originally developed by Clemson<sup>147</sup> to identify the elderly awareness and practice of fall

protective behaviors, with items such as cognitive adaptation, protective mobility, avoidance and awareness.<sup>138</sup> Respondents were asked to indicate actions they do in their everyday life, and answers were rated on a four-level scale ranging from 1, never to 4, always.<sup>138</sup>

The PMT constructs were assessed using the PMT scale for behaviors of falls, 5-point Likert scale from 1 strongly disagree to 5 strongly agree, and examples for each construct as follows: perceived vulnerability (“I’ll likely fall in the future”), perceived severity (“If I fall, I will break and injure my extremities”), perceived self-efficacy (“I can use a cane or auxiliary equipment when needed, even if I seem unable”), response efficacy (“Considering the possible dangers of doing things, falls can be prevented”), and protection motivation (“I intend to look for new information to protect myself from the falls”).<sup>138</sup> Mean (SD) age of the participants was 64.6 (5.5), 77.7% were male, and 55% of participants had a history of falls.<sup>138</sup> Fall protective behaviors were significantly associated with severity, fear, self-efficacy, response efficacy, and motivation.<sup>138</sup> Important to note that when severity and vulnerability levels were low, motivation seemed to be low as well.<sup>116,146</sup> Overall, protection motivation, coping appraisals, and reasonable fear were the strongest predictors of fall protective behaviors among the elderly population, results which may assist healthcare providers when planning effective fall prevention interventions.<sup>138</sup>

The PMT has lately been used in several studies on COVID-19 and preventive behaviors, clinical settings, or vaccination.<sup>148–152</sup> Bashirian et al.<sup>114</sup> conducted a cross-sectional study in Hamadan, Iran, utilizing the PMT to predict preventive behaviors of 761 healthcare workers towards COVID-19. They utilized a questionnaire consisting of two sections – demographics and PMT constructs. The PMT questionnaire, validated by healthcare experts and tested for

internal consistency, consisted of 23 questions on a five-point Likert scale, such as assessing vulnerability through “It is unlikely that I will be infected with the coronavirus,” or perceived severity with “Coronavirus disease can lead to death”.<sup>114</sup> The COVID-19 preventive behaviors were measured by five items rated by a three-point Likert scale (2, 1 and 0 scores, respectively).<sup>114</sup> Wearing a glove for procedures (43.3 %) and a face mask (51.8%) were least frequent preventive behaviors; 87% and 84.6% always washed hands frequently.<sup>115</sup> Preventive behaviors were considered at a somewhat desirable level, within 73.1% of the mean from the maximum score.<sup>115</sup> It was found that threat and coping appraisal ( $P<0.001$ ) and intention ( $P<0.001$ ) were the predictors of COVID-19 preventive behaviors, with the threat appraisal being the strongest predictor of preventive behaviors.<sup>114</sup>

One study on COVID-19 through the PMT was recently conducted by Rad et al<sup>115</sup> A cross-sectional research took place during March and April of 2020, in Hormogozan, Iran, aiming to predict COVID-19’s preventive behaviors as seen through the PMT. They surveyed 2,023 area residents 15 years or older, utilizing an online questionnaire composed of one demographic information and one PMT sections; constructs were rated on a Likert scale (1 to 5).<sup>115</sup> Constructs were assessed with statements such as “I may also get afflicted with Coronavirus” (vulnerability), “If afflicted with Coronavirus, there are chances of early death” (severity), “Recurrent washing of hands with water and soap for at least 20 seconds can protect me against Coronavirus” (response efficacy) and “I can adequately and appropriately disinfect contaminated or suspicious things and areas” (self-efficacy).<sup>115</sup> Questionnaire was validated and tested for internal consistency.<sup>115</sup> Most participants were 31 - 40 years old, female (60.4%), married (72%), urban residents (87.3%), had a bachelor’s degree or higher (58.8%) and were

employed (58.8%). A significant relationship was found between preventive behaviors of COVID-19 and perceived vulnerability ( $r=0.192$ ,  $p<0.001$ ), perceived severity ( $r=0.092$ ,  $p<0.001$ ), response efficacy ( $r=0.398$ ,  $p<0.001$ ), self-efficacy ( $r=0.497$ ,  $p<0.001$ ) and protection motivation ( $r=0.595$ ,  $p<0.001$ ).<sup>115</sup> Significant negative correlations were found between behavior and maladaptive behavior rewards ( $r=-0.243$ ,  $p<0.001$ ) and perceived costs ( $r=-0.121$ ,  $p<0.001$ ).<sup>149</sup> Authors expected for this research to contribute to policy making in Iran.

The PMT has been utilized in several studies to assess individuals' intention towards behavior change when in the presence of a threat.<sup>114,115,119,120,138</sup> It has also been utilized to analyze cognitive behavior and intent to change in experimental research.<sup>119</sup> The PMT theory is appropriate for this research, as it speaks to the perception of a threat and the efficacy beliefs to prompt and support response and coping, promoting behaviors to protect individuals from perceived risks in times of stressful events in life.<sup>13,42,118,120</sup>

## Chapter 3

### Methods

#### Statement of the Problem

For many years, the world had not seen a challenge such as the COVID-19 pandemic, which has strongly impacted the global economic, social, and individual spheres in such a short period. The COVID-19 *initial* fast impact timeline can be clearly seen in Figure 3 below:<sup>3</sup>

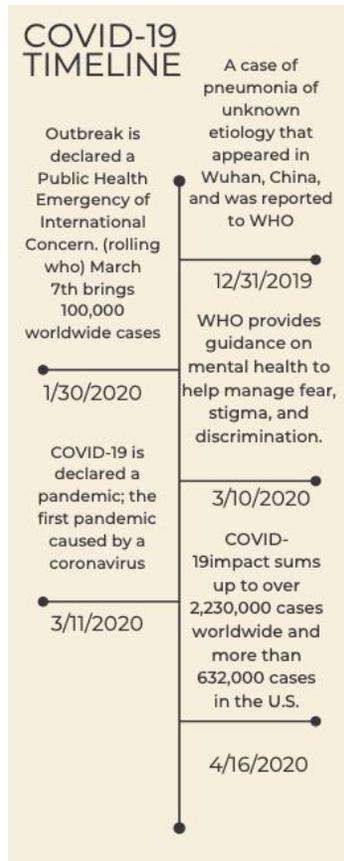


Figure 3 - The COVID-19 Initial Impact Timeline

This novel health threat promoted fear, while lockdown seemed to increase stress and anxiety.<sup>13</sup> Social isolation measures affected personal, social, and economic environments and affected individuals and group routines. In face of the fear of contagion and limited social access, people had to adapt in different ways to feel safe and maintain healthy habits for both physical and mental health support. During these trial times, an adequate diet and a healthy lifestyle are essential to support the immune system, particularly for those already at risk, who are more vulnerable to the virus. Furthermore, it is essential to observe mental health concerns and encourage behavior change to help risk appraisal and coping strategies. Identifying how communities felt and acted during the COVID-19 trial became imperative to support populations on promoting positive lifestyle changes during and after the

pandemic.<sup>126,139</sup> New studies in this area may assist with necessary information for public health officials to plan and implement efficient interventions, helping individuals while establishing and maintaining healthy habits during COVID-19 recovery and during possible future disaster times.

#### Research Aims & Questions

The purpose of this research was to examine the impact of the COVID-19-generated stress, health threat, and social isolation response efficacy on dietary, physical activity, and self-care habits of adults in Florida, utilizing constructs of the PMT as a framework to assist in predicting lifestyle changes. Information from this research may be applied towards developing effective behavior change techniques to assist individuals who need positive changes to manage daily stressors during disaster times.

- Aim 1: To examine the relationship between COVID-19 generated perceived threat and perceived efficacy and *adults' self-reported stress levels*.
- Research Question 1: Is there a relationship between COVID-19 generated perceived threat and perceived efficacy and *adults' self-reported stress levels*?
- Aim 2: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and *adults' self-reported changes in dietary habits* during COVID-19 social isolation experience.
- Research Question 2: Is there a relationship between perceived stress, perceived threat, and perceived efficacy and *adults' self-reported changes in dietary habits* during COVID-19 social isolation experience?

- Aim 3: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' *self-reported changes in physical activity habits* during COVID-19 social isolation experience.
- Research Question 3: Is there a relationship between perceived stress, perceived threat, and perceived efficacy and adults' *self-reported changes in physical activity habits* during COVID-19 social isolation experience?
- Aim 4: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' *self-reported changes in self-care habits* during COVID-19 social isolation experience.
- Research Question 4: Is there a relationship between perceived stress, perceived threat, and perceived efficacy and adults' *self-reported changes in self-care habits* during COVID-19 social isolation experience?

### Study Design

This cross-sectional descriptive study took place in Florida, United States, in the fall of 2020. The study involved an online questionnaire composed of four parts: demographics, a Perceived Stress Scale (Appendix C), and two PMT-guided, newly developed, and validated questionnaires, the COVID-19 PMT (CPMT – Appendix D) and the COVID-19 Change in Lifestyle Habits (CCLH – Appendix E).

### Study participants, Exclusion, and Inclusion Criteria

A quantitative online survey was conducted with a random sample of adults living in Florida.<sup>153</sup> The sample size calculation was done both manually as well as with Qualtrics and Raosoft online calculators, with a confidence interval of 95%, 80% power, and 5% margin of

error.<sup>143,145</sup> Florida's population source was at 21,477,737 individuals as of July 3, 2020, as per the United States Census Bureau, which resulted in a proposed sample size of 385 participants.<sup>154-157</sup> Inclusion criteria were being 18 years of age or older and a Florida resident; exclusion criteria were being younger than 18 years of age and/or not a Florida resident. All participants were required to sign an electronic informed consent to participate in the survey.

### Study Procedures and Measurements

As COVID-19 is a new topic, we developed two specific questionnaires to address the subject of this research study. Quantitative data were collected, with a set inclusion criteria of individuals living in Florida, through MTurk<sup>158</sup> with a combination of four questionnaires: a demographics section, a previously validated Perceived Stress Scale (PSS) questionnaire to assess stress (and coping), and two new questionnaires, the CPMT and CCLH, which were developed to allow for survey of the proposed research variables and PMT constructs.<sup>159</sup>

### Perceived Stress Scale Questionnaire

The PSS is a validated 1983 10-item instrument, divided into perceived stress and perceived self-efficacy, which measures how individuals assess situations in their lives to be stressful and cope with them through a 5-item Likert scale.<sup>159-161</sup> Negatively worded items represent stress and positively worded items represent self-efficacy.<sup>161</sup> The PSS scoring ranges from 1-50 (scores from questions 4,5,7,8 are reversed), with higher scores indicating higher perceived stress and lower perceived efficacy (1-17 low, 18-33 moderate, 34-50 high).<sup>162</sup> The PSS is a good instrument to assess how differently or similarly different individuals face the same experience in what relates to stress and coping, which makes it a valuable instrument for the purposes of this research.<sup>162</sup> This tool was useful in assessing some of the aims of this

research as it relates to the possible stress generated by the COVID-19 experiences presented during the social isolation experience.

For both CPMT and CCLH new questionnaires, Likert-type scales questions were developed with information obtained from the literature review and possible behavior changes observed during the pandemic and social isolation experiences.<sup>119,163–166</sup>

#### COVID-19 Protection Motivation Theory Questionnaire

The CPMT contains a total of 10 statements designed to assess the PMT constructs vulnerability, severity, response efficacy, and self-efficacy as they relate to the COVID-19 experience. All 10 statements were measured on a Likert scale from 1 strongly disagree to 5 strongly agree and scored from 1 to 5. To determine perceived threat, two questions represented the constructs of vulnerability, “I am sure I will contract COVID-19” and “I am scared of contracting COVID-19,” and two address severity, “If I contract COVID-19, I will have serious manifestations from it” and “If I contract COVID-19 I will have serious health issues because of other health conditions I have.” To determine perceived efficacy, six questions addressed social isolation and adoption of healthy habits as response efficacy paths, “I feel safe from COVID-19 when I social isolate,” “Social isolation has been helpful in making me cope with the COVID-19 pandemic,” “I have been adapting well to social isolation,” “I had to make lifestyle changes to self-isolate,” “Healthier lifestyle habits make me feel safe from COVID-19,” “Healthier lifestyle habits make me feel safe from complications from COVID-19.” A composite score was calculated from the sub-constructs: vulnerability (2 questions), severity (2 questions) for a total composite score ranging from a minimum 4, maximum 20 scores for perceived threat. A composite score was also calculated from self-efficacy (2 questions), social isolation

response efficacy (2 questions), and healthy lifestyles response efficacy (2 questions) for a total composite score with a minimum of 6, maximum 30 scores for perceived efficacy. Higher scores indicate a greater perception of the PMT threat and efficacy as they relate to COVID-19 effects, risk, and social isolation, and whether the practice of healthier lifestyle habits were perceived as beneficial in preventing COVID-19 possible harm.<sup>133</sup>

#### COVID-19 Change in Lifestyle Habits Questionnaire

The CCLH questionnaire is a 34 items instrument designed to measure changes in lifestyle habits, to include dietary, physical activity, and self-care practices, before and during social isolation. A dichotomous variable was created for each before and during question pairs, and a 0 was assigned to indicate “no change” while a 1 indicates “change.” For each category, dietary, physical activity, and self-care habits, a composite score was created by averaging the change/no change answers to individual questions; minimum 0, maximum 1.

#### Questionnaire Validation

As with any new questionnaire, it is important to ensure validity and reliability processes, so that data are accurately collected and measured.<sup>167</sup> Validity refers to assessing whether an instrument measures what it intends to measure, and includes face, content, construct, and criterion validity.<sup>168</sup> Face validity relates to an assumption that a test clearly represents the subject being evaluated.<sup>168</sup> Face validity relies somewhat on subjective methods; therefore, it may not be considered a superior method of validity, but it is nonetheless important, as instruments without face validity may have reduced relevance.<sup>168</sup> Content validity also relies on a subjective judgment, an expert’s opinion that an instrument appears to serve its proposed purpose.<sup>168</sup> Therefore, an instrument or survey needs to be clear and well defined to

meet face and content validity. Face and content validity were assessed for the demographics, CPMT, and CCHL surveys, as the PSS is an already validated questionnaire.<sup>167</sup> The validation processes generally rely on a panel of experts who evaluate an instrument; in this study, a panel of education, writing, and healthcare experts conducted face and content validation.<sup>169</sup>

### Face Validity

For face validity, we assessed the percentage agreement that the questions were clearly written and appropriate for the purpose of this survey: “How relevant is this item for the purposes of this survey” and thirty responses were recorded; however, four were empty and six were incomplete or duplicate, leading to 20 utilizable answers. From these, deletion was used to remove unanswered questions, as those were only two (-5%), and the new total used to calculate the final agreement percentages.<sup>170</sup> The demographics survey scored 99.5% agreement overall, with all questions scoring 100% agreement for questions clarity. The only suggestion provided to this section was to add answer options to the gender question, which was incorporated to the final survey. The CPMT survey scored 92.5% agreement of face validity overall; all questions individually scored above 80%. No suggestions or recommendations were made for this section; hence, no changes were needed.

The CCLH questionnaire presented some additional challenges, as the questions were specific and offered set times/dates/periods for the answers. Therefore, these allowed for a wider range of interpretation, and more suggestions were made to enhance questions objectivity. Overall, the questionnaire presented with 91.6% face validity; all questions individually scored above 85%, with only one question, #4, scoring 70% as it had a typo, which

was corrected. Suggestions were made to improve clarity of the physical activity questions. Small adjustments were made to the questions relating types of physical activity for clarity.

### Content Validity

To assess content validity, we utilized a proportion agreement method, the Content Validity Index (CVI), which is a quantitative estimation of content validity.<sup>168,169,171</sup> A panel of education, writing, and healthcare experts rated the questions on a 5-point Likert scale, from not relevant (1) to highly relevant (5). A Content Validity Index (CVI) was calculated by dividing the number of experts that arrived at an acceptable grade of 4 (very relevant) or 5 (highly relevant) by the total number of experts, with a cut-off point of 0.80 (if all experts agreed, CVI = 1.0, and if nine out of ten agreed, CVI = 0.9).<sup>167,168</sup> The demographics questionnaire scored 1.0, with all questions rated either 4 (very relevant) or 5 (highly relevant). On the CPMT survey, all questions scored >0.8. For the CCLH survey, all questions scored at or above 0.9.

