

Lifestyle Medicine as an Effective Virtual Intervention for Stroke Survivors

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## Abstract

Lifestyle medicine is the use of healthy lifestyle habits such as sleep, diet, physical exercise and social connections, as a primary therapeutic modality for treatment and reversal of chronic disease. Stroke is one of the leading chronic diseases, and both physicians and stroke survivors have appreciated the importance of lifestyle medicine in stroke prevention and rehabilitation. Despite this understanding, many stroke patients have unhealthy lifestyle habits even post stroke survival. A recent study found that the use of self-monitoring and an increased awareness about personal behavior may better facilitate a stroke survivor's efforts at secondary stroke prevention through lifestyle modification. We hypothesize that Spaulding's short-term Virtual Wellness Program will reverse this previous trend of unhealthy lifestyle habits exhibited by stroke survivors. In addition, our study will be a pioneer in the stroke rehabilitation industry by evaluating the efficacy of a Virtual Wellness Program which utilizes increased self-monitoring and awareness of unhealthy lifestyle habits as techniques to enhance healthy lifestyle modifications by stroke survivors.

## Dedication

I dedicate this to Victoria Woolard, Tessa Woolard, Priscilla Woolard, Juan Reyes, James Grappone III, Maria Grappone, Tyquan Crump, Jewel Collins, Adonis Crump, Quinton Crump, Tyanna Housely, Ilyanna Crump, Evan Reyes, Devon Reyes, Bishop Lonnie C. Woolard Jr, Mary Woolard, Joseph and Antoinette Macri, James Grappone Jr, Mary Grappone, Ed and Sarah Raczka, Naomi Woolard, Luis Fabian, Kiana Fabian, Susan Woolard, Larry E. Burns II, Ruth Woolard, Josh Beebe, Cali Beebe, Rachael Woolard, John Jackson, Levon Jackson, Taliah Jackson, Bentley Jackson, Philip Woolard, Erika Simons, Shanell Woolard, Denzell Woolard, Thomas Woolard, David Woolard, Brittany Dombkowski, Peter Woolard, Laila Alhalabi, Elder Lonnie C. Woolard Sr, Violet Woolard, Lloyd Williams Jr, Walter Woolard, Paul and Hilda Folk, June Woolard, Brenda Jones, Portia Jones, Danielle Jones, Jimmie and Delories Woolard, Nicole Woolard, Larry Woolard Sr and Jr, Terry Woolard Sr and Jr, John Woolard, John and Anna Pollack, Luke and Patty McLaughlin, Joe McLaughlin, Francis McLaughlin, Curtis and Mary Ann Smith, Zachary Smith, Frank and Lauren Macri, Albert and Helen Macri, Joseph Macri, Justin and Helen Verducci, Katherine Macri, Ronald and Diane Sills, Stephanie Sills, Erik Finkenzeller, Evan Finkenzeller, Nicole Sills, Taylor Edinger, Christian Sills, John and Teresa Panetta, Mario and Rosa Macri, Enza Macri, Tony and Silvana Pandolfe, Anthony and Justine Pandolfe, Alex and Jessica Soucy, Alex Pandolfe, Joseph and Margaret Besek, Wayne and Linda Del Vecchio, James and Dorothy Del Vecchio, Vinny and Patty Panetta, Daniel Panetta, Jamie Panetta, Chris Panetta, Frank Vumbaca Sr, Maria Vumbaca, Frank Vumbaca Jr, Sara Vumbaca, Bennett Vumbaca, Gracyn Vumbaca, Jim and Diane Butera, Alex Butera, Matthew Butera, Albert and Gina Macri, Makayla Macri, Desiree Macri, Spenser and Amanda Zahari, the Alpino, Cefaretti, Scascitelli, Galluzzo, Pandolfe, Montagano, Kepler, Longo, Levesque, Julian and Williams families as well as additional family and friends. Also, a special dedication to Dr. Elizabeth Pegg Frates and her loving parents, their memories will live on forever.

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## Chapter I

### Introduction

#### Background of Lifestyle Medicine

Lifestyle medicine is an evidence-based practice that aims to improve an individual's quality of life by helping them adopt and sustain healthy behaviors (American College of Lifestyle Medicine, n.d.). This practice relies on the application of “environmental, behavioural, medical and motivational principles to the management of lifestyle-related health problems in a clinical setting” (Egger, Binns, & Rossner, 2009). Some lifestyle-related changes include the management of obesity, sleep, mood states (anxiety, depression), addictions, sexual behaviour, skin health, oral and auditory health, pain, iatrogenic illness, and many types of injury (Egger, Binns, & Rossner, 2009).

Healthy behaviors such as exercising, nutrition, stress management, sleeping etc. have shown to have efficacy in reducing the risk of onset for many diseases. Although lifestyle medicine has only recently been integrated into the physician’s practice, the benefits of sustaining a healthy lifestyle has been well understood for centuries. In fact, Hippocrates is known as the father of lifestyle medicine due to his application of exercise and diet as treatments for certain diseases, also, in the late 1800’s Thomas Edison predicted that prescribing medication would be substituted with interesting patients in the care of the human frame (Becker, 2018).

An unhealthy lifestyle is the basis for 60-70 percent of all primary health care visits in developed countries (Egger, Binns, & Rossner, 2009). Chronic diseases caused by lifestyle and environmental factors are considered to be the leading causes of mortality and healthcare costs worldwide (Sagner, 2014). These chronic diseases account for over 80 percent of our healthcare

spending and the primary cause for all of these diseases are unhealthy lifestyle habits (Sagner, 2014).

### Background of Stroke

Stroke is among the leading diseases worldwide, and current studies have increasingly cited lifestyle medicine as an effective method for preventing initial strokes and reducing recurrent strokes. Strokes are caused by the obstruction of blood flow to an area of the brain. This obstruction deprives the brain of oxygen and subsequently leads to the death of brain cells and loss of function in that brain region (UNC School of Medicine, n.d.). There are two types of strokes which are commonly known as hemorrhagic and ischemic strokes. Hemorrhagic strokes are caused by an aneurysm bursts or weakened blood vessel leak in the brain (UNC School of Medicine, n.d.). On the other hand, ischemic strokes are caused by a clot formation in a blood vessel that supplies the brain (UNC School of Medicine, n.d.). The pathology in both hemorrhagic and ischemic strokes is a reduction of blood flow to the brain (UNC School of Medicine, n.d.).

Stroke ranks second among the leading causes of death in the United States accounting for 149,000 deaths per year and 6.5 million deaths in total (Emelia J et al., 2020). Although there has been a decline in stroke prevalence there are still 795,000 people who experience new or recurrent stroke events (hemorrhagic or ischemic) (Emelia J et al., 2020). The observed decline in stroke prevalence has been attributed to an improvement in the population health such as improved diet, lower body mass index and waist circumference (Emelia J et al., 2020). This trend further evidence's that health improvements can reduce the onset of new and recurrent strokes. This observation has increased the implementation of lifestyle interventions in the context of stroke preventions and rehabilitation.

Modern treatments for stroke can vary based on the type of stroke. For hemorrhagic strokes physicians aim to control bleeding, reduce the pressure in the brain, and stabilize vital signs. (Stanford Medical Center, n.d.). Current treatment is achieved through both drug administration, transfusion and surgical procedures. Hemorrhagic stroke patients may receive coagulation drugs and intravenous plasma transfusions (Stanford Medical Center, n.d.). Both the medications and the plasma function to minimize internal bleeding. Plasma is the largest component of human blood and therefore helps boost the patient's blood volume (Schaller et al., n.d). In addition, plasma contains clotting factors which supports blood coagulation (Schaller et al., n.d). If medications and transfusions are unsuccessful, surgical procedures may be required. Some instances where surgery is necessary is when aneurysms need to be repaired or when accumulated blood has to be removed from within the brain (Stanford Medical Center, n.d.).

Treatment for ischemic stroke focuses on restoring blood flow to the brain via drug administration and surgical procedures. Some administered drugs that are effective for ischemic stroke patients include systemic thrombolytic (clot-busting) agents such as tissue plasminogen activator (TPA) and antiplatelet medications such as aspirin (Stanford Medical Center, n.d.). These medications are especially effective if administered soon after the ischemic stroke happens (Stanford Medical Center, n.d.). A final treatment for an ischemic stroke is thrombectomy which is the surgical removal of a clot using modern stent-retrievers (Stanford Medical Center, n.d.).

### Rehabilitation after the First Stroke

Although treatments vary based on the type of stroke, one thing that is widely accepted is that post-treatment must shift to preventative methods to avoid recurrent strokes and other problems for both hemorrhagic and ischemic strokes (Stanford Medical Center, n.d.). Initial treatments provide stroke survivors with an acute remedy, but do not provide assurance that a

subsequent stroke will not occur. Therefore, preventative methods for reducing stroke recurrence are essential. Some recognized preventative steps include: (1) medications to control conditions that put you at risk for a recurrent stroke (2) surgery to remove plaque buildup from the blood vessels that supply the brain (carotid arteries) and (3) stroke rehabilitation programs to help stroke survivors regain skills that stroke survivors may have lost as a result of the stroke while also making the best of the stroke survivors remaining abilities (Stanford Medical Center, n.d.).

The application of lifestyle medicine in stroke rehabilitation programs has gathered increased relevance in response to recent studies which highlighted the unhealthy lifestyle habits adopted by stroke survivors. Some of these habits include remaining sedentary for 19 hours of the day (Tieges, et al., 2015). Also, many stroke survivors have hypertension and other cardiovascular illnesses, which are common complications in stroke patients, that could be ameliorated by healthy nutritional choices (Apostolopoulou et al., 2012). These studies provided foresight as to how positive lifestyle choices could benefit stroke survivors.

