Abstract
A comprehensive review of the most prevalent health issues facing Americans today reveals that carrying excess weight and obesity are the causes of serious health and psychosocial issues. Of specific concern is the higher rate of obesity, heart disease, and diabetes amongst rural and older Americans as compared to their urban counterparts. Given that access to comprehensive weight loss programs is limited in rural areas, the subject work endeavors to demonstrate how telemedicine can address the prevalence of weight-related health problems amongst rural residents by producing a comprehensive web-based system through which individuals may access information and services essential to a healthy weight-loss program. A study of relevant literature reveals seven essential components of effective programs: nutrition, social groups, psychiatric and psychological counseling, exercise, education, data gathering/reporting, and medical monitoring. We shall focus upon the development of a website to incorporate all seven components in order that users may achieve long-term resulting wellness and health.

1. Introduction
Telemedicine is the use of medical information exchanged from one site to another via electronic communication to improve patients' health [10]. A manifestation of telemedicine is in the area of Tele-Weight management. Currently, the rate of obesity in the U.S. is 35.7 percent and growing rapidly [12]. Furthermore, as the baby boomer generation continues to age, a large demographic is moving to more rural areas upon retirement from the workplace [9]. Accordingly, there exists a need for a Tele-Weight management system accessible to those individuals who do not have ready access to many weight management facilities in their immediate vicinity.

A review of many prominent weight management products such as Jenny Craig [13] and Weight Watchers [17], as well a review of a recent study on internet based weight loss [3], reveals that there are seven essential elements crucial to lowering current obesity rates throughout the U.S.: (1) Nutrition, (2) Social Support Groups, (3) Psychiatric and Psychological Counseling, (4) Education, (5) Exercise, (6) Data Gathering/Reporting, and (7) Medical Monitoring. Furthermore, our research reveals that none of the prominent weight loss products on the market today offer a complete solution encompassing all seven of these elements.

2. Website System
Our solution is to provide a website (Fig1) that encompasses the seven prime facets of weight management to offer a 24/7, one-stop shop for weight management. By offering all these weight management dimensions under one comprehensive banner we can offer a complete Tele-Weight management system to all.

Figure1. Tele-Weight Website

2.1. System Design
This project design is based on the Model-View-Controller (MVC) architecture (Fig2). The Tele-Weight Management system provides a web-based graphical user interface. It contains features that allow users to input query information in order to search the database for weight management and obesity related information, monitor self-progress, and commence therapy sessions with medical practitioners, etc. The user interface passes the action input to the controller component, which is implemented in PHP, MySQL, HTML, and CSS. The controller component is designed to mediate the action input from the user interface, generate the search query or implement the event action, and retrieve or update the data.
to/from the database accordingly. This result is returned to the user interface. The controller component also allows the users to search, update, insert, and delete records in the database through the GUI (Graphical User Interface) developed for their use.

The following is an Entity Relationship Diagram (ERD), which is a visual illustration of the entities and their association to one another. It also depicts how the data is correlated to each other.

The diagram (Fig3) is comprised of the following – the rectangles represent the entities, the ovals represent the attributes of each entity, and the diamonds symbolize the relationships between entities.

Figure3. ERD Diagram

Figure2. Deployment Diagram

The application will accept a number of user inputs such as:
When a user:
1. Logs onto the system (as either a customer or patient);
2. Completion of a registration form;
3. Selects a GUI component to submit input or to browse through the application (the GUI component can be a search link or a submit button);
4. Adds a Tele-Weight Management package to the shopping cart;
5. Updates user profile;
6. Performs a search;
7. Requests to commence an online therapy session.

The outcome of the user inputs could be as follows based on the selected feature:
1. If the user logs in successfully, a welcome screen will be displayed;
2. When all the details of the registration form are completed properly, a registration confirmation screen will be displayed;
3. Displays search results to user or navigates user to a different screen based upon a specific selection;
4. Screen displays a list of package(s) added to the users' shopping cart;
5. Screen displays confirmation of successful updating of the user profile;
6. Search result screen is displayed;
7. An online therapy session with the chosen medical practitioner is commenced.
2.2. User Stories

The following user stories are incorporated as the requirements for the web site based on a survey conducted by the team:

1. As a user, I want to have a customized nutritional plan for weight control based on my personal weight problem, so that I have a better experience than my previous experience which revealed that one diet doesn’t always work for everybody.
2. As a user, I want to see a recipe section for healthy meals, so that a vegan such as I can follow a nutritional plan.
3. As a user, I would like to have a remote session with my nutritionist, so that I don’t have to travel twice a week to see her/him.
4. As a user, I want to be able to chat with other users, so that we can discuss a given topic related to our experience with the weight management process and find support.
5. As a user, I want to learn the correct way to perform exercises so that I can avoid any injuries.
6. As a user, I should be able to see a list of all the different types of therapies offered so that I can choose the appropriate one.
7. As a user, I should be able to see patients’ reviews so that I can have a better idea about the counseling program.

3. Seven Dimensions

To become healthier it is essential to focus on the following aspects to create a sustainable weight-loss or weight-management program.