After the newly developed questionnaires were reviewed and examined for face and content validation, the survey was then pilot tested by 20 education professionals, which resulted in 100% agreement from experts “that the survey measures the constructs it is supposed to measure as per its title and the description provided under general information.”<sup>169,171</sup>

### Reliability

Cronbach- $\alpha$  is a measure of internal consistency and it is used to examine a scale’s reliability, which refers to whether a tool consistently measures a concept.<sup>120,133,138,172</sup> Values above .70 are generally considered adequate.<sup>173</sup> Cronbach- $\alpha$  was used to assess the newly developed surveys, as displayed below (Table 1).

Table 1 – Cronbach-alpha for the Study's Surveys

Cronbach- $\alpha$		
PSS (10 items)	Stress and coping	$\alpha = .88$
CPMT		
<i>Perceived Threat (4 items)</i>	Vulnerability and Severity	$\alpha=.83$
<i>Perceived Efficacy (6 items)</i>	Response Efficacy and Self-Efficacy	$\alpha=.75$
	<i>Overall</i>	$\alpha=.79$
CCHL		
	Dietary Habits	$\alpha=.71$
	Physical Activity Habits	$\alpha=.85$
	Self-Care Habits	$\alpha=.83$
	<i>Overall</i>	$\alpha=.80$

The final survey (Appendices B-E) was constructed utilizing the University of North Florida's Qualtrics XM Survey Software and distributed through Amazon Mechanical Turk (MTurk) to Florida residents. The research protocol was approved by Keiser University under number IRB000S20LS92R2.

#### Data Analysis

Quantitative data were exported from Qualtrics in a SPSS format, renamed and coded in rows and columns for practicality of data analysis. Data from entirely incomplete questionnaires ( $N = 17$ ) were deleted prior to final analysis; this prevented imputation of

missing data, which could affect reliability.<sup>170</sup> Data were labeled and total and sub-scale values were calculated for the PSS, CPMT, and CCLH questionnaires as described above. The PSS questions numbers 4, 5, 7, and 8 were reverse scored as per validated survey guidelines, to ensure correct assessment of stress levels.<sup>159</sup> Scorings of 0 for “no change” and 1 for “change” were assigned to all CCLH questionnaire items to allow for examination of whether lifestyle habits changes took place “before” or “during” social isolation. All the PSS scores were totaled and averaged. Scores from the CPMT questionnaire assessing threat and response efficacy were averaged. Scores representing dietary habits, physical activity habits, and self-care habits were averaged, respectively, and scores assessing sleep habits were labeled as changed and not changed only.

At the time of analysis, questions related to shopping for food, although part of the initial survey, were not included as they did not match the purposes of this research; therefore, the final questionnaire presented 34 instead of 40 questions. All data were adequately labeled as nominal and scale variables, accordingly.

Prior to choosing statistical tests, variables were assessed for independence and normality. Skewness and kurtosis for all dependent variables supported the conclusion that the data were normally distributed, as expected due to the large sample size. Variables were examined for multicollinearity in two ways, first checking for correlation values above 0.80 through Pearson and Spearman rho tests, as well as through VIF values; no multicollinearity was present.<sup>174</sup> Therefore, data met assumptions for correlations and multiple linear regression, as variables were normally distributed, and a linear relationship was observed; additionally, variables showed independence of observations via Durbin-Watson, and were

tested for homoscedasticity and residuals, and none was present.<sup>175</sup> Data were analyzed with the latest IBM Statistical Package for Social Sciences (SPSS) software version 27.<sup>176</sup> Level of significance was set at  $\alpha = 0.05$ ; power level at 0.80.<sup>144</sup>

#### Aims and Hypotheses Assigned Statistical Tests

Aim 1: To examine the relationship between COVID-19 generated perceived threat and perceived efficacy and adults' self-reported stress levels.

H<sub>01a</sub>: There is no relationship between COVID-19 generated perceived threat and adults' self-reported stress levels.

perceived efficacy and adults' self-reported stress levels.

H<sub>01b</sub>: There is no relationship between COVID-19 generated perceived efficacy and adults' self-reported stress levels.

H<sub>1a</sub>: There is a relationship between COVID-19 generated perceived threat and adults' self-reported stress levels.

H<sub>1b</sub>: There is a relationship between COVID-19 generated perceived efficacy and adults' self-reported stress levels.

A Pearson correlation measured the strength and direction between the continuous variables COVID-19 perceived threat and perceived efficacy, and adults' self-reported measures of stress.

Aim 2: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>02a</sub>: There is no relationship between perceived stress and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>02b</sub>: There is no relationship between perceived threat and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>02c</sub>: There is no relationship between perceived efficacy and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>2a</sub>: There is a relationship between perceived stress and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>2b</sub>: There is a relationship between perceived threat and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

H<sub>2c</sub>: There is a relationship between perceived efficacy and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

A partial correlation assessed whether relationships were significant to answer the research question on changes on dietary habits scores. A stepwise multiple regression test was conducted to find the best model to fit our data and examine outcome predictors of changes in dietary habits, while controlling for significant demographic variables.

Aim 3: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>03a</sub>: There is no relationship between perceived stress and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>03b</sub>: There is no relationship between perceived threat and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>03c</sub>: There is no relationship between perceived efficacy and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>3a</sub>: There is a relationship between perceived stress and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>3b</sub>: There is a relationship between perceived threat and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

H<sub>3c</sub>: There is a relationship between perceived efficacy and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

A partial correlation assessed whether relationships were significant to answer the research question on changes on physical activity habits scores. A stepwise multiple regression test was conducted to find the best model to fit our data and examine outcome predictors of changes in physical activity habits, while controlling for significant demographic variables.

Aim 4: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>04a</sub>: There is no relationship between perceived stress and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>04b</sub>: There is no relationship between perceived threat and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>04c</sub>: There is no relationship between perceived efficacy and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>4a</sub>: There is a relationship between perceived stress and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>4b</sub>: There is a relationship between perceived threat and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

H<sub>4c</sub>: There is a relationship between perceived efficacy and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

A partial correlation test assessed whether relationships were significant to answer the research question on changes on self-care habits scores. A stepwise multiple regression test was conducted to find the best model to fit our data and examine outcome predictors of changes in self-care habits, while controlling for significant demographic variables.

## Chapter 4

### Results

#### Goal

The goal of this research was to examine the impact of the COVID-19 health threat and social isolation on stress and lifestyle habits of adults, utilizing constructs of the PMT as a framework to assist in predicting protective behavior responses. This research was unique as it was the first study of its kind to examine the impact of COVID-19 on lifestyle habit changes of the Floridians, and the first one from a PMT-based perspective, evaluating those changes considering the constructs of vulnerability and severity (perceived threat) and response efficacy and self-efficacy (perceived efficacy).

#### Study Sample

Four hundred seventy-eight (478) surveys were received via MTurk.<sup>158,177</sup> Seventeen surveys (3.6%) presented with a large volume of missing data and were excluded by list wise deletion. The remaining surveys ready for analysis totaled 461, a sample size 20% above the minimum calculated sample size for this study.

### Demographic Data

Table 2 displays this study's demographic data discussed here; greyed out are characteristics used as reference for stepwise regression analyses. Males represented 53.6% ( $n = 247$ ) of the sample, while females represented 45.8% ( $n = 211$ ); other, transgender female, and gender nonconforming accounted for .2% ( $n = 1$ ) each, of the study population. Most of the population were between 25-34 years of age (36%,  $n = 165$ ), followed by 28.2% ( $n = 129$ ) represented by those between 35-49 years old, and 19.2% ( $n = 88$ ) being 50-64 years of age. Most of the respondents (75.3%,  $n = 345$ ) were white/Caucasian, followed by 9.2% ( $n = 42$ ) African American and 3.9% ( $n = 18$ ) Latino or Hispanic. Most respondents possessed a bachelor's degree (44.7%,  $n = 205$ ), followed by those with a master's degree (17.6%,  $n = 81$ ), and some college (15.3%,  $n = 70$ ). More than half of the participants (50.8%,  $n = 233$ ) were married, while 34% ( $n = 156$ ) were single. Most of the study sample (68.8%,  $n = 316$ ) was employed full-time, while 10.9% ( $n = 50$ ) of participants were employed part-time, 6.8% ( $n = 31$ ) were unemployed, and 5.2% ( $n = 24$ ) were retired. Twenty-six (5.7%) participants reported being unemployed due to COVID-19. The number of people per household varied, with similar percentages of reported households of 2 (25.9%,  $n = 119$ ), 3 (25.3%,  $n = 116$ ) and 4 (23.5%,  $n = 108$ ) people, respectively. Most of the participants fell into two of the household incomes brackets, 25,000 – 49,000 (35.1%,  $n = 162$ ) and 50,000-74,999 (26.5%,  $n = 122$ ).

Table 2 - Demographic Characteristics of Study's Participants (N = 461)

Factor	Number (n)	Percent (%)
<i>Gender</i>		
Male	247	53.6
Female	211	45.8
Transgender Female	1	.2
Gender Nonconforming	1	.2
Other	1	.2
<i>Age (yr)</i>		
18 – 24	42	9.2
25 – 34	165	36.0
35 – 49	129	28.2
50 – 64	88	19.2
65 +	34	7.4
<i>Ethnicity/Race</i>		
White/Caucasian	345	75.3
African American	42	9.2
Latino or Hispanic	18	3.9
Asian	13	2.8
Native American	7	1.5
Native Hawaiian or Pacific Islander	1	.2
Two or More	28	6.1
Other/Unknown	4	.9
<i>Highest Level of Education</i>		
Some High School	1	.2
High School	51	11.1
Some College	70	15.3
Associate Degree	45	9.8

Bachelor's Degree	205	44.7
Master's Degree	81	17.6
Doctoral Degree	6	1.3
<i>Marital Status</i>		
Single	156	34.0
Married	233	50.8
Domestic Partnership	27	5.9
Separated	3	.7
Divorced	31	6.8
Widowed	9	2.0
<i>Employment Status</i>		
Full-Time	316	68.8
Part-Time	50	10.9
Unemployed	31	6.8
Retired	24	5.2
Other	12	2.6
Unemployed due to COVID-19	26	5.7
<i>Household</i>		
1	66	14.4
2	119	25.9
3	116	25.3
4	108	23.5
5 persons or more	50	10.9
<i>Household Income</i>		
Less than 25,000	60	13.0
25,000 – 49,000	162	35.1
50,000 – 74,999	122	26.5
75,000 – 99,999	62	13.4

100,000 – 149,000	37	8.0
150,000 +	18	3.9

Table 3- Descriptive Characteristics of Study's Variables and Assigned Scores

	Mean	Std. Deviation	Minimum	Maximum	N
Stress	27.21	7.745	10	49	449
Vulnerability	5.88	2.022	2	10	460
Severity	5.84	2.279	2	10	457
Perceived Threat	11.72	3.943	4	20	457
Isolation	7.30	1.851	2	10	460
Healthy Habits	7.11	1.926	2	10	359
Response Efficacy	14.40	3.137	4	20	459
Self-Efficacy	7.05	1.635	2	10	457
Perceived Efficacy	21.44	4.291	6	30	456
Dietary	.46	.343	0	1	437
Physical Activity	.50	.400	0	1	452
Self-Care	.48	.391	0	1	453

Table 4- Spearman rho Correlations between Demographic Data and Dependent Variables.

Spearman's rho			Dietary	Physical Activity	Self-Care
Gender	Correlation Coefficient		-.016	-.013	.066
	Sig. (2-tailed)		.743	.787	.163
	N		437	452	453
Age	Correlation Coefficient		-.136**	-.198**	-.266**
	Sig. (2-tailed)		.005	.000	.000
	N		435	449	450
Ethnicity/Race	Correlation Coefficient		.036	.160**	.113*
	Sig. (2-tailed)		.454	.001	.017
	N		435	449	450
Highest Level of Education Completed	Correlation Coefficient		.219**	.184**	.175**
	Sig. (2-tailed)		.000	.000	.000
	N		435	450	451
Marital Status	Correlation Coefficient		.003	-.057	-.058
	Sig. (2-tailed)		.958	.230	.218
	N		436	450	451
Employment Status	Correlation Coefficient		-.154**	-.121*	-.170**

		Sig. (2-tailed)	.001	.010	.000
		N	435	450	451
Number of People in your Household		Correlation Coefficient	.197**	.218**	.256**
		Sig. (2-tailed)	.000	.000	.000
		N	435	450	451
		Correlation Coefficient	.121*	.132**	.111*
Household Income		Sig. (2-tailed)	.011	.005	.018
		N	437	452	453

### General Statistical Analyses of Study's Data

Descriptive statistics, such as mean, standard deviations, minimum and maximum values, were calculated and presented throughout the study (and on Appendix F) to show the frequency distribution of demographic characteristics of the sample population and summarize basic data related to PSS, CPMT, and CCLH questionnaires.<sup>133</sup> Table 2 displays the descriptive statistics of the study's variables. Table 3 shows the means and standard deviations of the constructs of interest. A Spearman rho test measured the relationships between demographics and dependent variables dietary, physical activity, and self-care habits (Table 4). A bivariate analysis was performed to explore the relationships between the variables to assess which should be included as covariates in the regression analyses. Table 5 shows the partial correlation between the study's variables. Tables 6-8 display PSS CPMT, and CCLH survey results. Table 8 shows the reported number of reported positive and negative lifestyle changes and the significance of those changes.<sup>151</sup>

*Table 5– Partial Correlation Among Study's Variables Controlling for Gender, Age, Education, Ethnicity/Race, Household, Income.*

Correlations		Dietary	Physical Activity	Self-Care
Stress	Pearson Correlation	.364	.243	.395
	Sig. (2-tailed)	<.001	<.001	<.001
	N	402	402	402

Vulnerability	Pearson Correlation	.303	.239	.331
	Sig. (2-tailed)	<.001	<.001	<.001
	N	402	402	402
Severity	Pearson Correlation	.358	.231	.328
	Sig. (2-tailed)	<.001	<.001	<.001
	N	402	402	402
Perceived Threat	Pearson Correlation	.362	.256	.359
	Sig. (2-tailed)	<.001	<.001	<.001
	N	402	402	402
Response Efficacy	Pearson Correlation	.036	.093	.079
	Sig. (2-tailed)	.468	.061	.136
	N	402	402	402
Isolation	Pearson Correlation	.053	.099	.128
	Sig. (2-tailed)	.292	.047	.008
	N	402	402	402
Self-Efficacy	Pearson Correlation	.147	.127	.125
	Sig. (2-tailed)	.003	.011	.014
	N	402	402	402
Perceived Efficacy	Pearson Correlation	.082	.116	.105
	Sig. (2-tailed)	.102	.022	.048
	N	402	402	402
Healthy Habits	Pearson Correlation	.008	.057	.006
	Sig. (2-tailed)	.861	.247	.931
	N	402	402	402

#### PSS Analysis

Referring to the social isolation period in Florida, 33.5% of the participants reported feeling often nervous or stressed. Almost half (47.9%) of participants reported not feeling on top of things; while 35.6% felt unable to control important things in life. More than half of the

respondents, 52.7% reported not feeling confident about handling personal problems and almost same felt not able to cope with things they had to do (44.1%); however, also almost half of participants (46.1%) did not feel difficulties were piling so high that they could not overcome them.

Table 6 - Distribution of PSS Answers among Research Participants (minimum 1, maximum 5) How often have you felt...?