#### Stroke Survivors Lifestyle Habits after a Stroke Event

Despite the plethora of research supporting the implementation of healthy lifestyle changes as a technique for preventing recurrent strokes; stroke patients fall in the lower category for healthy lifestyle choices (Nieuwlaat et al., 2013). A recent study analyzed where stroke survivors fell on the “7 ideal cardiovascular health metrics” which included not smoking, eating a healthy diet, getting regular physical activity, achieving a healthy weight and controlling high blood pressure, cholesterol and blood sugar levels (Lin et al., 2015). This study showed that stroke survivors performed the worst on behavioral health metric items, namely, physical activity and diet (Lin et al., 2015). In fact, only twenty percent of stroke survivors engaged in moderate or vigorous physical activity at least 150 minutes per week (Lin et al., 2015). A separate study

showed that most stroke survivors are sedentary 19 hours of the day (Tieges, et al., 2015). Lastly, roughly twenty percent of stroke survivors had a diet score that was considered ideal, with the other 80 percent falling below average (Lin et al., 2015).

This gap between the benefits of lifestyle medicine and the actual application of positive lifestyle changes is daunting. This disparity is even more surprising since stroke survivors attribute their initial stroke as being caused by their previous lifestyle choices and, as a result, they display an activated awareness of their body (Yuki and Kudo, 2011). However, this increased awareness has not translated into an increase in healthy lifestyle habits which is evidenced by the fact that 23 percent of strokes are recurrent events which pose a much higher risk for disability and mortality (Bailey, 2016).

#### An Effective Stroke Rehabilitation Program Structure

In response to this disparity, clinicians began evaluating the effectiveness of existing stroke rehabilitation programs. Their studies showed that the most effective stroke rehabilitation programs implemented intensive, long-term interventions that elicit social support and provide individuals and families with a variety of skills (Bailey, 2016). Although prior research reflects stroke survivor's reluctance to implement behavior change, this study found that the use of self-monitoring and an increased awareness about personal behavior may better facilitate a stroke survivor's efforts at secondary stroke prevention through lifestyle modification (Bailey, 2016). In their study, Bailey also emphasized the need for "effectiveness trials" as a way to examine primary care-based interventions (Bailey, 2016). The importance of "effectiveness trials" revolves around the understanding that physicians are often the first point of contact for patients seeking help for chronic conditions, and therefore, physician-initiated interventions need to be developed and tested for their efficacy (Bailey, 2016).



## Spaulding's Virtual Wellness Program Structure

Spaulding hospital's stroke post-rehabilitation program, which is commonly referred to as the stroke wellness program, revolves around lifestyle medicine and implementing healthy lifestyle changes to prevent recurrent strokes. A pilot study of PAVING the Path was completed in 2011 and reported in Global Advances. In response to the pandemic, Spaulding launched a six-week Virtual Wellness Program which took place from March 30, 2020 to May 4, 2020 and was designed in a way that would promote self-monitoring and an increased awareness about personal behavior through active conversations and program questionnaires.

### Study Aims

Our study aims to identify the effectiveness of Spaulding's six-week Virtual Wellness Program by determining: 1) the pre-program lifestyle habits of stroke survivors 2) the healthy lifestyle changes adopted by stroke survivors following their participation in the program and 3) determine which specific healthy lifestyle habits were changed significantly in stroke survivors following their participation in the Virtual Wellness Program.

### Hypothesis

We hypothesize that most of the stroke survivors will have unhealthy lifestyle habits prior to starting the Virtual Wellness Program. We further hypothesize that the structure of Spaulding's Virtual Wellness Program, although short term, will increase the adoption of positive lifestyle habits in stroke survivor's by utilizing techniques that promote self-monitoring and increased awareness about personal behavior.

### Significance of Study

Our study will provide guidance for future Virtual Wellness Programs dedicated to promoting healthy lifestyle choices in stroke survivors. The results from this study will help

Spaulding reflect on the efficacy of their program and determine the impact that their program has on stroke survivors. In addition, this study will help practitioners in the stroke care and lifestyle medicine fields better understand what strategies can be taken to educate stroke survivors and prevent recurrent stroke. Conclusively, the results from this study will help future researchers and physicians better understand the efficacy of stroke rehabilitation programs as defined by how many participants actually implement healthy lifestyle changes.

## Chapter II

### Methods

This is a quality improvement study which utilizes both qualitative and quantitative data for retrospective analysis. All data was collected by Dr. Elizabeth Pegg Frates, for independent purposes, during her 2020 Virtual Wellness Program at Spaulding Hospital. This study analyzes that data via qualitative analysis of the “PAVING Wellness Wheel” self-evaluations as a method for providing a baseline understanding of the improvement in lifestyle habits among stroke survivors in the Spaulding’s Virtual Wellness Program. Subsequently, quantitative analysis was employed as a means for expanding on the individual participant results in order to obtain a broader understanding of which lifestyle changes were adopted by stroke survivors by the end of Spaulding’s Virtual Wellness Program. Approval from the Harvard Institution Review Board (IRB) was sought, but the study was not granted review due to notification that this is a retrospective analysis of de-identified data and is therefore classified as a non-human study.

The structure of Spaulding’s Virtual Wellness Program revolved around weekly sessions, with one session per week, dedicated to two particular categories of lifestyle medicine chosen from twelve lifestyle medicine categories: (1) physical activity (2) goals (3) nutrition (4) investigations (5) sleep (6) attitude (7) social connections (8) time outs (9) purpose (10) energy (11) stress management and (12) variety. Spaulding’s Virtual Wellness Program syllabus is presented below:

Table 2.1. Spaulding Virtual Wellness Program Syllabus

Week 1:	Physical Activity and Goals
Week 2:	Nutrition and Investigations
Week 3:	Sleep and Attitude
Week 4:	Social Connections and Time Outs
Week 5:	Purpose and Energy
Week 6:	Stress Management and Variety

Participants

Program participants were not screened to meet a particular criterion. However, the resulting participants fell into one of two categories 1) brain injury survivors and 2) stroke survivors. Our data was solely based on responses from stroke survivors.

Interviews

Interviews were conducted via zoom by Dr. Elizabeth Pegg Frates. Interviews focused on questions from the program questionnaires which assessed participants in the twelve different lifestyle medicine categories. The questionnaires were designed in a way that would enhance self-monitoring and increase participant awareness about personal behaviors. In order to complete the program questionnaires, participants needed to have the time, as well as the physical and mental capabilities. The program questionnaires and respective lifestyle medicine categories are listed below:

## Program Questionnaires

Physical activity: discuss the importance of moving your body and maintaining an active lifestyle. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the physical activity category were based on a program questionnaire containing five physical activity related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

Table 2.2 Physical Activity Questionnaire

I exercise 5 days in the week for about a half an hour.	
I enjoy myself when I exercise.	
I perform strength training exercises twice a week.	
I perform flexibility exercises routinely.	
I perform balance exercises routinely.	

<u>Physical Activity Total:</u>	
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Goals: discuss the importance of setting weekly SMART goals. SMART goals are defined as goals that are specific, measurable, action oriented, realistic and time sensitive. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the goal’s category were based on a program questionnaire containing five goal related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

- 1 Never do this
- 2 Only rarely do this
- 3 Sometimes do this
- 4 Often do this
- 5 Do this regularly as part of my routine

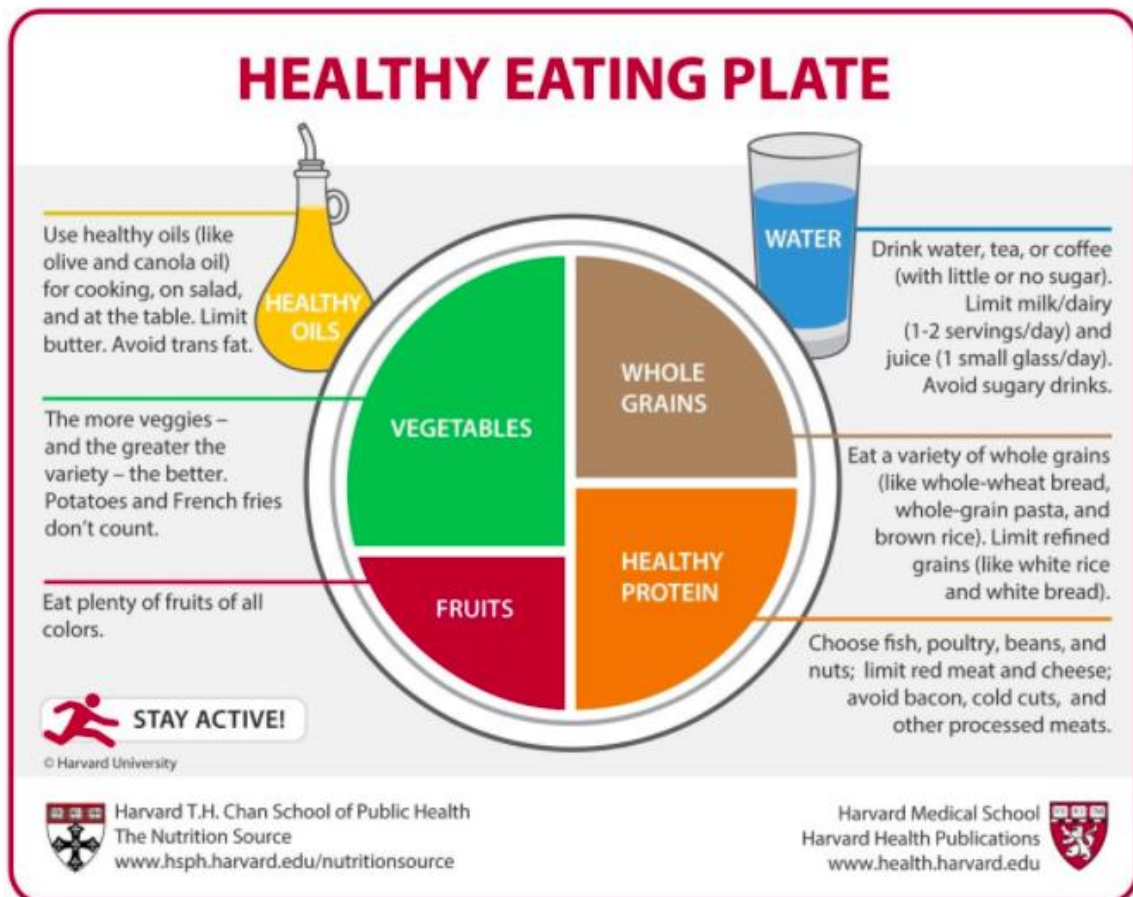
Table 2.3 Goals Questionnaire

Goals	
I set long-term goals for myself, share them with someone, and review them.	
I set three-month goals for myself, share them with someone, and work toward them.	

I set monthly goals and share them with someone.	
I set weekly goals and share them with someone.	
I set daily goals for myself and keep myself accountable for them.	
<u>Goals Total:</u>	

Nutrition: discuss the importance of eating delicious and nutritious food following the Harvard Healthy Eating Plate:

Figure 2.1 Harvard Healthy Eating Plate



(Harvard, 2020).

Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the nutrition category were based on a program questionnaire containing five nutrition related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

- 1 Never do this
- 2 Only rarely do this
- 3 Sometimes do this
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- 5 Do this regularly as part of my routine

Table 2.4 Nutrition Questionnaire

Nutrition	
I eat 4 fruits a day.	
I eat 5 or more vegetables a day.	
I know proper portions for protein, carbohydrates, and fats, and I eat those portions.	
I think about the food that I eat and ask myself if it is good for my body.	
I view food as fuel, as medicine, and enjoyment too.	



<u>Nutrition Total:</u>	
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Investigations: being curious and experimenting with new activities, vegetables, stress management techniques, and new social connections. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the investigation’s category were based on a program questionnaire containing five investigation related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

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Table 2.5 Investigations Questionnaire

I perform mini experiments on myself regularly.	
I am curious as to what foods are good for my body.	
I am curious as to what effect physical activity has on my body.	

I read about the latest research findings in medicine, nutrition, sleep, stress management, and/or exercise.	
I talk about health with family and friends.	
<u>Investigations Total:</u>	

Sleep: learn sleep guidelines and research on sleep. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the sleep category were based on a program questionnaire containing five sleep related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

Table 2.6 Sleep Questionnaire

I sleep 7-8 hours a night.	
I don't drink coffee after 12pm..	

I have a bedtime routine in which I relax before bed.	
I don't sleep with my phone on in the bedroom.	
I take 20 minute naps when I am over tired.	
<u>Sleep Total:</u>	

Attitude: discuss the importance of adopting a mindset of positivity, gratitude and growth. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the attitude category were based on a program questionnaire containing five attitude related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

Table 2.7 Attitude Questionnaire

I use mistakes as opportunities to learn and grow.	
I write thank you notes or express my gratitude verbally.	

I celebrate success when it happens.	
I concentrate on the task at hand fully without distraction.	
I am optimistic about the day.	
<u>Attitude Total:</u>	

Social Connection: discuss the importance of social connection to health and happiness.

Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the social connection category were based on a program questionnaire containing five social connection related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

Table 2.8 Social Connections Questionnaire

I can name at least one person who brings me strength.	
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I am involved with a group (activity, exercise class, art class, religious affiliation or the like)	
I visit with friends on the phone or in person at least 5 times a week.	
I have a healthy relationship with my spouse, partner, or best friend.	
I have a pet or plant that I can nurture and spend time with every day.	
<u>Social Connections Total:</u>	

Time Outs: understand the importance of breaks, empowerment moments, and how to use these for self-renewal. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the time out category were based on a program questionnaire containing five time out related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

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Table 2.9 Time Outs Questionnaire

If I sit for over an hour, I stand up and take a break for five minutes each hour.	
If I feel frustrated and annoyed, I take a few deep breaths to calm down.	
I take my vacation every year.	
When I am at home, I make sure to turn off my computer and put my work projects away at least for an hour at dinner time.	
After working on the same project for a few hours, I step away from it to get perspective on it.	
<u>Time Outs Total:</u>	

Purpose: investigate what brings people purpose and why it is correlated with health.

Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the purpose category were based on a program questionnaire containing five purpose related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

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5 Do this regularly as part of my routine

Table 2.10 Purpose Questionnaire

I feel that I have a clear purpose in life.	
I am able to prioritize my activities and projects easily.	
I make sure that my activities and projects are in alignment with my values.	
I have identified the people and activities that are most important to me.	
I am using my strengths to fulfill my purpose.	
<u>Purpose Total:</u>	

Energy: understand the importance of natural energy and how to get it. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program.

Participant assessments in the energy category were based on a program questionnaire containing five energy related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

Table 2.11 Energy Questionnaire

I have a friend who I know energizes me.	
I have identified at least one activity that brings me joy and energy.	
I am able to avoid situations and people that drain my energy.	
I only drink two cups of coffee a day.	
I don't rely on sugar/sweets or cookies for a quick energy fix.	
<u>Energy Total:</u>	

Stress Management: manage stress and increase resiliency. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the stress management category were based on a program questionnaire containing five stress management related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

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3 Sometimes do this



4 Often do this

5 Do this regularly as part of my routine

Table 2.12 Stress Management Questionnaire

I have learned about stress and its effect on the mind and body.	
I am familiar with stress reduction techniques, and I use at least one when I feel that I am anxious, annoyed, or worried.	
I know about stress resiliency, and I practice enhancing my resiliency on a regular basis.	
I don't get angry easily.	
I meditate, take deep breaths, practice yoga, or do mindfulness based stress reduction (MBSR) regularly.	
<u>Stress Total:</u>	

9. Variety: discuss the importance of diversifying your physical activities, nutrition and social connections. Participants were assessed before beginning (pre) and after the end (post) of the Virtual Wellness Program. Participant assessments in the variety category were based on a program questionnaire containing five variety related questions that assessed habits adopted by the participant. The participants rated themselves on a “key” numbered 1-5 with a “1” reflecting that the patient never does that particular habit and “5” showing that the participant does this habit regularly as part of their routine. The “key” and program questionnaire are provided below:

Key:

1 Never do this

2 Only rarely do this

3 Sometimes do this

4 Often do this

5 Do this regularly as part of my routine

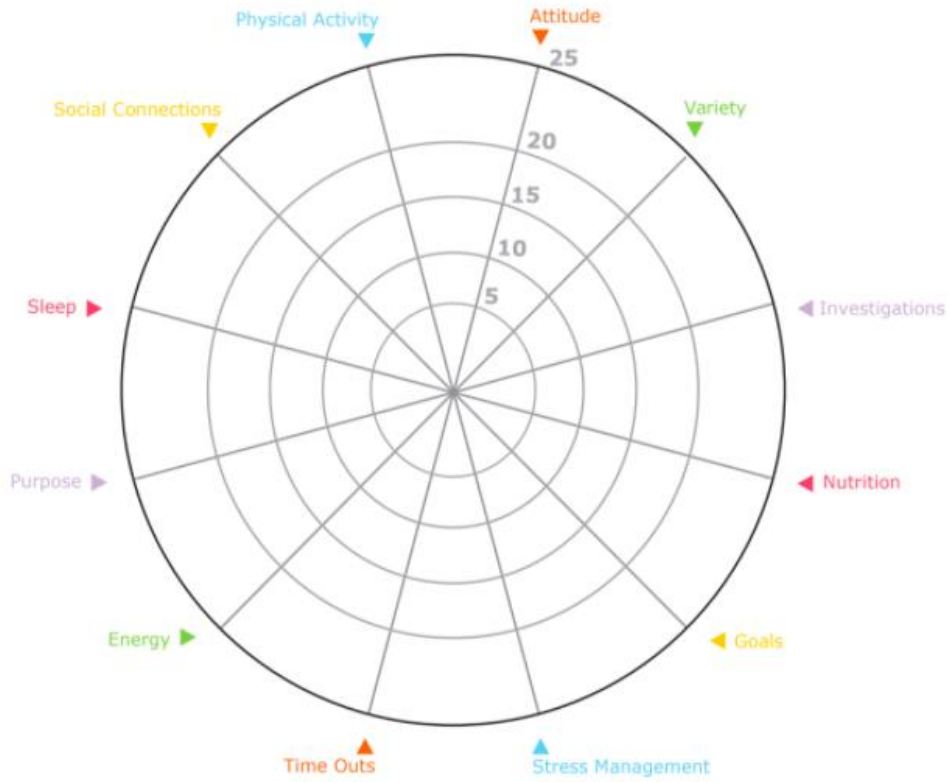
Table 2.13 Variety Questionnaire

I do a variety of different exercises.	
I try to have a rainbow of colors on my plate.	
I enjoy a variety of fruits and vegetables.	
I like to try new activities.	
I spend time and connect with a wide range of friends.	
<u>Variety Total:</u>	

### PAVING Wellness Wheel

After completing the program questionnaire, participants plotted the sum value for each lifestyle medicine category onto the “PAVING Wellness Wheel”. For example, a participant who rated themselves as a “3”, “4”, “3”, “2”, and “3” in response to the questions on the sleep questionnaire had a sum value of “15” which they plotted as a single dot along the line labeled as sleep on the “PAVING Wellness Wheel”.

Figure 2.2 PAVING Wellness Wheel



### Calculations

Each of the twelve wellness categories (physical activity, attitude, variety, social connection, sleep, investigations, purpose, nutrition, goals, energy, time outs and stress management) was mathematically analyzed separately using Microsoft Excel technology. The pre-Virtual Wellness Program responses (labeled “pre”) from the seven participants were added together and the sum was then divided by 7 to obtain an average value. The same strategy was used to calculate an average for the post-Virtual Wellness Program responses (labeled “post”). “Pre” responses and “post” responses were then analyzed separately for their standard deviation using the sample standard deviation calculation function on Microsoft Excel. A paired-two tailed t-test analysis was then performed between the “pre” and “post” responses for each of the 12 lifestyle medicine categories using Microsoft Excel technology. Lastly, the averages for “pre” and “post” responses

across all 12 lifestyle medicine categories was calculated along with standard deviations and p values using a paired-two tailed t-test analysis. Statistical significance was determined based on the paired two-tailed t-test values.

### Graphs

Individual bar graphs were created for each lifestyle medicine category using Microsoft Excel technology. The “pre” and “post” categories for each of the 12 lifestyle medicine categories were plotted on the x-axis and the average response values were plotted along the y-axis. In addition, the overall “pre” and “post” responses across all 12 lifestyle medicine categories were plotted against each other, using Microsoft Excel technology, with the “pre” and “post” responses plotted on the x-axis and the average response values plotted along the y-axis. Statistical significance was represented on each graph using asterisks and the following key: p-value < 0.05: \*, p-value < 0.01: \*\*, p-value < 0.001: \*\*\*, p-value < 0.0001: \*\*\*\*.