PSS	Never % (n)	Almost Never % (n)	Sometimes % (n)	Fairly Often % (n)	Often % (n)	Mean	Std Dev
...upset because of something that happened unexpectedly?	8.4(40)	24.1(115)	43.7(209)	15.5(74)	4.8(23)	2.84	.965
...you were unable to control the important things in your life?	15.1(72)	20.5(98)	31.0(148)	20.7(99)	9.2(44)	2.88	1.193
...nervous and stressed?	10.0(48)	17.6(84)	35.1(168)	22.6(108)	10.9(52)	3.07	1.134
...confident about your ability to handle your personal problems?	20.3(97)	32.4(155)	27.8(133)	12.6(60)	3.1(15)	2.44	1.061
...things were going your way?	11.3(54)	29.9(143)	34.7(166)	17.4(83)	2.9(14)	2.70	.996
...you could not cope with all the things you had to do?	23.2(111)	20.9(100)	23.4(112)	20.1(96)	8.8(42)	2.69	1.289
...able to control irritations in your life?	17.4(83)	28.9(138)	31.6(151)	15.1(72)	2.9(14)	2.55	1.053
...you were on top of things?	15.5(74)	32.4(155)	31.4(150)	12.6(60)	3.8(18)	2.55	1.036
...angered because of things that happened	14.9(71)	20.7(99)	30.3(145)	23.4(112)	6.9(33)	2.86	1.161

outside of your control?							
...difficulties were piling up so high that you could not overcome them?	24.1(115)	22.0(105)	24.7(118)	17.4(83)	8.2(18)	2.62	1.268

### CPMT Analysis

More than half (51.7%) of the participants reported to disagree with “I am sure I will contract COVID-19,” while 57.8% agreed with “I am scared of contracting COVID-19.” Thirty-six percent (36.4%) believed that “If I contract COVID-19, I will have serious manifestations from it,” even though only 34.5% believed that “If I contract COVID-19, I will have health issues because of other health conditions I have.” Perceived social isolation response-efficacy is shown as 66% of participants reported to agree and strongly agree “I feel safe from COVID-19 when I self-isolate,” while 57.6% reportedly agree that “Social isolation has been helpful in making me cope with the COVID-19 pandemic.” The majority of 61.4% of participants agreed with “I have been adapting well to social isolation.” Additionally, 54.9% agreed that “I had to make lifestyle changes to be able to self-isolate” and 56.9% agreed with “Healthier lifestyle habits make me feel safe from COVID-19” while 58.9% agreed that “Healthier lifestyle habits make me feel safe from complications from COVID-19.”

Table 7 - Distribution of CPMT Constructs Among Research Participants (scores: minimum 1, maximum 5)

CPMT	Strongly Disagree % (n)	Disagree % (n)	Neutral % (n)	Agree % (n)	Strongly Agree % (n)	Mean	Std Dev
I am sure I will contract COVID-19	21.5(99)	30.2(139)	28.9(133)	14.8(68)	4.6(21)	2.51	1.119

I am scared of contracting COVID-19	12.2(56)	15.2(70)	14.8(68)	39.1(180)	18.7(18)	3.37	1.283
If I contract COVID-19, I will have serious manifestations from it	11.8(54)	20.3(93)	31.6(145)	26.4(121)	10.0(46)	3.03	1.158
If I contract COVID-19, I will have health issues because of other health conditions I have	21.2(97)	21.2(97)	23.1(106)	24.5(112)	10.0(46)	2.81	1.293
I have been adapting well to social isolation	6.1(28)	10.0(46))	22.5(103)	39.1(179))	22.3(102))	3.61	1.119
I had to make lifestyle changes to be able to self-isolate	7.8(36))	13.5(62)	23.7(109)	37.5(172)	17.4(80)	3.43	1.157
I feel safe from COVID-19 when I self-isolate	2.8(13)	8.0(37)	23.0(106)	41.7(192)	24.3(112)	3.77	0.999
Social isolation has been helpful in making me cope with the COVID-19 pandemic	5.4(25)	13.7(63)	23.3(107)	37.8(174)	19.8(91)	3.53	1.117
Heathy lifestyle habits make me feel safe from COVID-19	3.3(15)	13.1(60)	26.8(123)	40.3(185)	16.6(76)	3.54	1.020
Healthy lifestyle habits make me feel safe from complications from COVID-19	4.1(19)	11.5(53)	25.4(117)	40.2(185)	18.7(86)	3.58	1.048
CPMT	Strongly Disagree % (n)	Disagree % (n)	Neutral % (n)	Agree % (n)	Strongly Agree % (n)	Mean	Std Dev

I am sure I will contract COVID-19	21.5(99)	30.2(139)	28.9(133)	14.8(68)	4.6(21)	2.51	1.119
I am scared of contracting COVID-19	11.7(56)	14.6(70)	14.2(68)	37.7(180)	3.8(18)	3.37	1.283
If I contract COVID-19, I will have serious manifestations from it	11.3(54)	19.5(93)	30.3(145)	25.3(121)	9.6(46)	3.03	1.158
If I contract COVID-19, I will have health issues because of other health conditions I have	20.3(97)	20.3(97)	22.2(106)	23.4(112)	9.6(46)	2.81	1.293
I have been adapting well to social isolation	2.7(13)	7.7(37)	22.2(106)	40.2(192)	23.4(112)	3.77	.999
I had to make lifestyle changes to be able to self-isolate	5.2(25)	13.2(63)	22.4(107)	36.4(174)	19.0(91)	3.53	1.117
I feel safe from COVID-19 when I self-isolate	5.9(28)	9.6(46)	21.5(103)	37.4(179)	21.3(102)	3.61	1.119
Social isolation has been helpful in making me cope with the COVID-19 pandemic	7.5(36)	13.0(62)	22.8(109)	36.0(172)	16.7(80)	3.43	1.157
Heathy lifestyle habits make me feel safe from COVID-19	3.1(15)	12.6(60)	25.7(123)	38.7(185)	15.9(76)	3.54	1.020
Healthy lifestyle habits make me feel safe from complications from COVID-19	4.0(19)	11.1(53)	24.5(117)	38.7(185)	18.0(86)	3.58	1.048

## CCLH Analysis

### Changes in Dietary, Physical Activity, and Self-Care Lifestyle Habits Before and During Social Isolation Overview

Significant positive changes were reported in cooking at home ( $p < .001$ ), sweets ( $p < .001$ ), and breakfast ( $p = .009$ ), consumption frequency, outdoors physical activity ( $p = .005$ ), self-care ( $p < .001$ ), relaxation ( $p < .001$ ), and rest ( $p < .001$ ) habits. Significant negative changes were reported in fast food ( $p = .004$ ) and snack ( $p < .001$ ) consumption. No changes were observed in fresh foods ( $p = .873$ ), alcoholic beverages ( $p = .811$ ), lunch ( $p = .697$ ), dinner ( $p = .433$ ), set mealtimes ( $p = .869$ ), any physical activity ( $p = .200$ ), new physical activity ( $p = .171$ ), average hours of sleep ( $p = .143$ ) (graphs of non-significant results presented in Appendix G).

Table 8– Sign-Rank Test derived  $p$  Values for Changes in Lifestyle Habits Scores (CCLH)

Lifestyle Habits	Positive Differences	Negative Differences	Ties	$p$
Cooking at Home	60	187	206	<.001
Fresh Foods	97	105	250	.873
Fast Food or Ready to Eat	141	94	216	.004
Sweets and Candies	65	125	258	<.001
Alcoholic Beverages	77	86	286	.811
Breakfast	66	104	282	.009
Lunch	81	80	292	.697
Dinner	59	74	316	.433
Set Mealtimes	78	88	284	.869
Snacking Between Meals	142	58	249	<.001
Any Physical Activity	127	120	203	.200
Outdoors Physical Activity	136	103	210	.005

New Physical Activity	82	103	260	.171
Self-Care Routines	83	151	217	<.001
Relaxation	74	127	250	<.001
Rest	67	148	235	<.001
Sleep	94	120	239	.143

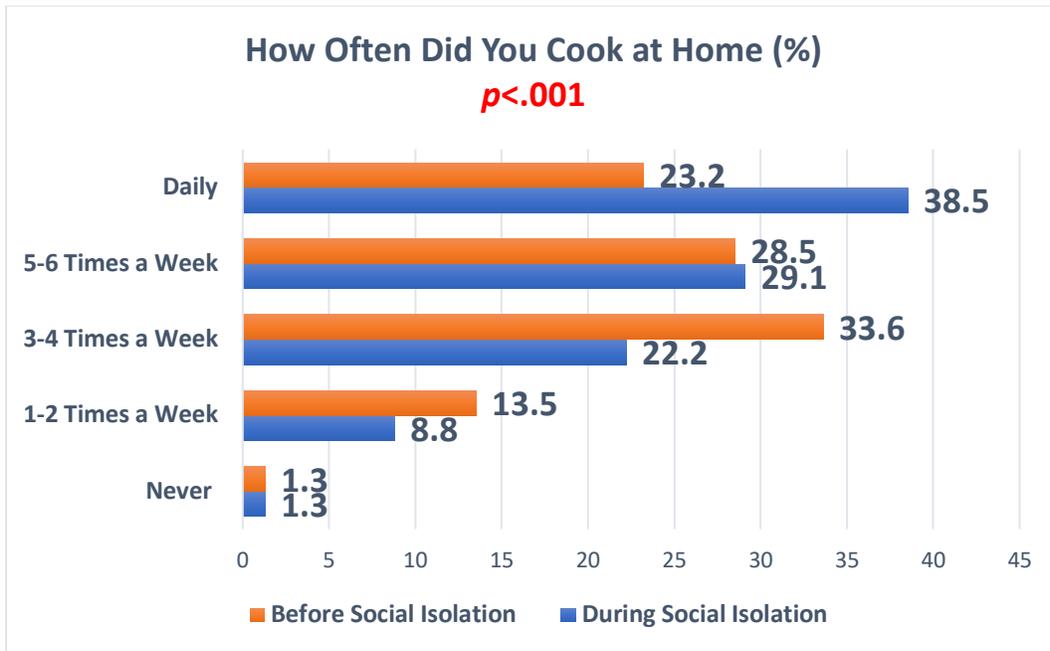


Figure 4 - Participants' Self-Reported Cooking at Home Frequency Before and During Social Isolation

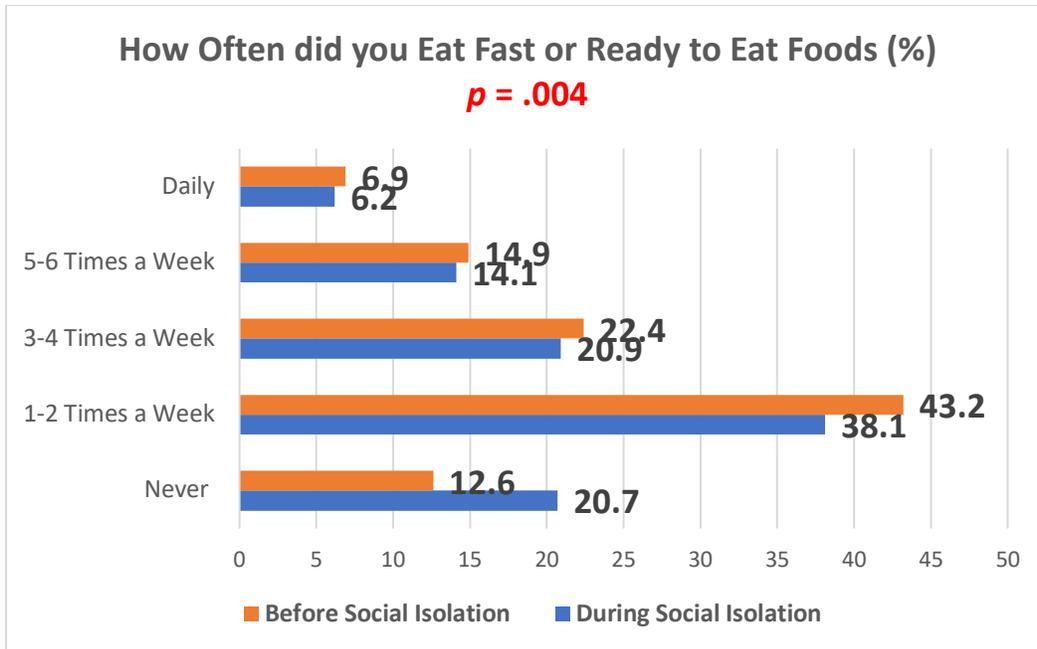


Figure 5 - Participants' Self-Reported Fast or Ready to Eat Consumption Frequency Before and During Social Isolation

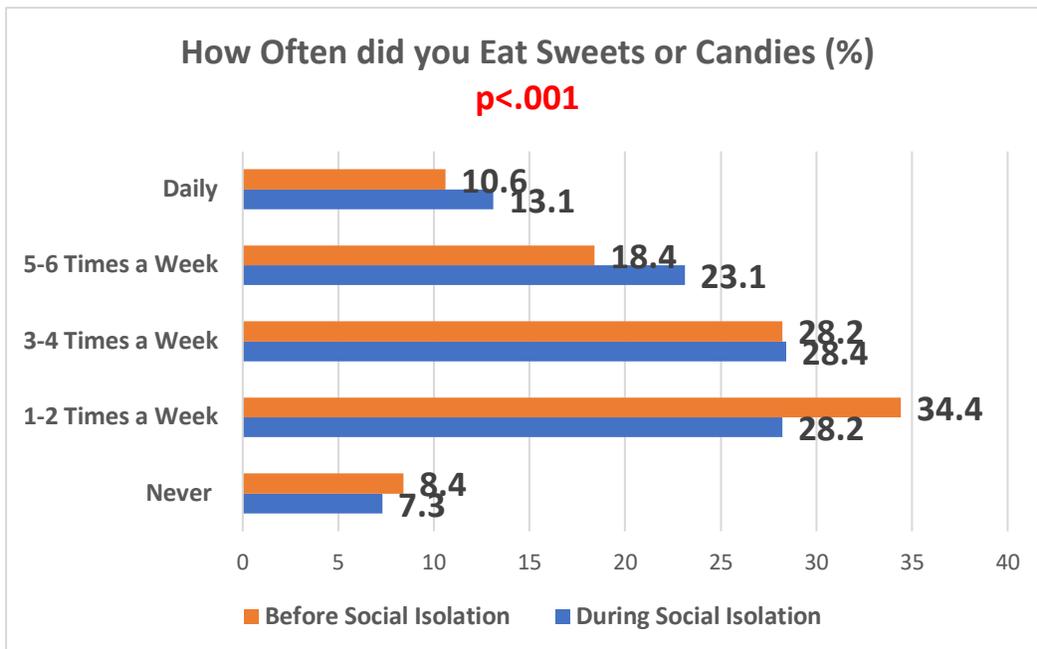


Figure 6 - Participants' Self-Reported Sweets or Candies Consumption Frequency Before and During Social Isolation

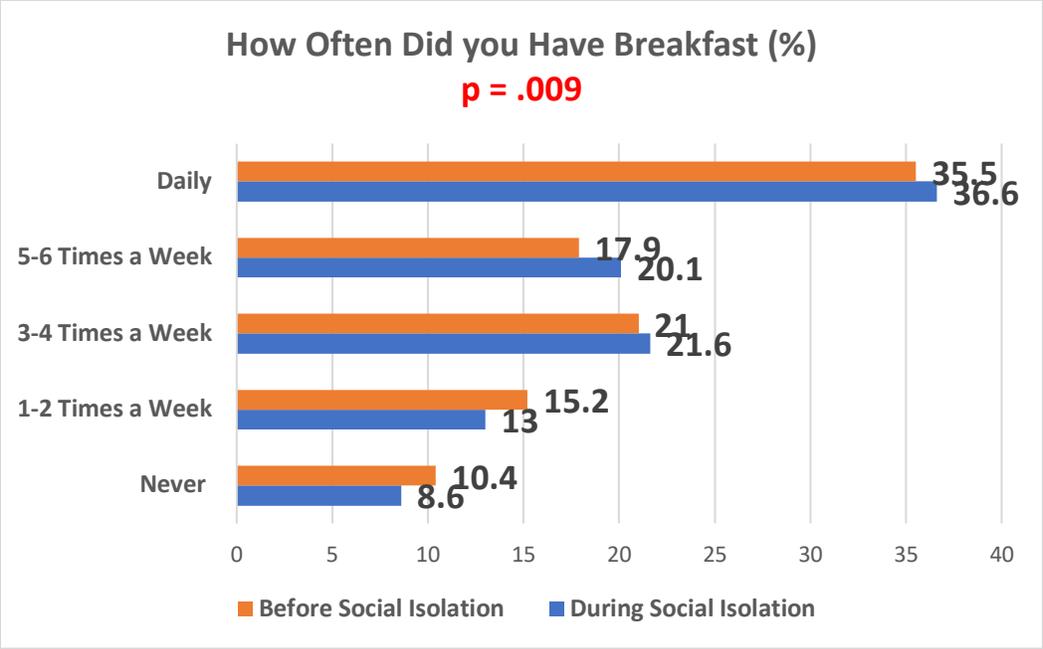


Figure 7- Participants' Self-Reported Breakfast Habits Before and During Social Isolation

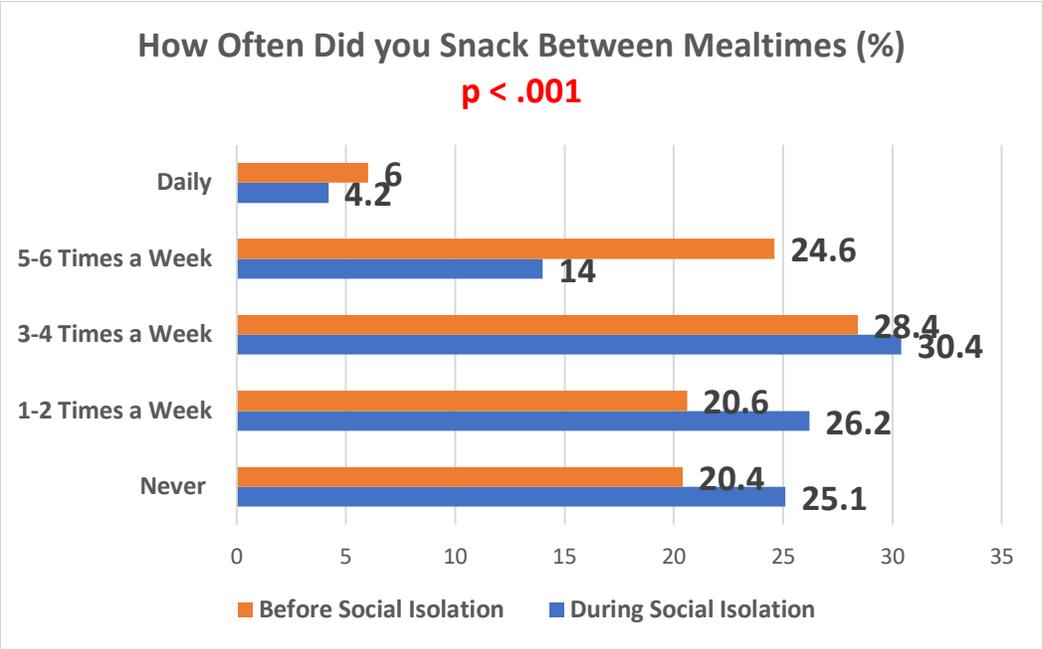


Figure 8 - Participants' Self-Reported Snacking Between Mealtimes Habits Before and During Social Isolation

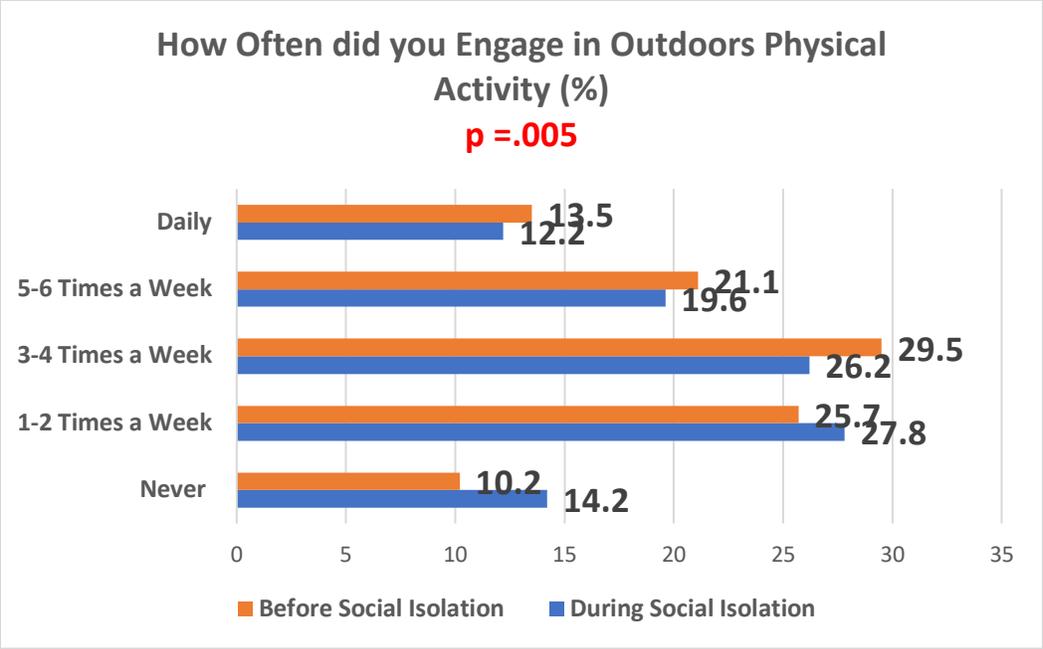


Figure 9 - Participants' Self-Reported Engaging in Outdoors Physical Activities Habits Before and During Social Isolation

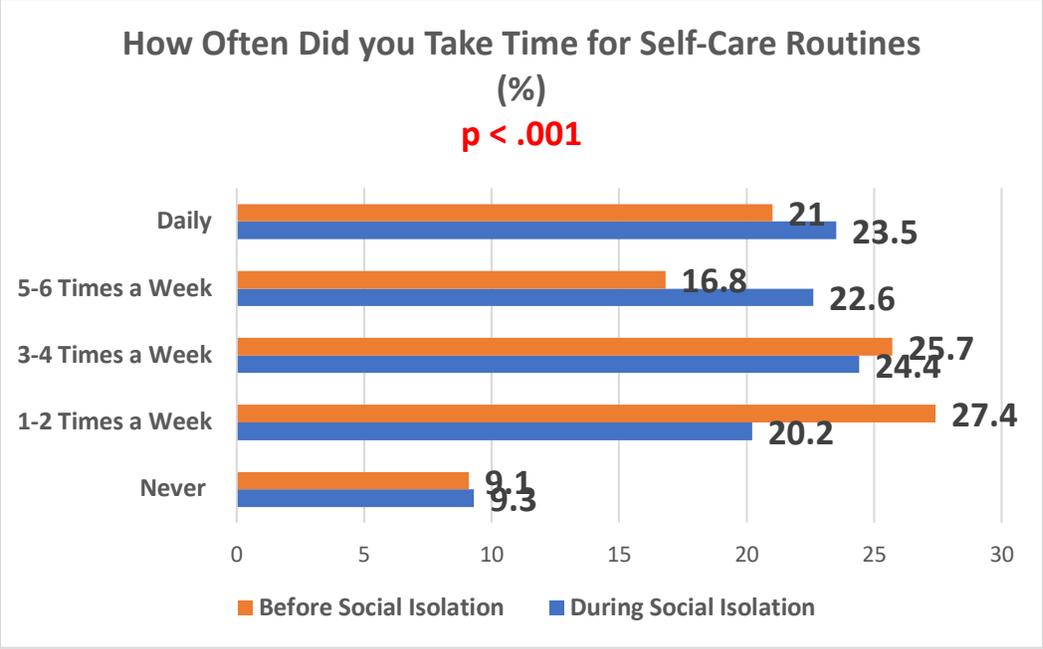


Figure 10 - Participants' Self-Reported Self-Care Routines Habits Before and During Social Isolation

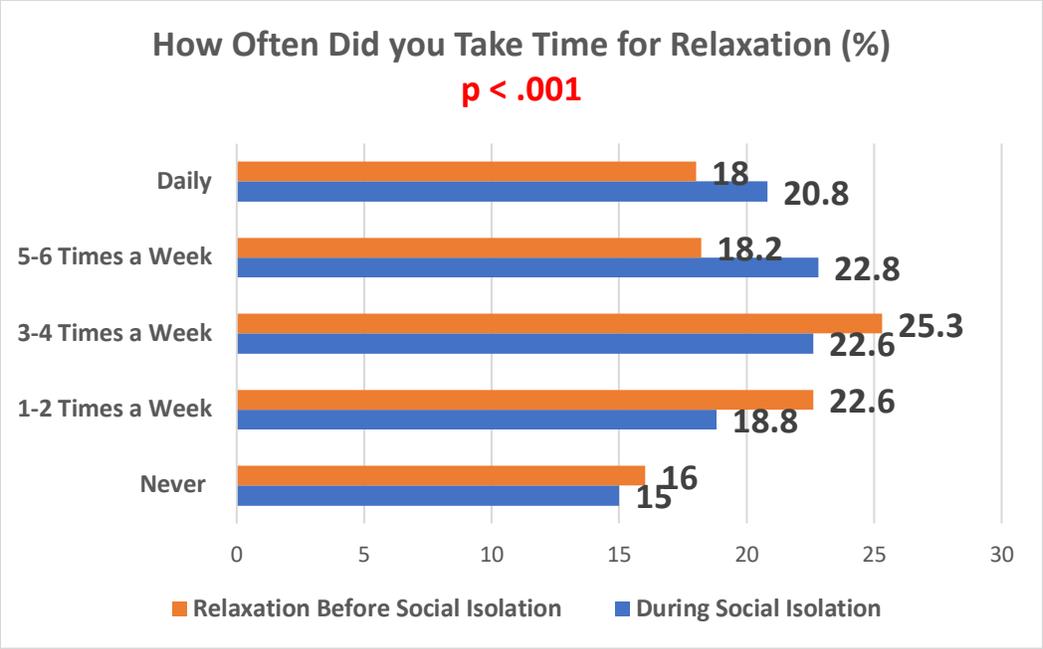


Figure 11 - Participants' Self-Reported Time for Relaxation Habits Before and During Social Isolation

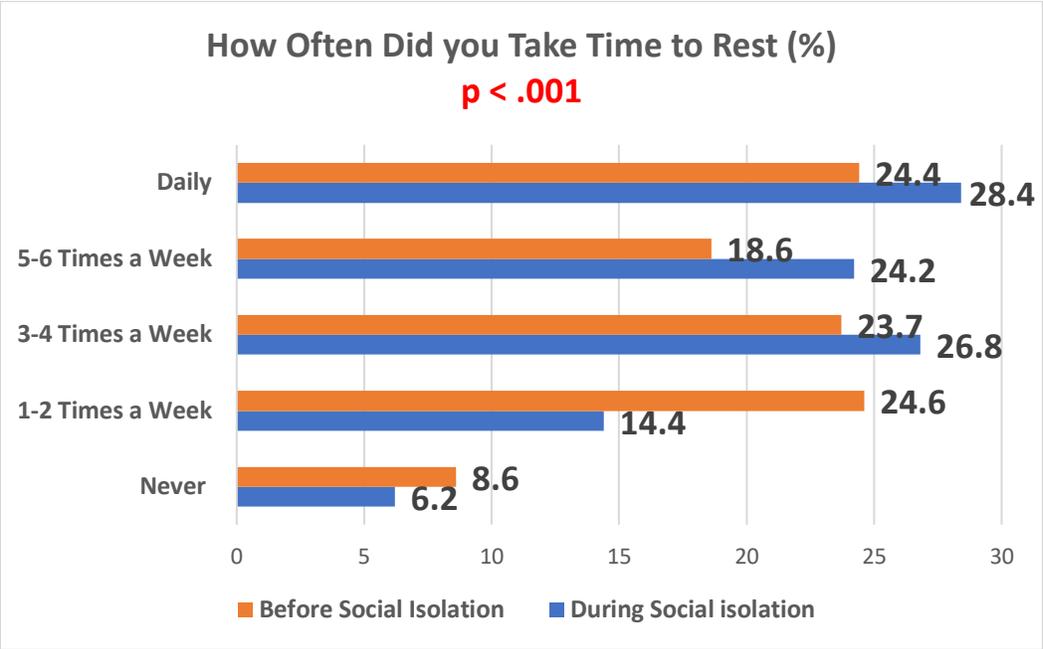


Figure 12 – Participants' Self-Reported Time to Rest Habits Before and During Social Isolation

Aim 1: To examine the relationship between COVID-19 generated perceived threat and perceived efficacy and adults' self-reported stress levels.

Table 9 – Spearman rho Correlation Between Stress, Perceived Threat, Perceived Efficacy and Demographic Variables

			Stress	Perceived Threat	Perceived Efficacy
Spearman's rho	Gender	Correlation Coefficient	.145**	.057	-.037
		Sig. (2-tailed)	.002	.226	.432
		N	449	457	456
	Age	Correlation Coefficient	-.369**	-.034	.010
		Sig. (2-tailed)	.000	.472	.832
		N	446	455	453
	Ethnicity/Race	Correlation Coefficient	.103*	.014	.020
		Sig. (2-tailed)	.030	.762	.670
		N	446	454	453
	Highest Level of Education Completed	Correlation Coefficient	-.002	.075	.154**
		Sig. (2-tailed)	.969	.110	.001
		N	447	455	454
	Marital Status	Correlation Coefficient	-.112*	.063	.096*
		Sig. (2-tailed)	.017	.183	.042
		N	448	455	454
	Employment Status	Correlation Coefficient	.066	.011	-.005
		Sig. (2-tailed)	.163	.822	.908
		N	447	455	454
	Number of People in your Household	Correlation Coefficient	.132**	.070	.068
		Sig. (2-tailed)	.005	.139	.147
		N	447	455	454
Household Income	Correlation Coefficient	-.099*	-.046	-.017	
	Sig. (2-tailed)	.036	.327	.715	
	N	449	457	456	

Table 10 – Partial Correlation between Adults’ Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy.

Partial Correlations					
Control Variables			Stress	Perceived Threat	Perceived Efficacy
Gender & Age & Ethnicity/Race & Highest Level of Education Completed & Marital Status & Employment Status & Number of People in your Household & Household Income	Stress	Correlation	1.000	.331	-.152
		Significance (2-tailed)	.	.000	.002
		df	0	424	424
	Perceived Threat	Correlation	.331	1.000	.303
		Significance (2-tailed)	.000	.	.000
		df	424	0	424
	Perceived Efficacy	Correlation	-.152	.303	1.000
		Significance (2-tailed)	.002	.000	.
		df	424	424	0

Results of a Spearman rho correlation (Table 9) showed the variables to be included in this question’s analysis. A partial correlation (Table 10) indicated that there was significant positive relationship between adults’ self-reported stress levels and perceived threat, ( $r = .33, p < .001$ ) and a significant negative relationship between adults’ self-reported stress levels and perceived efficacy, ( $r = -.15, p = .002$ ). Therefore, as perceived threat increased, stress levels increased, and as perceived efficacy increased, stress levels decreased. *As there was a statistically significant relationship between COVID-19 generated perceived threat and perceived efficacy and adults’ self-reported stress levels, we rejected the null hypotheses 01a and 01b.*

We conducted further exploratory analyses to examine relationships among PMT sub-constructs.

Table 11 – Partial Correlation between Self-Reported Stress Levels, Perceived Threat Sub-Constructs, and Perceived Efficacy Sub-Constructs.

Control Variables		Correlations					
		Stress	Vulnerability	Severity	Response Efficacy	Self-Efficacy	
Gender & Age & Ethnicity/Race & Highest Level of Education Completed & Marital Status & Employment Status & Number of People in your Household & Household Income	Stress	Correlation	1.000	.325	.286	-.167	-.080
		Significance (2-tailed)	.	.000	.000	.000	.099
		df	0	421	421	421	421
	Vulnerability	Correlation	.325	1.000	.688	.234	.333
		Significance (2-tailed)	.000	.	.000	.000	.000
		df	421	0	421	421	421
	Severity	Correlation	.286	.688	1.000	.187	.327
		Significance (2-tailed)	.000	.000	.	.000	.000
		df	421	421	0	421	421
	Response Efficacy	Correlation	-.167	.234	.187	1.000	.580
		Significance (2-tailed)	.000	.000	.000	.	.000
		df	421	421	421	0	421
	Self-Efficacy	Correlation	-.080	.333	.327	.580	1.000
		Significance (2-tailed)	.099	.000	.000	.000	.
		df	421	421	421	421	0

Results from a partial correlation (Table 11) indicated that there was a significant positive relationship between self-reported stress and vulnerability, ( $r(420) = .33, p < .001$ ), and a significant positive relationship between self-reported stress and severity ( $r(420) = .29, p < .001$ ). Results also indicated a significant negative relationship between self-reported stress and response efficacy, ( $r(420) = -.17, p < .001$ ). As perceived vulnerability to COVID-19 and perceived severity of the possible consequent conditions increased, stress increased, while as response

efficacy from social isolation or healthier eating habits increased, stress decreased. There was no significant association between self-reported stress and self-efficacy.