### Chapter III

#### Results

##### PAVING Wellness Wheel Values

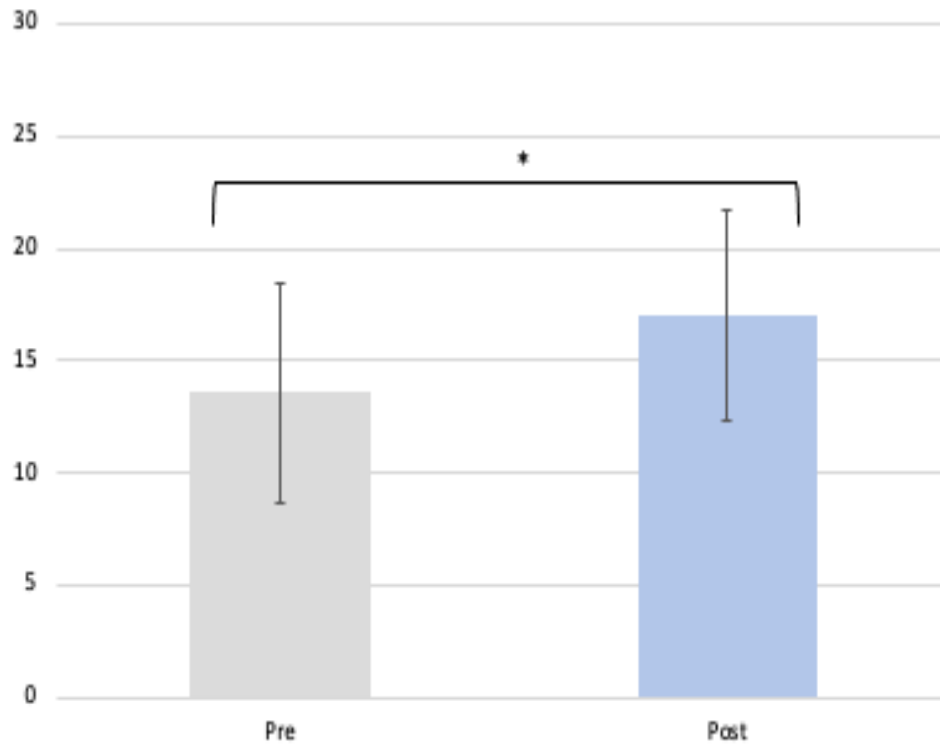
Table 3.1 Participants self-assessment of their Physical Activity before and after the Virtual Wellness Program

<b>Physical Activity</b>	Pre	Post
Participant 1:	6	10
Participant 2:	15	20
Participant 3:	17	21
Participant 4:	20	20
Participant 5:	19	25
Participant 6:	19	18
Participant 7:	13	22
Average:	13.63	17

On average, participants felt their physical activity improved by “3.38” points by the end of the Virtual Wellness Program. Participant 4 did not feel that they improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 6 was the only participant that felt their physical activity declined after the Virtual Wellness Program. Out of all of the participants, participant 7 reported the greatest improvement in their physical activity with an increase in “9” points from the beginning of the program to the end of the program. By the

end of the Virtual Wellness Program Participant 5 rated themselves as being perfect, with score of “25”, in the physical activity category.

Figure 3.1 Combined analysis of participants self-assessment of their Physical Activity before and after the Virtual Wellness Program



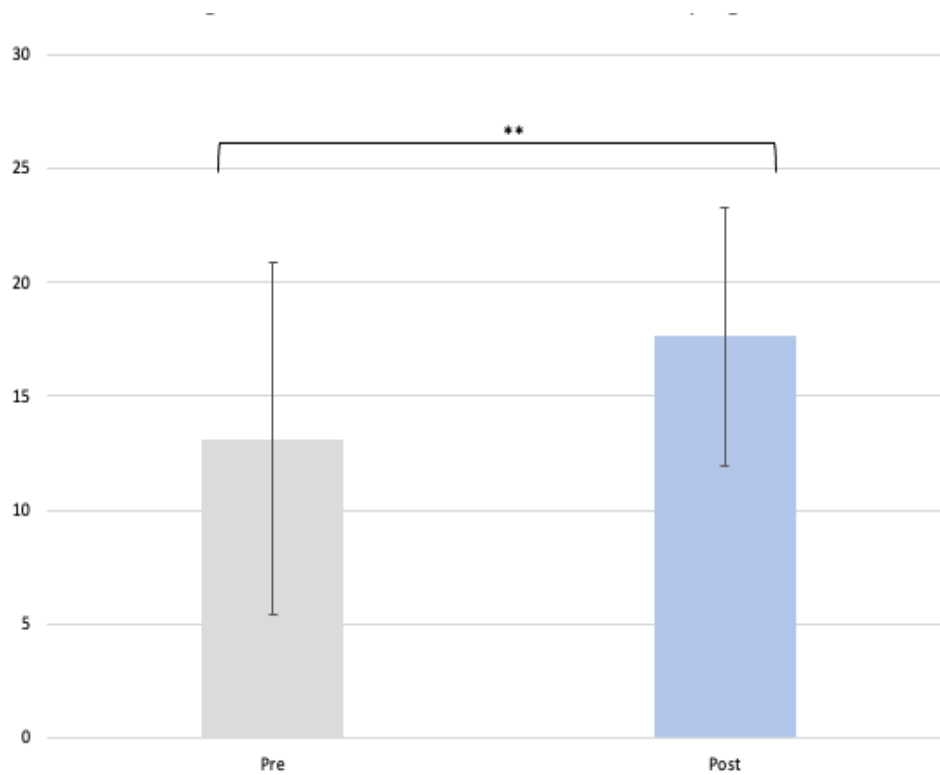
Participants ( $n = 7$ ) reported an average physical activity value of 13.63 ( $s = 4.89$ ) before the start of the Virtual Wellness Program and 17 ( $s = 4.69$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p = 0.013$ ) improvement in the stroke survivor’s physical activity from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.2 Participants self-assessment of their Stress Management before and after the Virtual Wellness Program

Stress Management	Pre	Post
Participant 1:	15	19
Participant 2:	5	15
Participant 3:	15	20
Participant 4:	22	25
Participant 5:	5	10
Participant 6:	18	23
Participant 7:	25	25
Participant 8:	15	23
Average:	13.13	17.63

On average, participants felt their stress management improved by “4.50” points by the end of the Virtual Wellness Program. Participant 7 did not feel that they improved from the beginning to the end of the six-week Virtual Wellness Program and reported themselves as being perfect, with a “25”, at stress management both before and after ending the Virtual Wellness Program. Out of all of the participants, participant 2 reported the greatest improvement in their stress management with an increase in “10” points from the beginning of the program to the end of the program.

Figure 3.2 Combined analysis of participants self-assessment of their Stress Management before and after the Virtual Wellness Program



Participants ( $n = 7$ ) reported an average stress management value of 13.13 ( $s = 7.72$ ) before the start of the Virtual Wellness Program and 17.63 ( $s = 5.67$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p = 0.002$ ) improvement in the stroke survivor's stress management from before the Virtual Wellness Program to after the Virtual Wellness Program.

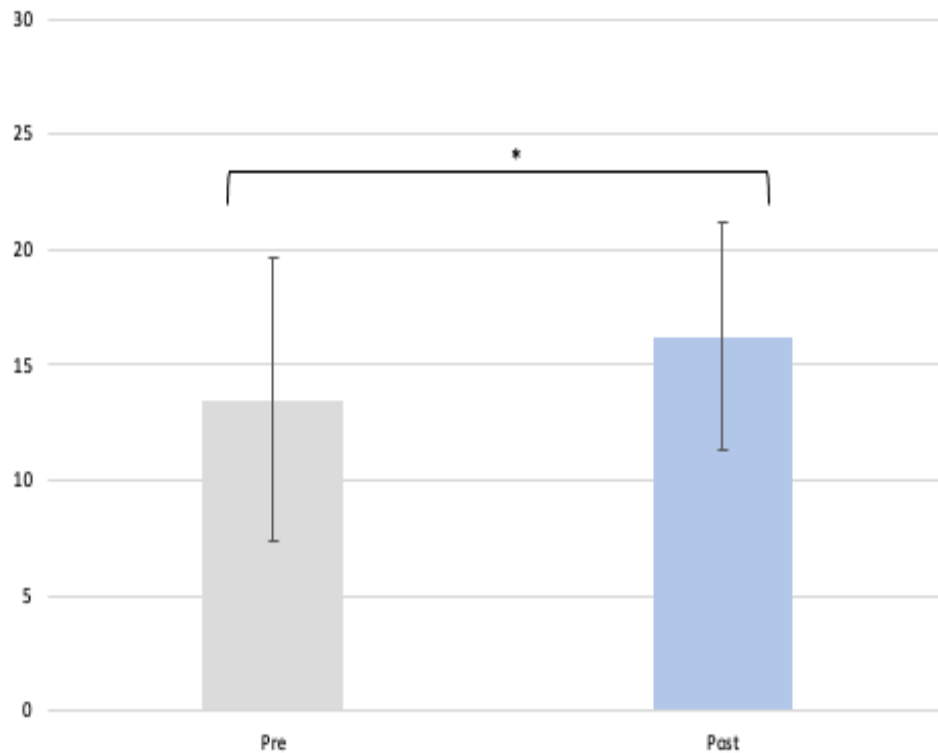


Table 3.3 Participants self-assessment of their Attitude before and after the Virtual Wellness Program

Attitude	Pre	Post
Participant 1:	5	8
Participant 2:	10	20
Participant 3:	23	23
Participant 4:	15	18
Participant 5:	18	21
Participant 6:	17	20
Participant 7:	20	20
Average:	13.50	16.25

On average, participants felt their attitude improved by “2.75” points by the end of the Virtual Wellness Program. Participant 3 and participant 7 did not feel that they improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 1 entered the Virtual Wellness Program with a minimal score of “5” in the attitude category and participant 7 reported themselves as being perfect with a “25” in the attitude category. Out of all of the participants, participant 2 reported the greatest improvement in their attitude with an increase in “10” points from the beginning of the program to the end of the program.

Figure 3.3 Combined analysis of participants self-assessment of their Attitude before and after the Virtual Wellness Program



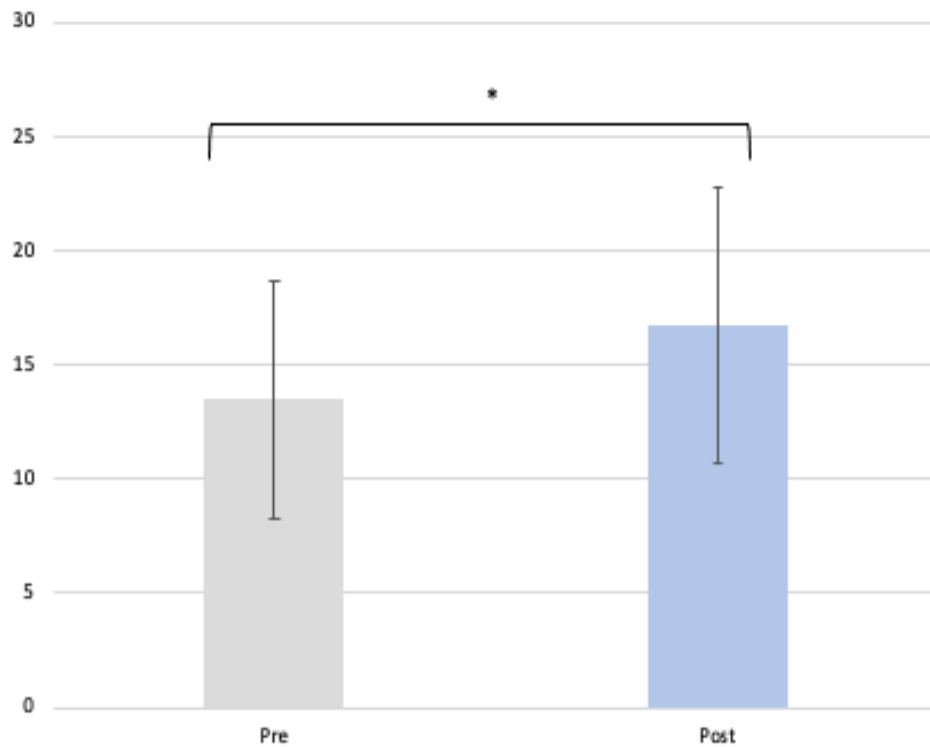
Participants ( $n = 7$ ) reported an average attitude value of 13.50 ( $s = 6.13$ ) before the start of the Virtual Wellness Program and 16.25 ( $s = 4.89$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p = 0.0497$ ) improvement in the stroke survivor's stress management from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.4 Participants self-assessment of their Time Outs before and after the Virtual Wellness Program

Time Outs	Pre	Post
Participant 1:	6	6
Participant 2:	15	20
Participant 3:	21	23
Participant 4:	15	20
Participant 5:	20	24
Participant 6:	19	20
Participant 7:	12	21
Average:	13.50	16.75

On average, participants felt their use of time outs improved by “3.25” points by the end of the Virtual Wellness Program. Participant 1 did not feel that they improved from the beginning to the end of the six-week Virtual Wellness Program and reported themselves as being slightly above the minimum, with a score of “6”, for their use of time outs both before and after the Virtual Wellness Program. Participant 7 reported the greatest improvement in their use of time outs with an increase in “9” points from the beginning of the program to the end of the program.

Figure 3.4 Combined analysis of participants self-assessment of their Time Outs before and after the Virtual Wellness Program



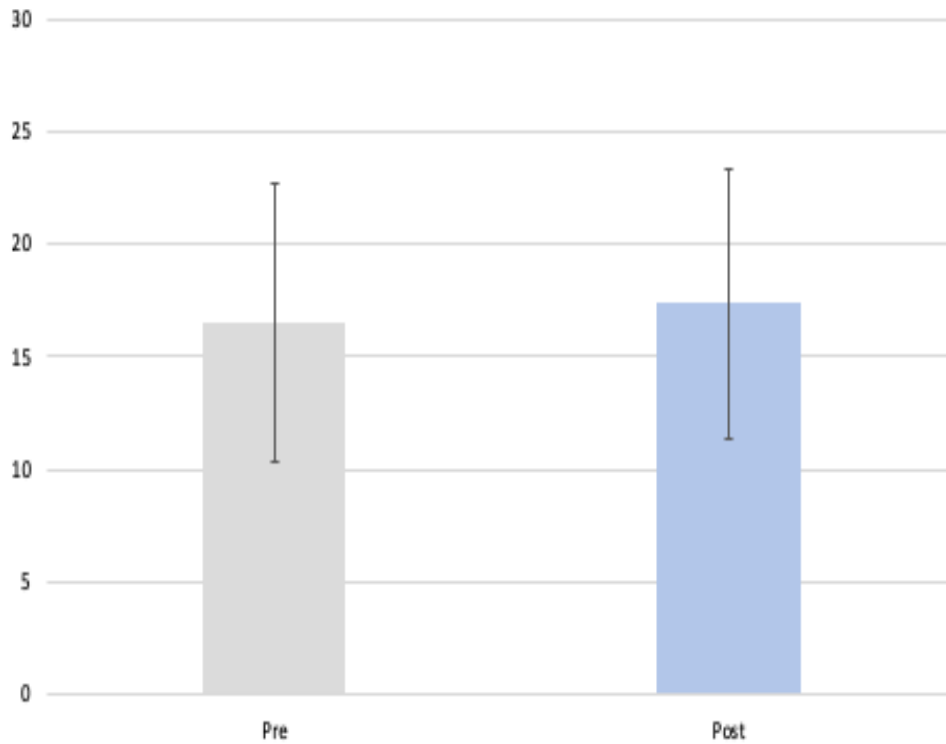
Participants ( $n = 7$ ) reported an average time out value of 13.50 ( $s = 5.26$ ) before the start of the Virtual Wellness Program and 16.75 ( $s = 6.01$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p = 0.011$ ) improvement in the stroke survivor's use of time outs from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.5 Participants self-assessment of their Variety before and after the Virtual Wellness Program

Variety	Pre	Post
Participant 1:	7	9
Participant 2:	15	15
Participant 3:	20	21
Participant 4:	25	25
Participant 5:	21	25
Participant 6:	20	20
Participant 7:	24	24
Average:	16.50	17.38

On average, participants felt their variety improved by “0.88” points by the end of the Virtual Wellness Program. Participant 2, participant 4, participant 6 and participant 7 did not feel that their variety improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 4 reported themselves as being perfect at variety. Participant 5 reported the greatest improvement in their variety with an increase in “4” points from the beginning of the program to the end of the program.

Figure 3.5 Combined analysis of participants self-assessment of their Variety before and after the Virtual Wellness Program



Participants ( $n=7$ ) reported an average variety value of 16.50 ( $s = 6.15$ ) before the start of the Virtual Wellness Program and 17.38 ( $s = 5.96$ ) after the end of the Virtual Wellness Program. The data did not reflect a statistically significant ( $p= 0.086$ ) improvement in the stroke survivor's variety from before the Virtual Wellness Program to after the Virtual Wellness Program.

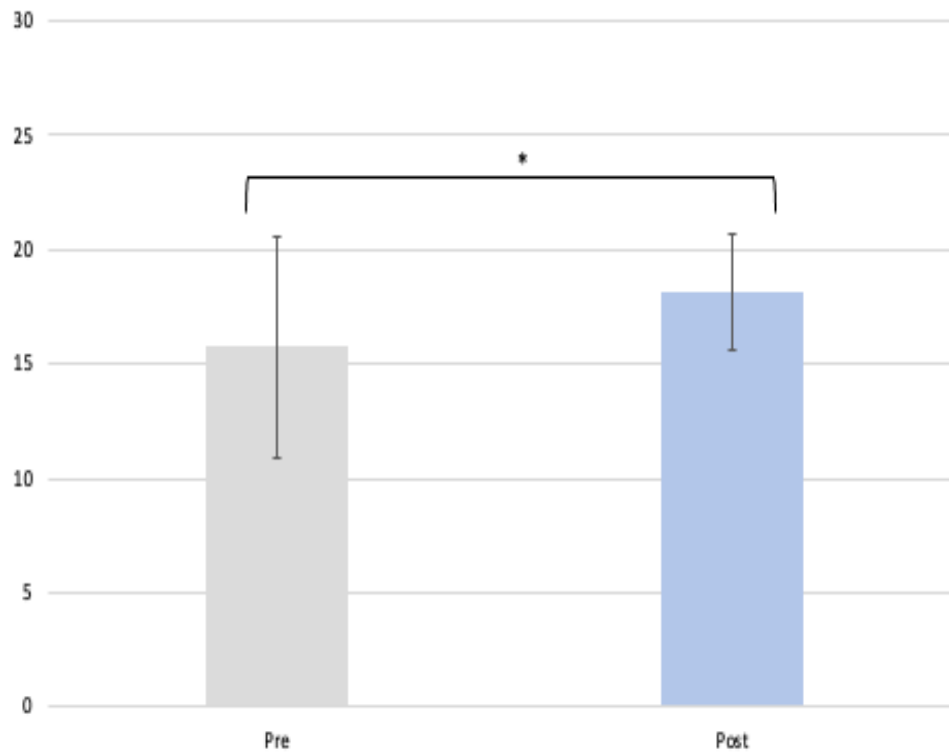
Table 3.6 Participants self-assessment of their Energy before and after the Virtual Wellness

Program

Energy	Pre	Post
Participant 1:	15	18
Participant 2:	10	18
Participant 3:	25	25
Participant 4:	20	20
Participant 5:	19	21
Participant 6:	16	20
Participant 7:	21	23
Average:	15.75	18.13

On average, participants felt their energy improved by “2.38” points by the end of the Virtual Wellness Program. Participant 3 and participant 4 did not feel that their energy improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 2 reported the greatest improvement in their energy with an increase in “8” points from the beginning of the program to the end of the program.