Table 12 – Partial Correlation between Self-Reported Stress Levels and Perceived Response Efficacy Sub-Constructs.

Correlations					
Control Variables			Stress	Social Isolation	Healthier Habits
Gender & Age & Ethnicity/Race & Highest Level of Education Completed & Marital Status & Employment Status & Number of People in your Household & Household Income	Stress	Correlation	1.000	-.128	-.155
		Significance (2-tailed)	.	.008	.001
		df	0	426	426
	Social Isolation	Correlation	-.128	1.000	.397
		Significance (2-tailed)	.008	.	.000
		df	426	0	426
	Healthy Habits	Correlation	-.155	.403	1.000
		Significance (2-tailed)	.001	.000	.
		df	426	426	0

We conducted further exploratory examination to assess whether response efficacy sub-constructs, isolation and healthy habits, influence stress levels in different ways. After controlling for gender, age, education, ethnicity, marital status, employment status, household, and income, results from a partial correlation (Table 12) indicated that there was a significant negative correlation remaining between self-reported stress and healthy habits, ( $r(425) = -.16, p = .001$ ), followed by social isolation ( $r(425) = -.13, p = .008$ ). Therefore, results indicated that as a perception of the adoption of healthy habits and social isolation practice increased, stress decreased.

Aim 2: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in dietary habits during COVID-19 social isolation experience.

Table 13 – Partial Correlation between Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores (N = 407).

Correlations						
Control Variables			Stress	Perceived Threat	Perceived Efficacy	Dietary Habits
Age & Highest Level of Education Completed & Employment Status & Household Income & Number of People in your Household	Stress	Correlation	1.000	.357	-.140	.349
		Significance (2-tailed)	.	.000	.005	.000
		df	0	407	407	407
	Perceived Threat	Correlation	.357	1.000	.303	.353
		Significance (2-tailed)	.000	.	.000	.000
		df	407	0	407	407
	Perceived Efficacy	Correlation	-.140	.303	1.000	.085
		Significance (2-tailed)	.005	.000	.	.087
		df	407	407	0	407
Dietary Habits	Correlation	.349	.353	.085	1.000	
	Significance (2-tailed)	.000	.000	.087	.	
	df	407	407	407	0	

Results of a partial correlation analysis (Table 13) indicated that there was a significant positive relationship self-reported stress levels ( $r(406) = .35, p < .001$ ) and perceived threat ( $r(406) = .35, p < .001$ ), while no significance was found between perceived efficacy ( $r(406) = .09, p = .087$ ) and adults' self-reported changes in dietary habits scores. A Pearson correlation showed a significant positive correlation between perceived efficacy and change in dietary habits scores ( $r(433) = .12, p = .015$ ); however this did not hold true when controlling for significant demographics. *There was a statistically significant relationship between self-reported stress and perceived threat changes in dietary habits scores. There is no statistically significant*

relationship between perceived efficacy and changes in dietary habits scores. Therefore, we rejected the null hypotheses 02a and 02b, and accept null hypothesis 02c.

These preliminary results indicated a relationship that warranted further examination. Table 14 and Table 15 (multiple linear regression models with and without controlling for demographic variables are shown below for comparison) showed that the best model found for examination of these factors as predictors of changes in dietary eating habits during COVID-19 social isolation considered controlling for demographic variables (Table 15).

Table 14 – Multiple Linear Regression Model Summary on Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.430 <sup>a</sup>	.185	.179	.310
a. Predictors: (Constant), PerceivedEfficacy, Stress, PerceivedThreat				

Table 15 - Multiple Linear Regression Model Summary on Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores, Controlling for Significant Demographic Variables.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.560 <sup>a</sup>	.314	.270	.292
a. Predictors: (Constant), Income=100,000 - 149,000, Employment=Unemployed, PerceivedEfficacy, Age=35 - 49, Household=4, Education=Associate Degree, Employment=Unemployed due to COVID-19, Education=Doctoral Degree, Employment=Part-Time, Education=Some College, Income=50,000 - 74,999, Employment=Retired, Household=5 persons or more, PerceivedThreat, Income=75,000 - 99,999, Education=High School, Age=50 - 64, Education=Master's Degree, Age=18 - 24, Household=2, Stress, Income=25,000 - 49,000, Household=3, Age=25 - 34, Employment=Full-Time				

As our data included several demographic variables, stepwise regression was the statistical test of choice to narrow those possible outcome predictors; results are shown below for questions #2 to #4.<sup>178</sup>

Table 16 – Coefficients for Stepwise Multiple Linear Regression Analysis between Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores.

Coefficients <sup>a</sup>								
Model	Unstandardized Coefficients			Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta	Tolerance			VIF	
7	(Constant)	-.183	.067		-2.724	.007		
	Perceived Threat	.022	.004	.255	5.654	.000	.877	1.140
	Stress	.011	.002	.253	5.514	.000	.845	1.183
	Employment=Full-Time	.093	.032	.128	2.883	.004	.908	1.101
	Household=4	.144	.037	.178	3.906	.000	.855	1.169
	Education=High School	-.147	.048	-.137	-3.091	.002	.909	1.100
	Education=Some College	-.092	.041	-.097	-2.235	.026	.945	1.059
	Household=3	.071	.036	.090	1.987	.048	.877	1.140
a. Dependent Variable: Dietary Habits								
Note: Adjusted R <sup>2</sup> = .26 for step 7, *p < .05.								

These results (Table 16) indicated that perceived threat, stress, employment status, household size, education level, and marital status were significant predictors of changes in dietary habits, sharing 26% of the variability in changes in dietary habits scores. As we could see by  $R^2 = .26$ , these variables shared the explanation of 26% of the variability in changes in dietary habits during social isolation, while about 74% of the variability changes in dietary habits during social isolation could be explained by these variables and likely there were other factors influencing these dietary changes. *Perceived threat was the most important variable for prediction of changes in dietary habits score, representing 13% of the total variability; perceived*

threat and stress combined accounted for 18% of the total variability in changes in dietary scores.

- *Perceived threat significantly predicted changes in dietary habits during social isolation,  $\beta = .255, p < .001$ .* For each one unit increase in perceived threat score, there was an increase of .022 in scores of changes in dietary habits.
- *Stress significantly predicted changes in dietary habits during social isolation,  $\beta = .253, p < .001$ .* For each one unit increase in perceived threat score, there was an increase of .011 in scores of changes in dietary habits.

Aim 3: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience.

Table 17 – Partial Correlation between Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Physical Activity Habits Scores (N = 421).

Correlations						
Control Variables			Stress	Perceived Threat	Perceived Efficacy	Physical Activity
Age & Ethnicity/Race & Highest Level of Education Completed & Employment Status & Number of People in your Household & Household Income	Stress	Correlation	1.000	.331	-.146	.225
		Significance (2-tailed)	.	<.001	.003	<.001
		df	0	421	421	421
Perceived Threat	Perceived Threat	Correlation	.322	1.000	.347	.254
		Significance (2-tailed)	.000	.	<.001	<.001
		df	421	0	421	421
Perceived Efficacy	Perceived Efficacy	Correlation	-.146	.314	1.000	.112
		Significance (2-tailed)	.003	.000	.	.021
		df	421	421	0	421
Physical Activity	Physical Activity	Correlation	.225	.247	.112	1.000
		Significance (2-tailed)	<.001	<.001	.021	.
		df	421	421	421	0

Results of a partial correlation analysis (Table 17) indicated that there was a significant positive relationship between perceived self-reported stress levels ( $r(420) = .23, p < .001$ ),

perceived threat ( $r(420) = .25, p < .001$ ), and perceived efficacy ( $r(420) = .11, p = .021$ ) and adults' self-reported changes in physical activity habits. *As there was a statistically significant relationship between self-reported stress levels, perceived threat, and perceived efficacy and changes in physical activity habits scores, we rejected the null hypotheses 03a, 03b, and 03c.* These results indicated a relationship that warranted further examination. The best model found for examination of these factors as predictors of changes in physical activity habits during COVID-19 social isolation considered our independent variables and demographic factors; stepwise multiple linear regression results are shown below.

*Table 18 - Coefficients for Stepwise Multiple Linear Regression Analysis Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Physical Activity Habits Scores.*

Coefficients <sup>a</sup>								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
6	(Constant)	.099	.079		1.253	.211		
	Stress	.008	.002	.152	3.137	.002	.838	1.194
	Household=4	.154	.042	.163	3.625	.000	.968	1.033
	Perceived Threat	.018	.005	.177	3.789	.000	.896	1.116
	Age=50 - 64	-.149	.046	-.150	-3.270	.001	.934	1.071
	Education=High School	-.183	.058	-.144	-3.180	.002	.953	1.050
	Education=Some College	-.111	.050	-.100	-2.207	.028	.961	1.041
a. Dependent Variable: Physical Activity								
Note: Adjusted R <sup>2</sup> = .17 for step 6, *p < .05.								

These results (Table 18) indicated that stress, household size, perceived threat, education level, and age were significant predictors of changes in physical activity habits, sharing 17% of the variability in changes in physical activity habits during social isolation. As we

could see by  $R^2 = .17$ , these variables shared the explanation of 17% of the variability in changes in physical activity habits during social isolation, while about 83% of the variability changes in physical activity habits during social isolation could be explained by these variables and likely there were other factors influencing these dietary changes. *Stress was the most important variable for prediction, representing 6% of the total variability; stress, household size, and perceived threat combined accounted for 13% of total variability in changes in physical activity scores.*

- *Stress significantly predicted changes in physical activity habits during social isolation,  $\beta = .152, p < .001$ . For each one unit increase in perceived threat score, there was an increase of .008 in scores of changes in physical activity.*
- *Perceived threat significantly predicted changes in physical activity habits during social isolation,  $\beta = .177, p < .001$ . For each one unit increase in perceived threat score, there was an increase of .018 in scores of changes in physical activity habits.*

Aim 4: To examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

*Table 19 - Partial Correlation among Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Self-Care Habits Scores (N = 422).*

Correlations						
Control Variables			Stress	Perceived Threat	Perceived Efficacy	Self-Care
Gender & Age & Ethnicity/Race & Highest Level of Education	Stress	Correlation	1.000	.334	-.144	.391
		Significance (2-tailed)	.	<.001	.003	<.001
		df	0	422	422	422
	Perceived	Correlation	.334	1.000	.315	.360

Completed & Marital Status & Employment Status & Number of People in your Household & Household Income	Threat	Significance (2-tailed)	<.001	.	<.001	<.001
		df	422	0	422	422
	Perceived Efficacy	Correlation	-.144	.315	1.000	.102
		Significance (2-tailed)	.003	<.001	.	.036
		df	422	422	0	422
	Self-Care	Correlation	.391	.360	.102	1.000
		Significance (2-tailed)	.000	.000	.024	.
		df	422	422	422	0

Results of a partial correlation analysis (Table 19), controlling for demographics, indicated that there was a significant positive association adult's self-reported stress levels, ( $r(421) = .39, p < .001$ ), perceived threat, ( $r(421) = .36, p < .001$ ), and perceived efficacy ( $r(421) = .10, p = .024$ ) and adults' self-reported changes in self-care habits. *As there was a statistically significant relationship between self-reported stress levels, perceived threat, and perceived efficacy and changes in self-care habits, we rejected the null hypotheses 04a, 04b, and 04c.*

These preliminary results indicated a relationship that warranted further examination. The best model found for examination of these factors as predictors of changes in self-care habits during COVID-19 social isolation considered our dependent variables and demographic factors; stepwise regression best fit models results are shown below.

Table 20 - Coefficients from a Stepwise Multiple Linear Regression Analysis between Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Self-Care Habits Scores.

Coefficients <sup>a</sup>							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error				Beta	Tolerance
1 (Constant)	-.484	.114		-4.263	.000		

Stress	.019	.002	.375	8.494	.000	.820	1.220
Perceived Threat	.018	.005	.184	4.014	.000	.759	1.317
Employment= Full-Time	.166	.034	.199	4.899	.000	.973	1.028
Household=4	.096	.038	.104	2.494	.013	.918	1.089
Household=1	-.119	.045	-.109	-2.640	.009	.941	1.063
Ethnicity_Race =Asian	-.308	.096	-.136	-3.211	.001	.893	1.119
Ethnicity_Race =White/Caucasian	-.088	.038	-.097	-2.301	.022	.894	1.119
Perceived Efficacy	.009	.004	.098	2.249	.025	.837	1.195
a. Dependent Variable: Self Care							
Note: Adjusted $R^2 = .32$ for step 8, $*p < .05$ .							

These results (Table 20) indicated that stress, perceived threat, household size, employment status, race/ethnicity, and perceived efficacy are significant predictors of changes in self-care habits, sharing 32% of the variability in changes in self-care habits during social isolation. As we could see by  $R^2 = .32$ , these variables shared the explanation of 32% of the variability in changes in self-care habits during social isolation, while about 68% of the variability changes in self-care habits during social isolation could be explained by these variables and likely there were other factors influencing these dietary changes. *Stress was the most important variable for prediction, representing 18% of the total variability; stress and perceived threat combined accounted for 23% of total variability in changes in self-care scores.*

- *Stress significantly predicted changes in self-care habits during social isolation,  $\beta = .375, p < .001$ .* For each one unit increase in stress score, there was an increase of .019 in scores of changes in self-care habits.
- *Perceived threat significantly predicted changes in self-care habits during social isolation,  $\beta = .184, p < .001$ .* For each one unit increase in perceived threat score, there was an increase of .018 in scores of changes in self-care habits.
- *Perceived efficacy significantly predicted changes in self-care habits during social isolation,  $\beta = .098, p < .05$ .* For each one unit increase in perceived threat score, there was an increase of .009 in scores of changes in self-care habits.

Outcomes of this study may be applied towards developing effective behavior change techniques to assist individuals who need positive changes to manage daily stressors during disaster times.

## Chapter 5

### Discussion

This research examined the impact of the COVID-19 generated stress, health threat, and social isolation on lifestyle habits of adults in Florida, utilizing constructs of the PMT as a framework to assist in predicting protective behavior responses. It looked at whether stress, perceived threat, and perceived efficacy have influenced individuals to change dietary, physical activity, and self-care habits during the social isolation period. Results of this study show significant relationships between PMT constructs and adults' changes in lifestyle behaviors. Self-reported stress, perceived threat, and perceived efficacy

Aim 1 was to examine the relationship between COVID-19 generated perceived threat and perceived efficacy and adults' self-reported stress levels. Our results showed a positive relationship between adults' self-reported stress and perceived threat levels. These are expected outcomes in the middle of the COVID-19 pandemic, where the fear of contagion, contamination, and becoming sick has been a constant daily presence in people's lives, creating a social environment that increases stress levels.<sup>26</sup> Moderate to severe levels of stress have been observed in other major health threats, such as during the SARS outbreak and H1N1 pandemic.<sup>43,53</sup> Accordingly, over one third of our participants reported feeling stressed and nervous, and more than 20% felt upset by things happening outside of their control during the social isolation period in Florida. More than half of the participants also reported at least sometimes unable to control important things in life; this insecurity also reflected on how the population has been coping with the pandemic and social isolation. Consequently, more than half of our participants reported not feeling confident to handle their own problems, while over 40% reported not being able to cope with things they had to do.