Figure 3.6 Combined analysis of participants self-assessment of their Energy before and after the Virtual Wellness Program



Participants ( $n=7$ ) reported an average energy value of 15.75 ( $s = 4.83$ ) before the start of the Virtual Wellness Program and 18.13 ( $s = 2.56$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.023$ ) improvement in the stroke survivor's energy from before the Virtual Wellness Program to after the Virtual Wellness Program.

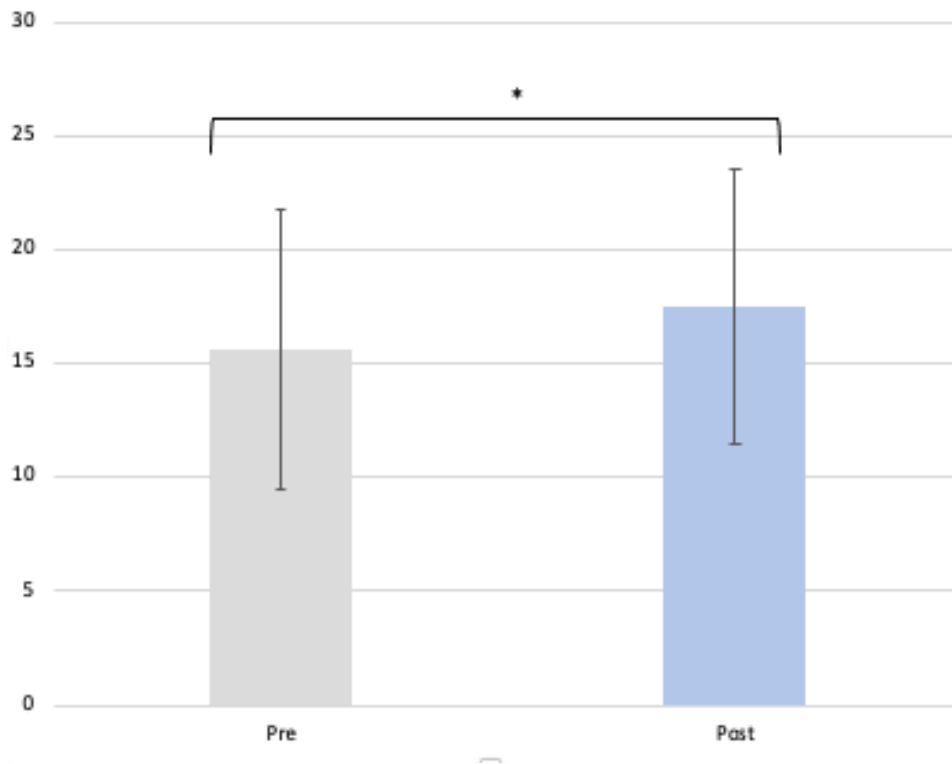


Table 3.7 Participants self-assessment of their Investigations before and after the Virtual Wellness Program

Investigations	Pre	Post
Participant 1:	6	7
Participant 2:	15	20
Participant 3:	21	22
Participant 4:	25	25
Participant 5:	20	24
Participant 6:	17	20
Participant 7:	21	22
Average:	15.63	17.50

On average, participants felt their investigations improved by “1.88” points by the end of the Virtual Wellness Program. Participant 4 did not feel that their investigations improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 4 reported themselves as being perfect at investigations, with a score of “25”, both before and after the Virtual Wellness Program.

Figure 3.7 Combined analysis of participants self-assessment of their Investigations before and after the Virtual Wellness Program



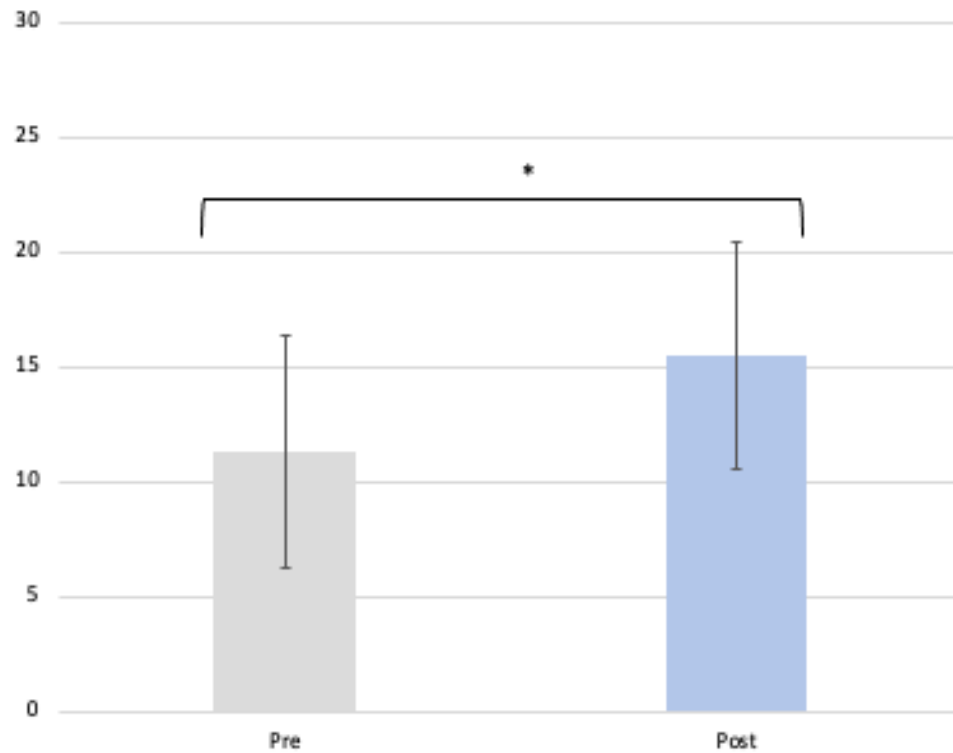
Participants (n=7) reported an average investigations value of 15.63 ( $s = 6.12$ ) before the start of the Virtual Wellness Program and 17.50 ( $s = 6.03$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.026$ ) improvement in the stroke survivor's investigations from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.8 Combined analysis of participants self-assessment of their Purpose before and after the Virtual Wellness Program

Purpose	Pre	Post
Participant 1:	9	9
Participant 2:	10	17
Participant 3:	16	19
Participant 4:	10	16
Participant 5:	23	25
Participant 6:	12	17
Participant 7:	10	21
Average:	11.25	15.50

On average, participants felt their purpose improved by “4.25” points by the end of the Virtual Wellness Program. Participant 1 did not feel that their sense of purpose improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 7 reported the greatest improvement in their sense of purpose with an increase in “11” points from the beginning of the program to the end of the program. Participant 5 gave themselves a perfect score of “25” at understanding their purpose by the end of the six-week Virtual Wellness Program.

Figure 3.8 Combined analysis of participants self-assessment of their Purpose before and after the Virtual Wellness Program



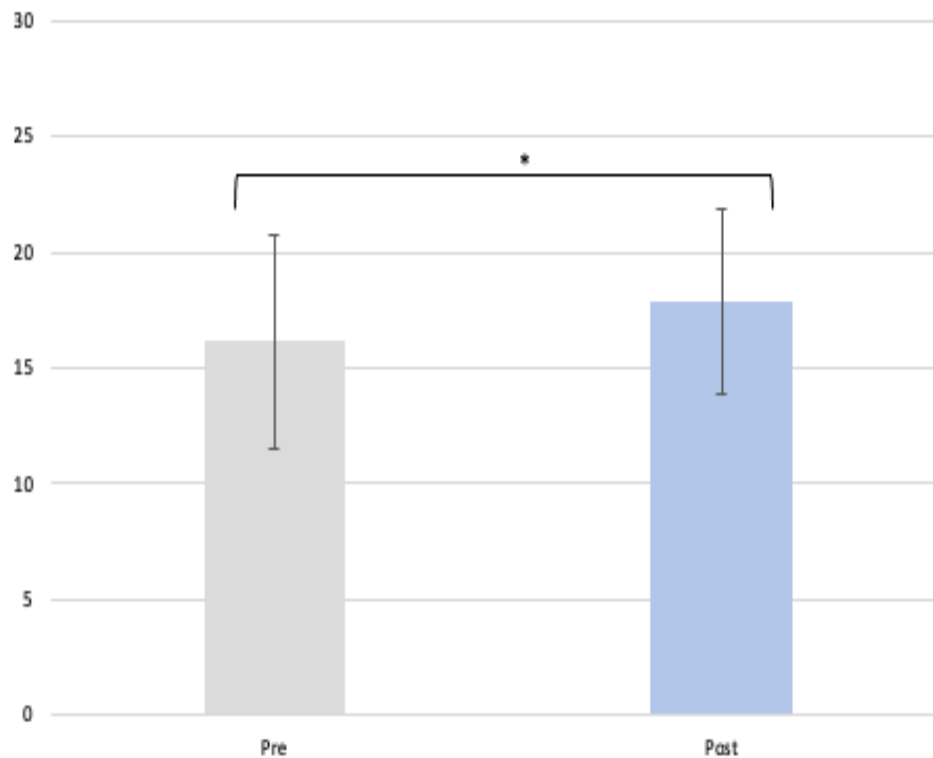
Participants ( $n=7$ ) reported an average purpose value of 11.25 ( $s = 5.05$ ) before the start of the Virtual Wellness Program and 15.50 ( $s = 4.92$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.015$ ) improvement in the stroke survivor's purpose from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.9 Participants self-assessment of their Nutrition before and after the Virtual Wellness Program

Nutrition	Pre	Post
Participant 1:	21	24
Participant 2:	15	20
Participant 3:	20	21
Participant 4:	10	12
Participant 5:	21	21
Participant 6:	18	21
Participant 7:	24	24
Average:	16.13	17.88

On average, participants felt their nutrition improved by “1.75” points by the end of the Virtual Wellness Program. Participant 5 and participant 7 did not feel that their nutrition improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 2 reported the greatest improvement in their nutrition with an increase in “5” points from the beginning of the program to the end of the Virtual Wellness Program.

Figure 3.9 Combined analysis of participants self-assessment of their Nutrition before and after the Virtual Wellness Program



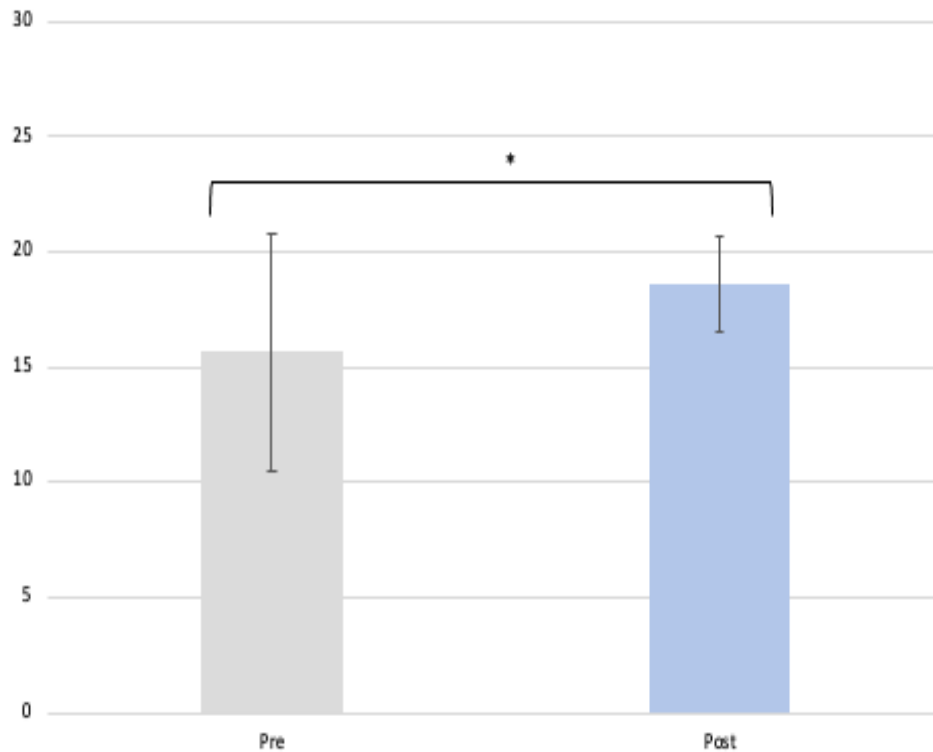
Participants (n=7) reported an average nutrition value of 16.13 ( $s = 4.65$ ) before the start of the Virtual Wellness Program and 17.88 ( $s = 4.04$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p = 0.031$ ) improvement in the stroke survivor's nutrition from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.10 Participants self-assessment of their Sleep before and after the Virtual Wellness Program

Sleep	Pre	Post
Participant 1:	25	25
Participant 2:	10	20
Participant 3:	18	21
Participant 4:	15	20
Participant 5:	19	21
Participant 6:	15	19
Participant 7:	23	23
Average:	15.63	18.63

On average, participants felt their sleep improved by “3.00” points by the end of the Virtual Wellness Program. Participant 1 and participant 7 did not feel that their sleep improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 2 reported the greatest improvement in their sleep with an increase in “10” points from the beginning of the program to the end of the Virtual Wellness Program.

Figure 3.10 Combined analysis of participants self-assessment of their Sleep before and after the Virtual Wellness Program



Participants (n=7) reported an average sleep value of 15.63 ( $s = 5.11$ ) before the start of the Virtual Wellness Program and 18.63 ( $s = 2.06$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.032$ ) improvement in the stroke survivor's sleep from before the Virtual Wellness Program to after the Virtual Wellness Program.

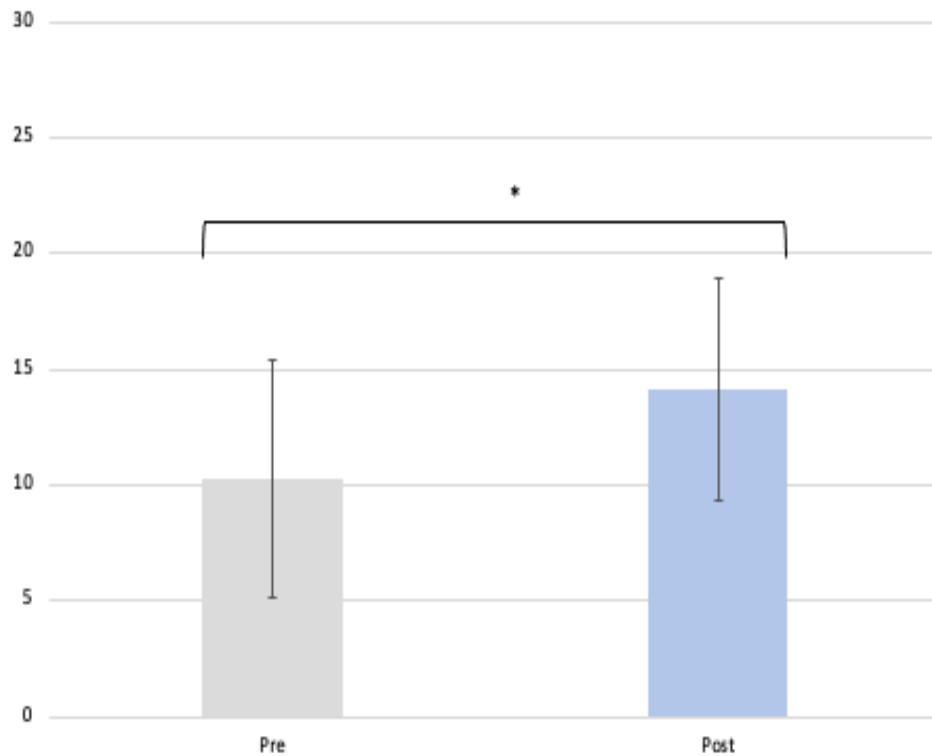


Table 3.11 Participants self-assessment of their Goals before and after the Virtual Wellness Program

Goals	Pre	Post
Participant 1:	5	6
Participant 2:	10	19
Participant 3:	15	18
Participant 4:	5	15
Participant 5:	14	16
Participant 6:	18	19
Participant 7:	15	20
Average:	10.25	14.13

On average, participants felt their goals improved by “3.88” points by the end of the Virtual Wellness Program. All participants felt their goals improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 1 and participant 4 entered the Virtual Wellness Program with the minimal score of a “5” in the goal’s category. Participant 2 reported the greatest improvement in their goals with an increase in “9” points from the beginning of the program to the end of the Virtual Wellness Program.

Figure 3.11 Combined analysis of participants self-assessment of their Goals before and after the Virtual Wellness Program



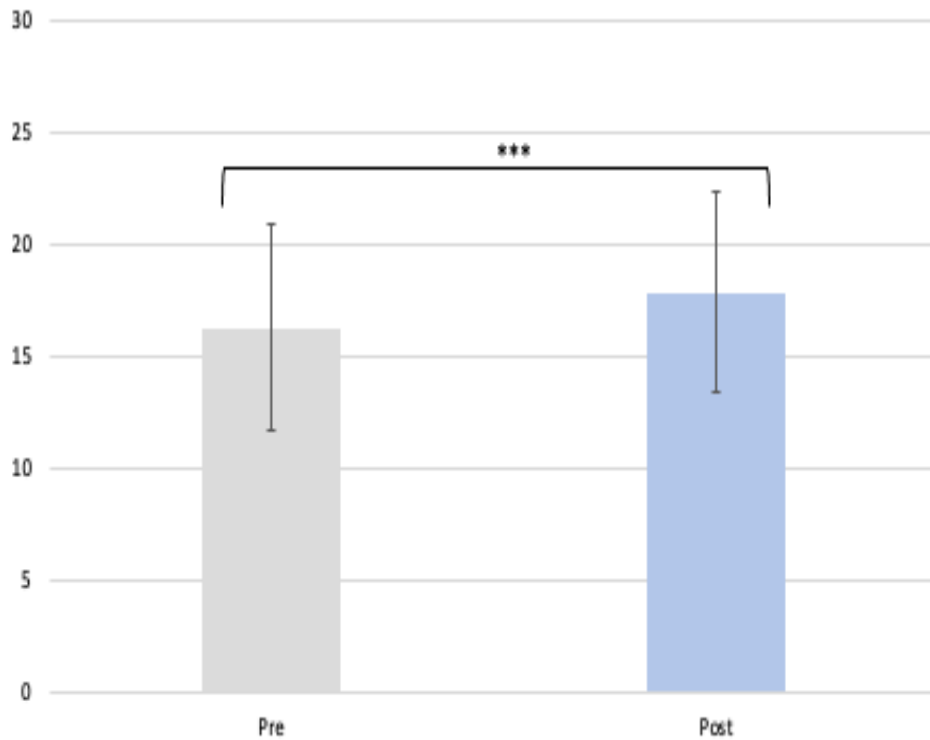
Participants (n=7) reported an average goals value of 10.25 ( $s = 5.15$ ) before the start of the Virtual Wellness Program and 14.13 ( $s = 4.81$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.014$ ) improvement in the stroke survivor's goals from before the Virtual Wellness Program to after the Virtual Wellness Program.