While 21.5% of our participants stated being sure they would contract COVID-19, 57.8% stated being afraid of such, demonstrating the psychological impact of the threat. This effect only seems to have increased with social isolation measures. An examination at the onset of the COVID-19 pandemic on the Chinese population, prior to lockdown, found almost 35% of the participants at high levels of reported psychological distress.<sup>1</sup> In our study, more than 60% scored on high levels of PSS (>27). It seems that any added challenges brought about by COVID-19 have exacerbated stress; as the threat level, contagion, deaths, lockdown, and needed preventative measures have increased, so has the stress levels of populations.<sup>179</sup> Mental health

during these times of pandemic has been a crescent concern, and the CDC has been reaching out to the population to warn about signs of struggles and assist individuals on how to cope with these new trials.<sup>180</sup> The effects of challenges individuals have been facing are traumatic, and social isolation effects may have caused a series of other concerns in populations, including health-related ones.<sup>5,24,76,180,181</sup>

A negative relationship was seen between adults' self-reported stress levels and perceived efficacy, or else, as perceived self and response efficacy increase, stress decreases. Results from the PSS and CPMT questionnaires showed that, although there was an increase in stress and anxiety during the social isolation period of the pandemic, there was also a perceived belief in self-efficacy through the coping ability and response efficacy of the social isolation process. Over 60% of participants stated feeling safe when socially isolating, 57.8% reported that social isolation has helped them cope with the pandemic. Moreover, 61.4% stated adapting well to social isolation. Additionally, more than 40% reported not feeling that difficulties were piling up so high they could not overcome them. Hence, the relationship between stress and perceived efficacy was an inversed one; as perceived efficacy increased, stress decreased. This may be as the social isolation initially may have seemed to be a temporary measure, as populations were exposed to a *learn as we go* process. This may indicate that individuals either assumed social isolation to be an efficient measure to prevent COVID-19 contagion, believed to be able to cope with COVID-19 and social isolation as they were thought to be a transitory event, or did not see the proportions of the event ahead of us. Cultivating resilience through this pandemic has become a necessity, and as that builds up, efficacy antagonizes stress, as seen as per the relationships demonstrated in our study.<sup>182</sup>

Self-reported stress, perceived threat, perceived efficacy, and changes in dietary habits

Aim 2 was to examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in dietary habits during COVID-19 social isolation experience. A statistically significant relationship was seen between self-reported stress ( $p < .001$ ) and perceived threat ( $p < .001$ ) and changes in dietary habits scores; however, there was no statistically significant relationship between perceived efficacy ( $p = .087$ ) and changes in dietary habits scores. These findings suggest that the changes that may have happened in dietary habits were mostly related to measures needed to deal with the perceived threat and the stress of the pandemic and the lack of access of being in lockdown. Emphasis on threat and stress as a function of motivation has been noted in several studies.<sup>118–120,184</sup>

This study showed significant changes in dietary habits such as in increase cooking at home ( $p < .001$ ), decline in ordering ready meals ( $p = .004$ ), snacking habits ( $p < .001$ ), increase in candy consumption ( $p < .001$ ). These results indicated that dietary changes were mostly due to restricted access to supplies, use of groceries at hand, lack of access restaurants and ready to eat foods, food safety concerns, and eating to cope and ease stress.<sup>16,106,185</sup> The COVID-19 related changes in dietary patterns seem to have happened in order to adapt to the lack of access generated by social isolation (increased frequency of cooking at home, decreased frequency of fast-food consumption), to manage stress by using food as comfort (increased candy consumption), or there were no changes noted, supporting the maintenance of a regular routine (no changes in set mealtimes). No change was seen in fresh food consumption ( $p = .873$ ) in our study, maybe due to lack of regular access to food places and stores. Although a significant increase was seen in breakfast consumption ( $p = .009$ ), probably due to more time

spent at home, lunch ( $p = .697$ ) and dinner ( $p = .433$ ) habits remained the same. No change was observed in set mealtimes ( $p = .869$ ), fact supported in other studies also reporting an increase in consumption in meals at regular times.<sup>16,106,107</sup> No significant change was seen in alcohol consumption ( $p = .811$ ). Differently, Murphy et al<sup>106</sup> reported a slight increase in basic food consumption, and Di Renzo et al<sup>16</sup> reported an increased consumption of farmer's market items and adherence to the Mediterranean diet.<sup>16,106</sup> These distinctions noted in dietary habits among different studies conducted during the pandemic may be due to the locations where these studies took place, as Europeans may have different eating habits than Americans, added to the fact that lockdown worked differently in each country, allowing for adjustments to differ per location.<sup>106</sup>

During COVID-19, fear of contagion, comfort eating, boredom, loss of socialization, stress, changes in shopping and food access, and social isolation were reported as reasons for changes in dietary habits in studies in Italy and India.<sup>16,105,107,185</sup> Equally in our study, fear, stress, changes in access, availability, and new restrictions, and comfort eating seem to have motivated change, while coping with social isolation seem to have mostly set the stage for adherence to known habits, for maintenance of routine for comfort and safety. On the other hand, the threat/fear generated protection of social isolation and coping with stress have been noted as promoters of behavior changes, as in several studies utilizing the PMT during COVID-19.<sup>114,149</sup>

While this is a new topic, as the majority of our participants agreed that they adapted well to social isolation and made lifestyle changes to be able to socially isolate, inferences can be made to the fact that changes in eating habits seem to have been a consequence of stress

and fear of the exposure to the health threat and need to cope with the lockdown. People were looking for comfort and known things in the middle of the chaos and unknown brought about by the pandemic and uncertainty of contamination and the health status of oneself and loved ones. In the absence of human contact and care from families and friends, and when dealing with stress and fear, people tend to maintain known habits, and dietary habits are a major source of comfort. Therefore, the response efficacy of social isolation seems to have supported individuals seeking the emotional consolation and security often perceived to be found in comfort foods and routine.

Self-reported stress, perceived threat, perceived efficacy, and changes in physical activity habits

Aim 3 was to examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in physical activity habits during COVID-19 social isolation experience. There was a significant positive relationship between perceived self-reported stress levels ( $p < .001$ ), perceived threat ( $p < .001$ ), and perceived efficacy ( $p = .017$ ) and adults' self-reported changes in physical activity habits. No significant change was seen in any physical activity, ( $p = .200$ ) or new types of physical activity, ( $p = .171$ ), while a significant decrease in frequency was seen in outdoors physical activity patterns ( $p = .005$ ), 3-4 times a week from 29.5% to 26.2% and 5-6 times a week from 21.1% to 19.6%.

Studies analyzing physical activity found that adults increased sedentary times during the pandemic and reduced physical activity levels, especially outdoor activities, as in our study.<sup>186,187</sup> This reflects the reality of the lockdown period in Florida, where people kept at home for most of the time, only occasionally running errands outside. The pandemic and resulting social isolation have resulted in closure of physical activity conducive areas, such as

gyms, parks, playgrounds, arenas.<sup>107</sup> Even though some places eventually reopened and outdoors activities were recommended, leaving the house, whether to go to a gym or a park, represented stress and exposure to the virus and many people preferred refraining from participating in physical activities rather than risking contagion. During COVID-19 isolation, outdoor exercise has been discouraged, unless required precautionary measures were followed. It is important to note that any initiative during social isolation required added steps, such as mask wearing and disinfecting areas, which would mean extra motivation would be required to start a new physical activity, or any other practice. Lack of motivation, stress, threat, and restricted access to adequate areas would both factor in preventing physical activity practices.<sup>107</sup>

While at home, people seem to have maintained routines that were already established.<sup>107</sup> Participants who did not exercise before the pandemic did not report trying new activities, as most of the participants kept the same physical activity habits before and during lockdown.<sup>107</sup> Overall, the findings suggest that, while at home, exercising or trying new physical activities did not seem to be a priority, or maybe people did not know how to start or maintain physical activity routines at home. This presents an opportunity for education, as those who exercise presents with lower stress levels than those who do not, so the practice of physical activities could be of benefit when dealing with the stress of pandemic and its consequences.<sup>188</sup> Lack of access to exercise and physical activity may impact and even increase mental health, stress, and anxiety already existent with the pandemic and social isolation. However, about one-third (35.9%, 32.2%, respectively) reported participating in some kind of physical activity 3-4 times a week or 14.9% to 14.2% daily. While staying protected at home speaks to the response efficacy

of social isolation, maintenance of physical activity routines as before the pandemic speaks to self-efficacy, as well as to the response efficacy of healthy habits, as people who were used to exercising and probably believe in its health or psychological benefits continued to do so.

Once again, it seems that people were looking for comfort and care during the pandemic, and the social isolation environment invited more towards coziness than activity. This demonstrates the need for campaigns to promote physical activity as a relevant means to support overall health and encourage and promote lifestyle modifications that can be done at home, motivating implementation and maintenance of healthy lifestyle habits during required periods of social isolation for any reason.

Self-reported stress, perceived threat, perceived efficacy, and changes in self-care habits

Aim 4 was to examine the relationship between perceived stress, perceived threat, and perceived efficacy and adults' self-reported changes in self-care habits during COVID-19 social isolation experience.

There was a significant positive relationship between adult's self-reported stress levels, ( $p < .001$ ), perceived threat, ( $p < .001$ ), and perceived efficacy ( $p = .024$ ) and adults' self-reported changes in self-care habits. The CDC's analysis of the pandemic effects reinforces an increase in stress and anxiety in our population.<sup>180</sup> Taking care of oneself eases stress, and therefore we saw an increase in self-care practices and routines during the social isolation period in Florida. Increased frequency was observed in self-care routines ( $p < .001$ ), relaxation ( $p < .001$ ), and rest ( $p < .001$ ) habits. Changes were not seen in hours of sleep ( $p = .143$ ) with most people (55% before and 45% after) sleeping 6-7 hours per night, once again reinforcing the suggestion examined on this study that in times of distress, people tend to maintain their

basic habits, such as hours of sleep, as those seem to create a sense of security and reinforcing those habits that can further promote additional comfort. Perceived efficacy played a larger role in influencing changes in this lifestyle habit than in dietary or physical activity ones, which makes sense as these habits were the ones that people most actually changed, probably because of the instinct to perform these and feel better and taken care of, as well as because of the propitious environment created by social isolation as a protection from contagion, which would motivate and allow for rest and relaxation practices. Spiritual practices, yoga, meditation, and other rest and relaxation practices may have been used for resilience and stress control during the pandemic, supporting response efficacy, and helping achieve a protective feeling from the outside threat.<sup>189</sup>

Additionally, the safety and perceived efficacy of social isolation created an appropriate space for self-care routines and allowed time for increased rest and relaxation. Self-care is an easy task to accomplish when time allows for it, creating a sense of well-being, as one feels cuddled and appreciated. Moreover, it only seems natural that in times of fear and anxiety, calming and self-care routines would be welcome as moments to center and disconnect from the outside events such as the ongoing pandemic, making these even more appealing as a response efficacy under the COVID-19 experience. Additionally, several campaigns have been seen throughout the pandemic focusing on hygiene and self-care, which presented combined effective contamination preventive actions with moments to quiet the mind. Utilizing self-care activities as part of aseptic practices may help to manage stress and avoid difficulties and symptoms of health problems.<sup>190</sup> Therefore, it seems that self-care practices could assist

populations through the pandemic and its recovery and could play a positive role to support prevention of long-term chronic consequences.

### Conclusion

Our hypotheses were well supported by this study, showing that COVID-19 related stress, perceived threat, and social isolation perceived efficacy had an impact in changes in dietary, physical activity, and self-care habits of adults in Florida. This is to say that protection motivation influenced behavior in a time of unexpected events, which is supportive evidence for the need of effective interventions to promote behavior changes towards healthy habits in times of distress. Overall, it seems that in times of distress, people tend to maintain their basic habits, such as set mealtimes, physical activity routines, hours of sleep, as those seem to create a sense of security and reinforcing those habits that can further promote additional comfort. Nevertheless, it seems that perceived threat and stress motivate change in lifestyle habits, which could indicate a path to promote changes if adequate interventions were to be implemented. In times like this, where chronic comorbidities have become a fate determinant in COVID-19 outcomes, it is imperative to conduct research to better understand how human responses to external factors affect behavior and behavior change. This is needed to provide supportive evidence to successfully develop and promote educational interventions to assist populations on containing the increase poor lifestyle choices related to the prevalence of chronic conditions in the American population. This is imperative to assist in controlling sizable tragedies as those we have been witnessing these days.

Understanding the impact of outside factors on lifestyle habits is of benefit for substantiating our current research body and for supporting the development of public health

preventive initiatives which, therefore, highlights the interest in our research on how times of distress may affect behavior change. To our knowledge, this is the first study to examine the impact of the COVID-19 generated stress, health threat, and social isolation on lifestyle habits of adults in Florida, utilizing constructs of the PMT as a framework to assist in predicting protective behavior responses, making it an important study for our time and a relevant resource for our evidence-based practice.

### Strengths and Limitations

A limitation of our study is the fact that it is based on a self-reported questionnaire, which may lead to data misreporting; this is a cross-sectional study, which does not allow for data collection at two different points. However, a strength of our study is that data were collected right after the lockdown period in Florida, which may have improved memory reliability and accuracy. Computer literacy is always a concern for data collection via online surveys, but this has been less and less a worry nowadays, as more people have access to the online environment. The utilization of a large and randomized sample benefited our study; yet the use of a Florida population may have impacted the generalizability of the results. The development and validation of two new surveys to assess human perceptions and consequent lifestyle changes in a population during times of severe stress presents as an important contribution to the field of research, which allows for application during other times of distress. However, being that these were the first two surveys developed to examine the impact of COVID-19, a new pandemic and event in public health history, on lifestyle habits, came along with challenges on how to best approach the subject. Nevertheless, the two questionnaires specifically developed to assess human behavior from a nutritional perspective at this time in

history and the timeliness of this research is a strength of this study, which clearly delineates its uniqueness. This is one of the few studies to analyze changes in lifestyle behaviors related to COVID-19, and as per our knowledge, the first examining the connection of PMT constructs and dietary, physical activity, and self-care behaviors during the pandemic in Florida.

### Recommendations and Implications for Practice

Recommendations are to further this research by distributing the updated survey to a larger American sample population, which could contribute to a more comprehensive assessment of different reactions to constant threat and different forms of social isolation and, therefore, have broader results for future development of efficient initiatives in times of healthcare emergency. This study presents unique data showing that as stress and perceived threat predict lifestyle changes and social isolation prompts routine maintenance, which enlightens the arena for educational opportunities. It seems that the vulnerability presented during times of distress presents possibilities for population guidance, as seen during the educational campaigns and societies' receptivity of those during the pandemic. That points towards a moment that seems propitious for dietetics professionals to address the importance of adequate habits for health and prevention of chronic diseases. As people seem to maintain habits to cope with moments of distress, it is imperative to teach individuals easy and quick routines that can be reminded during those times of emergency to support healthy practices. As more have increased cooking habits, this presents an opportunity to guide them easy and healthy shopping, cooking, and eating habits. On the other hand, as people seem to have not initiated new or ongoing physical activity routines and this may have been because of the lack of knowledge on how-to, this also presents a teaching opportunity. All these findings point out

towards opportunities for effective campaigns to support behavior change and behavior maintenance, as well as the importance of community initiatives to support public health.

This research represents an initial step into assessing whether and how populations adapt lifestyle habits to stress, threat, and the response efficacy of preventive measures in times of distress, which represents an important tool to assist guide future research and initiatives as the world navigate COVID-19 recovery, as well as, as seen through history, in preparation to other possible pandemics or worldwide times of distress. Tools validated for this research and the challenges presented by those may be useful as a starting point to assist researchers interested in studying this topic in developing additional instruments. Research on COVID-19 may supply relevant data for individual and community initiatives during recovery, help with future pandemics and promote initiatives to assist in the prevention of chronic conditions. Results from this study may assist healthcare professionals in creating effective educational interventions to support health in times of threat, distress, and recovery; as such, it represents a valuable addition to the body of literature on COVID-19 to support public health and enrich our evidence-based practice.

## Appendix A

### Consent Form for Collecting Data Online

You are being asked to participate in an online survey, titled *An Examination of the Impact of the COVID-19 Health Threat, Stress and Anxiety, and Social Isolation on Lifestyle Habits as Analyzed Through the Protection Motivation Theory*, led by Luciana Soares, MS, RDN, LDN.

#### *General Information*

There are some things you should know about this study. The purpose of this study is to examine the relationship between the COVID-19 generated health threat, stress, and imposed social isolation with the dietary, physical activity, and wellbeing habits of adults. If you choose to participate you will be asked to answer an online survey. Participation in the study should take approximately 30 minutes to complete. There are no foreseeable risks in participating in this study, as participation includes only answering impersonal survey items. There are not any foreseeable direct benefits to the study, as this research's information aims to be applied towards the development of effective behavior change techniques to assist individuals who need positive changes to manage daily stressors during disaster times.

#### *Confidentiality*

This survey is anonymous and there is no identifying information requested in this study. Please do not include your name or identifiable information in your responses.

#### *Voluntary Participation*

*Your participation in this study is entirely voluntary.* You may refuse to participate in this research. Such refusal will not have any negative consequences for you. If you begin to participate in the research, you may at any time, for any reason, discontinue your participation without any negative consequences. You may skip questions you do not want to answer at any time during this survey.

This research is in affiliation with Keiser University and has been certified by the Keiser University Institutional Review Board, Protocol Number [insert once assigned]. If you have any questions or concerns regarding participants' rights, please contact the IRB Chair at (954) 318-1620. You may contact the IRB Chair, principal investigator Luciana Soares, [lusoares@keiseruniversity.edu](mailto:lusoares@keiseruniversity.edu), (305) 336-7394, or faculty advisor Andrea Arikawa, (612) 703-3133, [andrea.arikawa@unf.edu](mailto:andrea.arikawa@unf.edu), with questions or concerns.

#### *Consent*

By clicking below you are indicating you are 18 years of age or older, have read the information above, and voluntarily agree to participate in this study.

Please print a copy of this consent for your records.

Basic consent statement will be added immediately prior to participation in the survey:

I have read and understood the information sent via email to me concerning participation in this study. By clicking below, I am indicating that I am 18 years of age or older, and voluntarily agree to participate in this study.

## Appendix B

### Demographics

For each question, please choose the answer that best describes you:
Gender
Male, Female, Transgender Male Transgender Female, Gender Nonconforming, Other
Age
18-24, 25-34, 35-49, 50-64, 65+
Ethnicity/Race
White/Caucasian, African American, Latino or Hispanic, Asian, Native American, Native Hawaiian or Pacific Islander, Middle Eastern or North African, Two or More, Other/Unknown
Highest Level of Education Completed
No High School, Some High School, High School, Some College, Associate Degree, Bachelor's Degree, Master's Degree, Doctoral Degree
Marital Status
Single, Married, Domestic Partnership, Separated, Divorced, Widowed
Employment Status
Full-Time, Part-Time, Unemployed, Unemployed due to COVID-19, Retired, Other
Number of People in your Household
1, 2, 3, 4, 5 persons or more
Household Income
Less than 25,000; 25,000-49,999; 50,000-74,999; 75,000-99,999; 100,000-149,999; 150,000+

## Appendix C

### Perceived Stress Scale ( $\alpha = .88$ )

<p>For each question, choose:</p> <p>0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often</p>
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 felt you were on top of things?
In the last month, how often have you been angered because of things that happened outside of your control?
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix D

CPMT ( $\alpha = .80$ )

For each question, choose:

1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

"I am sure I will contract COVID-19"

"I am scared of contracting COVID-19"

"If I contract COVID-19, I will have serious manifestations from it."

"If I contract COVID-19, I will have health issues because of other conditions I have."

"I feel safe from COVID-19 when I self-isolate."

"Social isolation has been helpful in making me cope with the COVID-19 pandemic."

"I have been adapting well to social isolation."

"I had to make lifestyle changes to be able to socially isolate."

"Healthy lifestyle habits make me feel safe from COVID-19."

"Healthy lifestyle habits make me feel safe from complications from COVID-19."

Appendix E

CCLH Survey ( $\alpha = .80$ )

For each question, choose: 1 = never, 2 = 1-2 times a week, 3 = 3-4 times a week, 4 = 5-6 times a week, 5 = Daily
How often did you or a family member cook at home before social isolation?
How often did you or a family member cook at home during social isolation?
How often did you eat fresh foods before social isolation?
How often did you eat fresh foods during social isolation?
How often did you eat fast foods or ready to eat foods before social isolation?
How often did you eat fast foods or ready to eat foods during social isolation?
How often did you eat sweets/candies before social isolation?
How often did you eat sweets/candies during social isolation?
How often did you drink alcoholic beverages before social isolation?
How often did you drink alcoholic beverages during social isolation?
How often did you have breakfast before social isolation?
How often did you have breakfast during social isolation?
How often did you have lunch before social isolation?
How often did you have lunch during social isolation?
How often did you have dinner before social isolation?
How often did you have dinner during social isolation?
How often did you have set mealtimes before social isolation?
How often did you have set mealtimes during social isolation?
How often did you snack between mealtimes before social isolation?
How often did you snack between mealtimes during social isolation?
How often have you engaged in any physical activity before social isolation?
How often have you engaged in any physical activity during social isolation?
How often did you try a new type of physical activity (yoga, Pilates, barre, Zumba, weightlifting, walking, running, etc.) before social isolation?

How often did you try a new type of physical activity (yoga, Pilates, barre, Zumba, weightlifting, walking, running, etc.) during social isolation?
How often have you engaged in outdoors physical activity before social isolation?
How often have you engaged in outdoors physical activity during social isolation?
How often did you take time for self-care routines before social isolation?
How often did you take time for self-care routines during social isolation?
How often did you take time for relaxation practices before social isolation?
How often did you take time for relaxation practices during social isolation?
How often did you take to rest before social isolation?
How often did you take time to rest during social isolation?
For each question, choose: 1 = 0-1 hours, 2 = 2-3 hours, 3 = 4-5 hours, 4 = 6-7 hours, 5 = 8 or more hours
Which were your average hours of night sleep before social isolation?
Which are your average hours of night sleep during social isolation?

## Appendix F

### Additional Tables

*Table 21 – Significant Self-Reported Changes in Lifestyle Habits Before and During Social Isolation (How often did you?)*

	Never %(n)	1-2 Times a Week %(n)	3-4 Times a Week %(n)	5-6 Times a Week %(n)	Daily %(n)
Cook at Home Before Social Isolation	1.3(6)	13.5(61)	33.6(152)	28.5(129)	23.2(105)
Cook at Home During Social Isolation	1.3(6)	8.8(40)	22.2(101)	29.1(132)	38.5(175)
Eat Fresh Foods Before Social Isolation	2.4(11)	15.2(69)	28.6(130)	28.4(129)	25.3(115)
Eat Fresh Foods During Social Isolation	3.5(16)	14.6(66)	27.0(122)	28.5(129)	26.3(119)
Eat Fast or Ready Food Before Social Isolation	12.6(57)	43.2(195)	22.4(101)	14.9(67)	6.9(31)
Eat Fast or Ready Food During Social Isolation	20.7(94)	38.1(173)	20.9(95)	14.1(64)	6.2(28)
Eat Sweets or Candies Before Social Isolation	8.4(38)	34.4(155)	28.2(127)	18.4(83)	10.6(48)
Eat Sweets or Candies During Social Isolation	7.3(33)	28.2(127)	28.4(128)	23.1(104)	13.1(59)
Consumed Alcoholic Beverages Before Social Isolation	31.3(142)	29.8(135)	16.8(76)	13.5(61)	8.6(39)
Consumed Alcoholic Beverages During Social Isolation	34.2(154)	24.4(110)	19.1(86)	14.0(63)	8.2(37)
Have Breakfast Before Social Isolation	10.4(47)	15.2(69)	21.0(95)	17.9(81)	35.5(161)
Have Breakfast During Social Isolation	8.6(39)	13.0(59)	21.6(98)	20.1(91)	36.6(166)
Have Lunch Before Social Isolation	2.9(13)	11.2(51)	19.4(88)	25.6(116)	41.0(186)
Have Lunch During Social Isolation	2.6(12)	10.6(48)	20.8(94)	23.6(107)	42.2(192)
Have Dinner Before Social Isolation	2.2(10)	6.4(29)	13.1(59)	22.4(101)	55.8(251)
Have Dinner During Social Isolation	2.0(9)	7.1(32)	11.8(53)	21.7(98)	57.4(259)
Have Set Mealtimes Before Social Isolation	17.3(78)	12.2(55)	25.1(113)	20.9(94)	24.4(110)
Have Set Mealtimes During Social Isolation	19.2(87)	12.4(56)	20.3(92)	24.5(111)	23.6(107)
Snack Between Mealtimes Before Social Isolation	20.4(92)	20.6(93)	28.4(128)	24.6(111)	6.0(27)
Snack Between Mealtimes During Social Isolation	25.1(113)	26.2(118)	30.4(137)	14.0(63)	4.2(19)
Engage in Any Physical Activity Before Social Isolation	5.8(26)	23.1(104)	35.9(162)	20.4(92)	14.9(67)
Engage in Any Physical Activity During Social Isolation	8.0(36)	24.0(108)	32.2(145)	21.6(97)	14.2(64)
Engage in Outdoors Physical Activity Before Social Isolation	10.2(46)	25.7(116)	29.5(133)	21.1(95)	13.5(61)
Engage in Outdoors Physical Activity During Social Isolation	14.2(64)	27.8(125)	26.2(118)	19.6(88)	12.2(55)
Try a New Type of Physical Activity Before Social Isolation	37.9(170)	25.4(114)	18.7(84)	12.0(54)	6.0(27)
Try a New Type of Physical Activity During Social Isolation	36.6(164)	25.0(112)	20.1(90)	11.8(53)	6.5(29)

Take Time for Self-Care Routines Before Social Isolation	9.1(41)	27.4(124)	25.7(116)	16.8(76)	21.0(95)
Take Time for Self-Care Routines During Social Isolation	9.3(42)	20.2(91)	24.4(110)	22.6(102)	23.5(106)
Take Time for Relaxation Before Social Isolation	16.0(72)	22.6(102)	25.3(114)	18.2(82)	18.0(81)
Take Time for Relaxation During Social Isolation	15.0(68)	18.8(85)	22.6(102)	22.8(103)	20.8(94)
Take Time to Rest Before Social Isolation	8.6(39)	24.6(111)	23.7(107)	18.6(84)	24.4(110)
Take Time to Rest During Social isolation	6.2(28)	14.4(65)	26.8(121)	24.2(109)	28.4(128)

Table 22 – Descriptive Statistics of Adults’ Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy.

	Mean	Std. Deviation	Minimum	Maximum	N
PSS	27.21	7.745	10	49	449
Perceived Threat	11.72	3.943	4	20	457
Perceived Efficacy	21.44	4.291	6	30	456

Table 23 – Descriptive Statistics between Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores.

Variable	Mean	Std. Deviation	Minimum	Maximum	N
Changes in Dietary Habits Scores	.46	.342	0	1	412
Stress	27.21	7.82	10	49	412
Perceived Threat	11.66	3.90	4	20	412
Perceived Efficacy	21.38	4.26	6	30	412

Table 24 - Descriptive Statistics on Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Dietary Habits Scores.

Variable	Mean	Std. Deviation	Minimum	Maximum	N
Changes in Dietary Habits Scores	.46	.342	0	1	412
Stress	27.22	7.82	10	49	412
Perceived Threat	11.68	3.91	4	20	412
Perceived Efficacy	21.39	4.26	6	30	412

Table 25 - Descriptive Statistics on Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Physical Activity Habits Scores.

Variable	Mean	Std. Deviation	Minimum	Maximum	N
Changes in Physical Activity Habits Scores	.49	.398	0	1	426
Stress	27.27	7.76	10	49	426
Perceived Threat	11.65	3.91	4	20	426

Perceived Efficacy	21.36	4.23	6	30	426
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*Table 26 - Descriptive Statistics on Self-Reported Stress Levels, Perceived Threat, and Perceived Efficacy, and Self-Reported Changes in Self-Care Habits Scores.*

Variable	Mean	Std. Deviation	Minimum	Maximum	N
Changes in Self-Care Habits Scores	.48	.390	0	1	427
Stress	27.30	7.77	10	49	427
Perceived Threat	11.67	3.91	4	20	427
Perceived Efficacy	21.37	4.23	6	30	427

Appendix G

Additional Figures

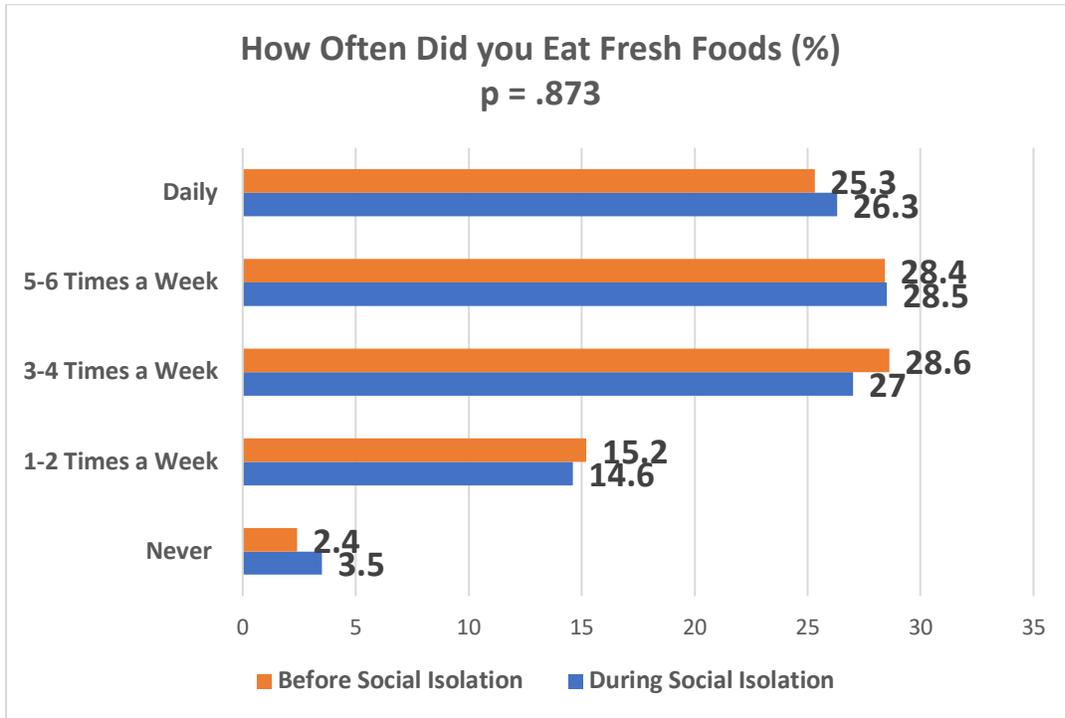


Figure 13 - Participants' Self-Reported Fresh Foods Consumption Frequency Before and During Social Isolation

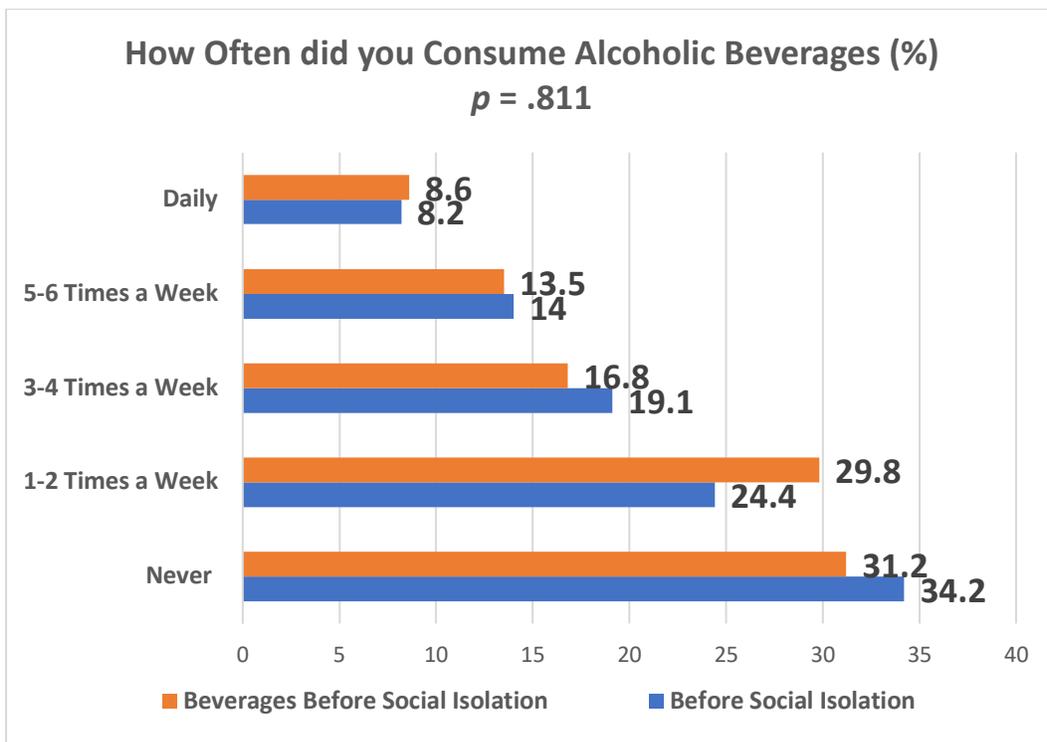


Figure 14 - Participants' Self-Reported Alcoholic Beverage Consumption Frequency Before and During Social Isolation