Table 3.12 Participants self-assessment of their Social Connections before and after the Virtual Wellness Program

Social Connections	Pre	Post
Participant 1:	10	12
Participant 2:	15	17
Participant 3:	20	21
Participant 4:	20	23
Participant 5:	24	25
Participant 6:	21	22
Participant 7:	20	23
Average:	16.25	17.88

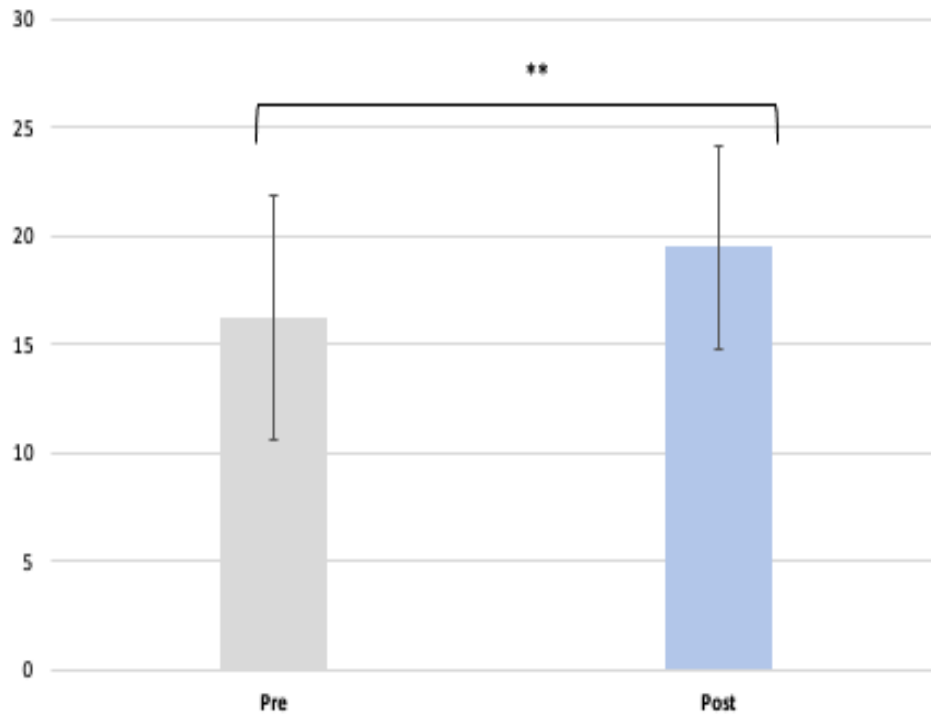
On average, participants felt their social connections improved by “1.63” points by the end of the Virtual Wellness Program. All participants felt their social connections improved from the beginning to the end of the six-week Virtual Wellness Program. Participant 4 and participant 7 reported the greatest improvements in their social connections with an increase in “3” points from the beginning of the program to the end of the Virtual Wellness Program.

Figure 3.12 Combined analysis of participants self-assessment of their Social Connections before and after the Virtual Wellness Program



Participants (n=7) reported an average social connection value of 16.25 ( $s = 4.61$ ) before the start of the Virtual Wellness Program and 17.88 ( $s = 4.47$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.0008$ ) improvement in the stroke survivor's social connection from before the Virtual Wellness Program to after the Virtual Wellness Program.

Figure 3.13 Combined analysis of participants self-assessment of their lifestyle habits before and after the Virtual Wellness Program



Participants ( $n=7$ ) reported an overall average lifestyle habit value of 16.22 ( $s = 5.62$ ) before the start of the Virtual Wellness Program and 19.49 ( $s = 4.71$ ) after the end of the Virtual Wellness Program. The data reflected a statistically significant ( $p= 0.0018$ ) improvement in the stroke survivor's lifestyle habits from before the Virtual Wellness Program to after the Virtual Wellness Program.

## Chapter IV

### Discussion

In our study we evaluated the efficacy of Spaulding's Virtual Wellness Program by determining: 1) the pre-program lifestyle habits of the stroke survivors 2) the healthy lifestyle changes adopted by the stroke survivors following their participation in the program and 3) which specific healthy lifestyle habits were changed significantly in stroke survivors following their participation in the Virtual Wellness Program.

#### Efficacy of Spaulding's Virtual Wellness Program

The findings of our study showed that stroke survivors self-assessed themselves as having unhealthy overall lifestyle habits, with an average overall rating of 16.22 ( $s = 5.62$ ), before beginning the Spaulding Virtual Wellness Program. By the end of Spaulding's Virtual Wellness Program, stroke survivors' self-assessments reflected a "3.27" point increase 19.49 ( $s = 4.71$ ) in their overall lifestyle habits resulting in a statistically significant ( $p = 0.0018$ ) increase in the overall average lifestyle habit rating.

The self-assessments provided by the stroke survivors in each of the twelve individual lifestyle medicine categories also provided reassuring results. Participants reported a statistically significant improvement in their physical activity ( $p = 0.013$ ), stress management ( $p = 0.002$ ), attitude ( $p = 0.0497$ ), use of time outs ( $p = 0.011$ ), energy ( $p = 0.023$ ), investigations ( $p = 0.026$ ), purpose ( $p = 0.015$ ), nutrition ( $p = 0.031$ ), sleep ( $p = 0.032$ ), goals ( $p = 0.014$ ) and social connections ( $p = 0.0008$ ). The most significant change was in the stroke survivor's social connections which may have been reflective of the fact that they were, at the time, actively participating in Spaulding's Virtual Wellness Program which is a social environment in and of

itself. Therefore, the social stimulation during the six-week program may have had a direct impact on how stroke survivors assessed their social connections.

The only lifestyle medicine category that did not reflect a statistically significant change by the end of the six-week program was variety. This finding was interesting since variety was defined as the diversification of physical activities, nutrition and social connections. Meanwhile, investigations was defined as being curious and experimenting with new activities, vegetables, stress management techniques, and new social connections. Therefore, the statistically significant increase observed in investigations but not variety suggests that participants identified themselves as trying new healthy lifestyle habits but not diversifying those lifestyle habits. Also, the statistically significant increase in stroke survivor's physical activities, nutrition and social connections is particularly interesting because these results, when combined with the results from investigations and variety, suggest that stroke survivors experimented with new healthy lifestyle habits, enough to have significantly improved in each of those individual lifestyle medicine categories, but repeatedly engaged in the same healthy lifestyle activities. In other words, stroke survivors did not combine their adopted healthy lifestyle habits with other new healthy lifestyle habits or their previous healthy lifestyle habits.

Our findings emphasize the efficiency of Spaulding's Virtual Wellness Program's utilization of techniques such as increased self-monitoring and awareness of unhealthy lifestyle habits in order to motivate stroke survivors to adopt healthy lifestyle habits. These results are astounding given that Spaulding's Virtual Wellness Program had a short-term implementation of six-weeks. In addition, these results surface at a time where unhealthy lifestyle habits in stroke survivors has been repeatedly observed even after the first stroke event. Recent studies have

highlighted the need for effective rehabilitation programs especially those that are physician-initiated.

### Improvements

Although Spaulding's Virtual Wellness Program has proven to be effective at promoting healthy lifestyle changes in stroke survivors, there is still room for improvement. Firstly, the data could be more immense and extensive. Currently, Spaulding's Virtual Wellness Program relies on data collected from small cohorts which dramatizes the skewing of data that results in the presence of outliers. Also, the collection of data via program questionnaires poses concerns for external factors such as false reports by participants, uncertainty about the meaning of specific questions and unrealistic ratings of personal standing in various areas of lifestyle medicine. To combat these limitations, Spaulding's Virtual Wellness Program could collaborate with other hospitals performing the PAVING wellness program to evaluate larger numbers of subjects. Spaulding could also provide for validation of the PAVING Wellness Wheel to ensure that the data obtained is both useful and accurate. Furthermore, in addition to the PAVING Wellness Wheel, Spaulding could gather data through usage of the Perceived Stress Scale, Gratitude Scale, Physical Activity Scale, Sleep Scale and Well-Being Scales which are all validated data instruments. Moreover, Spaulding could expand on data collection methods by utilizing wearable devices that track activity. These devices would be a more accurate measure of physical activity. Lastly, Spaulding could pair participants with one another as a way to reinforce transparency, allow for greater accountability, and increased social connections.

Another limitation to Spaulding's Virtual Wellness Program relates to the short-term, six-week structure. This time period may be adequate for analyzing the adoption of healthy lifestyle habits, but it is not ideal for understanding the sustainability of those habits. In response to this



limitation, Spaulding could provide participants with an avenue for future connections with their physicians as a way to supply additional support, updates on recurrent programs, and permit post-program follow-ups on the participants current lifestyle habits. In addition, Spaulding could obtain an institutional review board (IRB) to perform prospective studies. These longitudinal cohort studies would authorize practitioners to analyze participants who vary in respect to certain factors in order to determine how those factors affect the frequency of a certain outcomes over an extended period of time.

Finally, we recognize that support for participants should not cease after the conclusion of their rehabilitation. Therefore, Spaulding's assistance should expand beyond the six-week's it allots to the Virtual Wellness Program. Some proposed additions would be a social platform for participant outreach as a means for reconnecting with other participants. In addition, Spaulding could provide a PAVING Alumni Network with monthly lectures to keep the group together while also reinforcing and broadening the knowledge they obtained while enrolled at Spaulding's Virtual Wellness Program.

#### Future Research

There are still many opportunities for future research on lifestyle medicine focused virtual rehabilitation programs as a tool for promoting the adoption of healthy lifestyle habits in stroke survivors. Due to the small sample sizes in current studies, there is a need for future studies which focus on large cohorts. Studies containing large cohorts can better reflect the efficacy of virtual stroke rehabilitation programs without the increased concerns related to the presence of potential outliers.

Also, clinical studies following stroke rehabilitation could be used to determine what physiological effects arise as a result of specific lifestyle changes. This type of future study

would educate physicians on the relationship between healthy lifestyle changes and the physiological effects they induce.

### Conclusion

In conclusion, Spaulding's Virtual Wellness Program, which is one of the first to evaluate the impact of virtual groups on stroke survivor's lifestyle habits and well-being, has proven to be feasible and helpful to patients. Our findings are beneficial to both practitioners and stroke survivors alike. As a direct benefit, these results provide a foundation for future practitioners in the stroke care and lifestyle medicine fields as well as future virtual wellness programs by providing a framework for better understanding what strategies can be taken to educate stroke survivors and prevent recurrent stroke. And indirectly, these results will provide practitioners with the necessary tools for creating more effective rehabilitation programs for stroke survivors with the potential for unlimited outreach through the utilization of a virtual platform. Collectively, these results will help decrease stroke recurrence and subsequently modulate mortality rates amongst stroke survivors.

In a time when people are social distancing during the COVID pandemic, and feeling lonely, programs like PAVING the Path to Wellness in a virtual format allowed patients to connect weekly and create a sense of belonging.

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