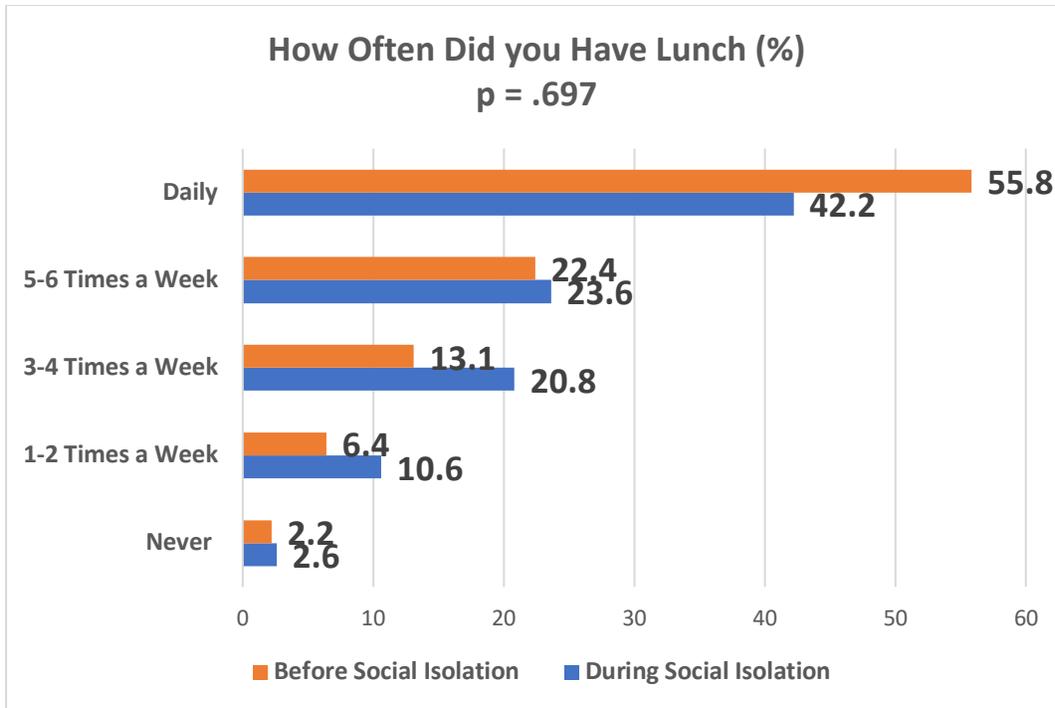


Figure 15 - Participants' Self-Reported Lunch Habits Before and During Social Isolation

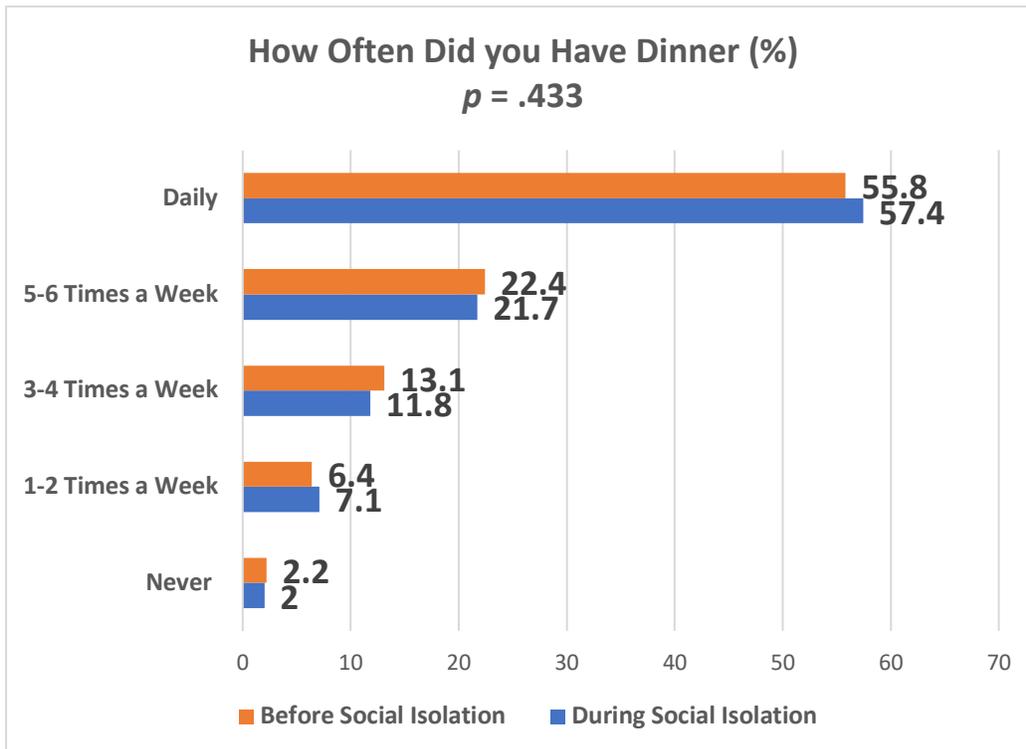


Figure 16 - Participants' Self-Reported Dinner Habits Before and During Social Isolation

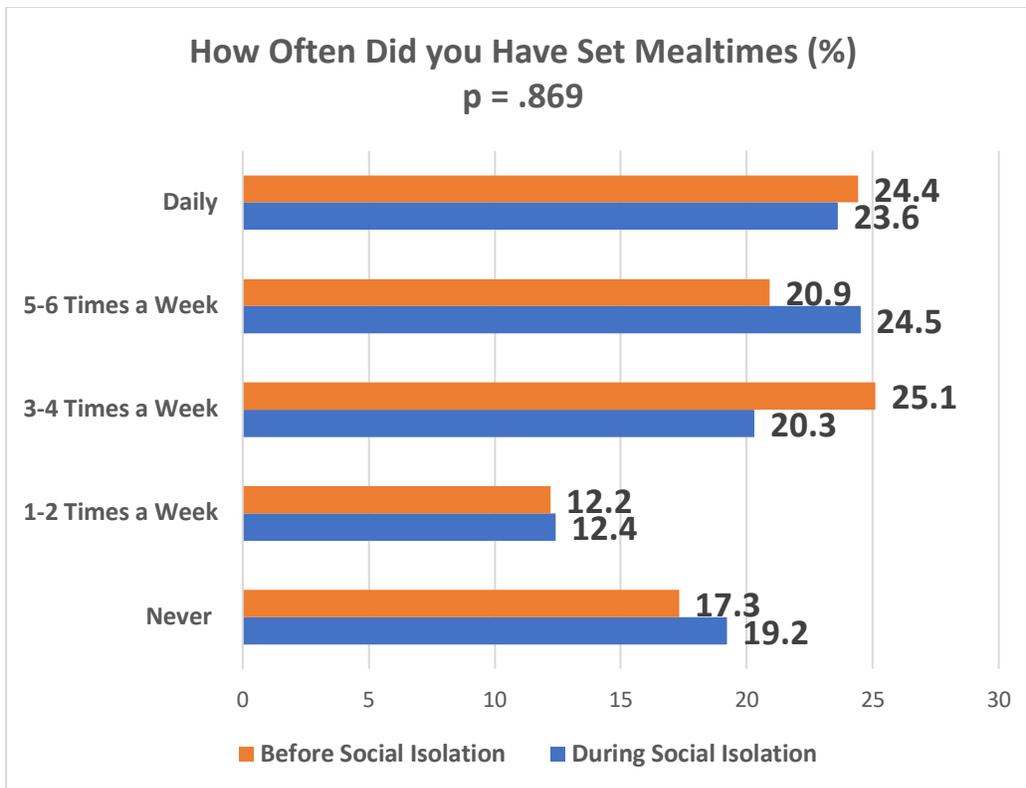


Figure 17 - Participants' Self-Reported Set Mealtimes Habits Before and During Social Isolation Chart

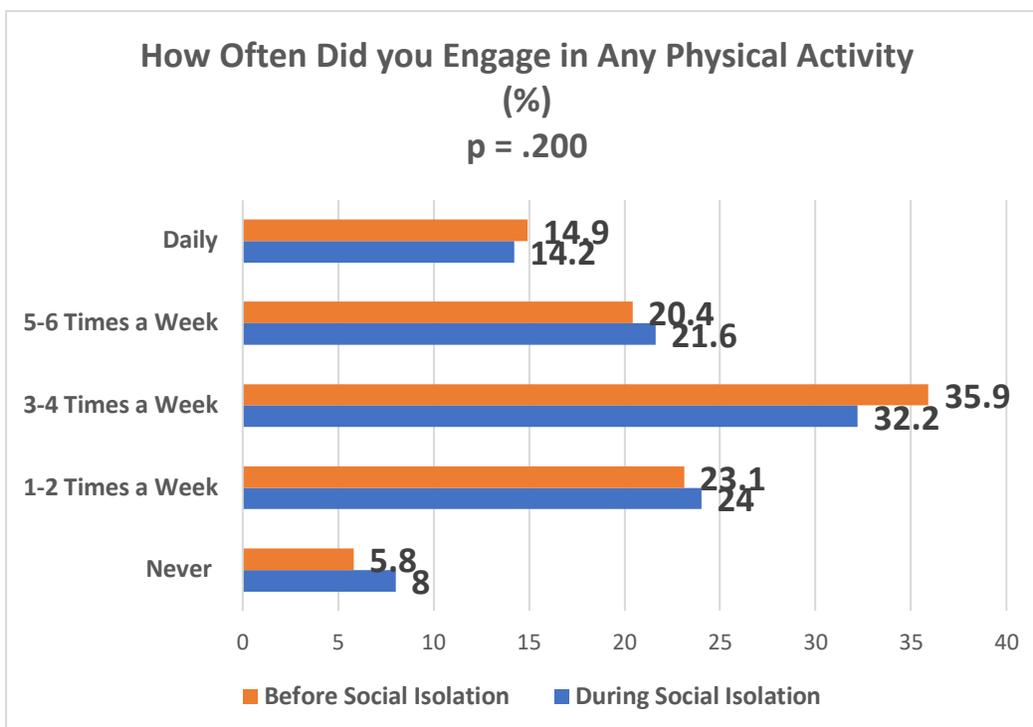


Figure 18 - Participants' Self-Reported Engaging in Any Physical Activity Habits Before and During Social Isolation

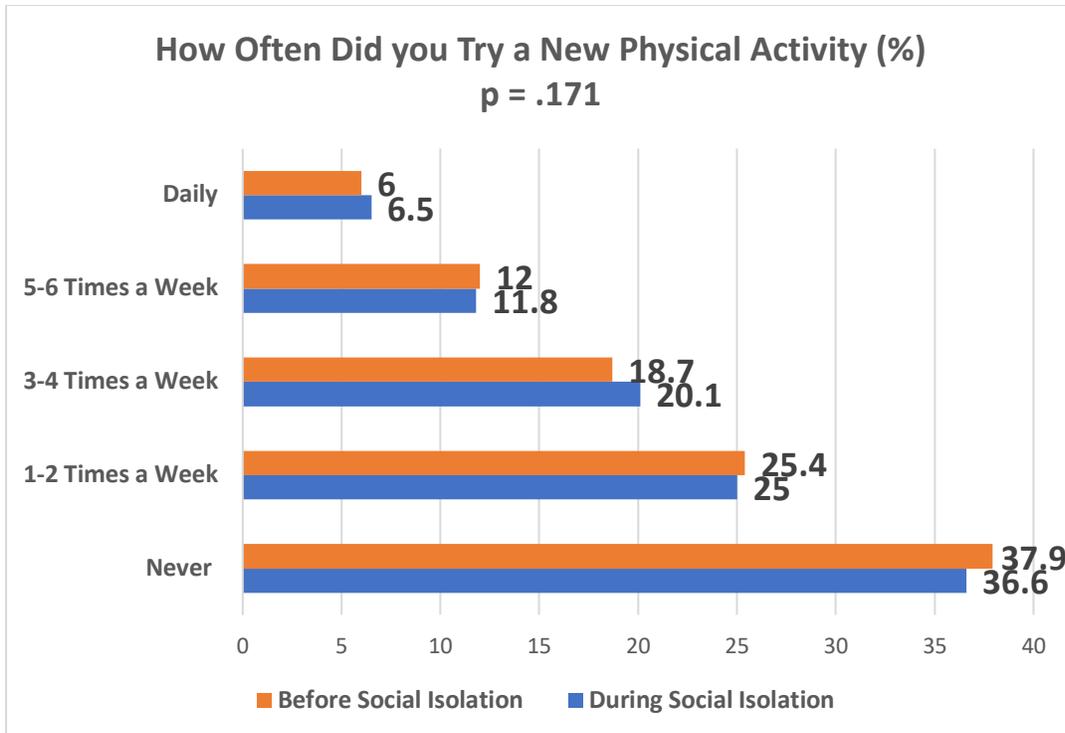


Figure 19 - Participants' Self-Reported Trying New Physical Activity Habits Before and During Social Isolation Chart

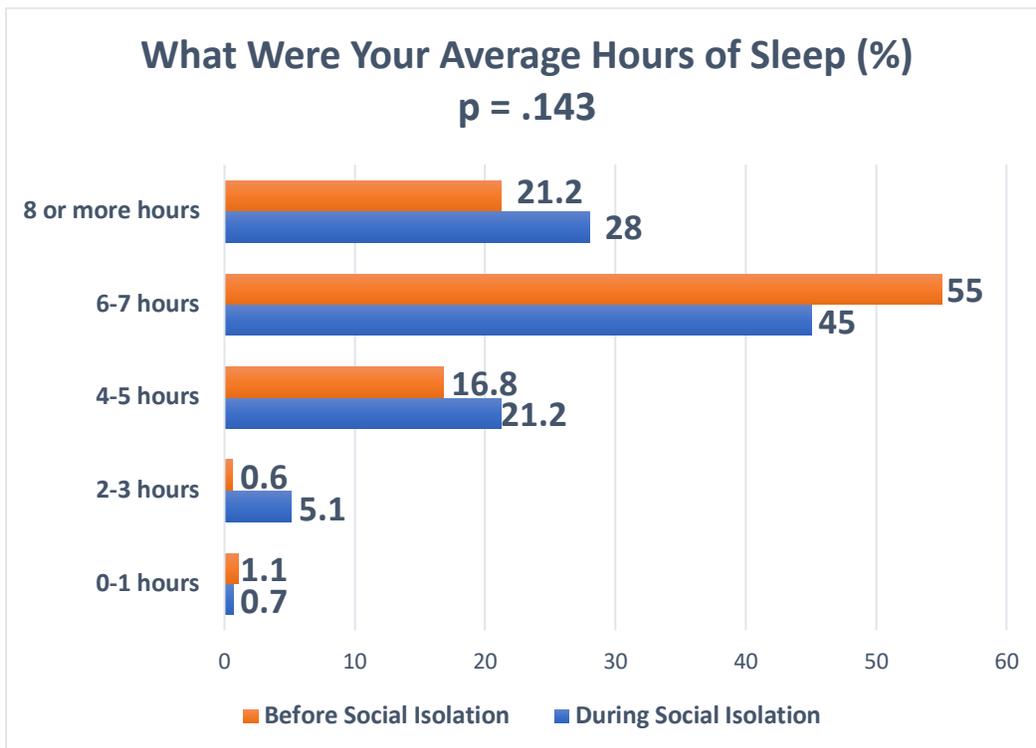


Figure 20 – Participants' Self-Reported Hours of Sleep Before and During Social Isolation

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