3.1. Nutrition

Many common health problems can be prevented with a healthy diet [11]. Nutritionists are health professionals who advise on matters of food and its impact on health [18]. Although nutritionists insist that calorie intake can be reduced while controlling hunger, achieving and maintaining a healthy body weight can be challenging. A person must sustain a careful balance between the consumed calories and energy expended in order to maintain an ideal, healthy weight. The experts for weight control have developed many dietary strategies.

Diet is defined as a temporary and highly restrictive program of eating in order to lose weight [8]. We believe most diets fail because they consist of counting calories and depriving people of eating foods they are familiar with which ultimately leads to binge eating. Our program approaches a healthy way of living by including the consumption of fruits, vegetables and meat. What do these three food groups have in common? They are not processed. Processed foods and sugars are difficult for our bodies to breakdown, which leads us to store fat and gain weight. It is encouraged to eat as much as one wants until satisfied. Generally, people who cheat on diets tend to do so because they are still hungry. Our mission is to make a healthy plan that is easy to follow.

Tele-Weight will include a nutrition feature that contains online cooking classes where customers can learn how to prepare healthy meals (Fig 4). They can learn how to cook with a developed, step-by-step cooking lesson plan similar to those available to online culinary school students or, in the alternative, customers can just pick and choose which cooking videos to explore. Learning which food ingredients can positively affect their body and energy level can improve participants’ overall success with weight control programs.

Figure 4. An embedded video allows Users to view lessons on cooking.

Our web services will provide online nutritional counseling enabling the participant to contact a nutritionist who, based upon the user’s health condition, will provide advice regarding an appropriate diet plan. The same nutritionist can then follow the user’s progress from the day he/she starts using the services provided on the website until reaching the main goal.
emotionally happier and healthier than those with limited social contacts [2]. Some experts claim that weight problems may move through social networks, like families, friends, or co-workers. Therefore, building supportive social networks and healthy environments can help clients remain motivated throughout the process of resolving their weight problem [5]. According to Wright, people join online self-help groups for the same reason they join real-world ones. The support people receive through online interaction services is perceived to be as helpful as support provided by real-world contacts. The studies report that members of online self-help groups handle information about their medical condition better because of the online support they receive and that their emotional status improved as well [4]. These studies suggest that online groups do provide support and that customers have been positively affected by joining in such groups.

Today, there are weight-loss programs which have implemented the use of social group. “Weight Watchers” is a diet program which has recognized the need of a social support system to enable weight loss and touts its weekly meetings as a key cornerstone of the program [17]. Other examples of such diet programs are “eDiet”, “The 50 Million Pound Challenge”, and “The Biggest Loser Club”, all of which have online supportive social groups in common. We believe that providing the online social group as a part of our weight loss system is significant in assisting users with their weight loss journey. Collaborating regularly with a group provides members the chance to talk and connect with others. As with other social groups, participants can choose how much or how little they want to participate. Our program will provide forums, blogs (Fig8), and chat rooms where users can share stories, problems, and achievements. Given the nature of the web-based system, participants require only a computer, tablet or any kind of mobile device with an internet connection with which to sign-in to our online social groups and connect with other members at any time.

3.2. Social Groups

A number of social experiments conclude that people who have social support experience better mental and physical health. When people have more social contact, they are...
Figure 8. A Blog provides for another method of communication amongst the website’s user community.

Figure 9. Chat Room

In addition, a chat session feature allows users to communicate in real time. The chat can be used to communicate with medical practitioners as well as with other users. This synchronous method of communication allows for conversations to be held without the need for older conventional technology such as a phone (Fig 9).

3.3. Psychiatric and Psychological Counseling

Is there a strong connection between being overweight and mental health? Adults diagnosed with depression are 60% more likely to be obese than their non-depressed counterparts [7]. Accordingly, there is an undeniable correlation between stress and excess body fat. Furthermore, numerous studies also indicate that there is a direct relationship between anxiety disorders (namely, Post Traumatic Stress Disorder (PTSD)) and being overweight.

Overweight and obese people may feel discriminated against or insecure because of their weight. Discrimination usually begins during the early school years, when overweight students are not chosen for school teams in instances where physical activity is involved. Often, this discrimination continues into their adult life.

Our application provides counseling as a direct response to assist those suffering from mental illness due to their status as overweight or obese individuals. Our caring therapists and medical staff can help by assessing a patient's lifestyle and assisting each in attaining a proper understanding of that which can be done in order to achieve an established weight loss goal. Patients will have access to our medical experts 24/7 via the internet. In addition, our application facilitates group counseling sessions using online webcams where people can interact and share their experiences with each other.

Our goal is to perform interviews and provide motivational therapy to encourage patients to make necessary changes in their lifestyles. Allowing patients to share what they want to change can be far more effective than simply providing the instruction on what to change. Our belief is that people only change when they are ready to do so. Our counseling approach provides the assistance and support required in order for patients to approach their own weight goals by presenting them with the resources and educational programs required to do so.

3.4. Exercise

Physical exercise is any activity that enhances a person’s overall wellness. Studies show that sixty percent of American adults do not get the recommended amount of physical activity and over twenty-five percent of adults are not active at all. The most popular reasons for not exercising are: selection of an exercise one does not enjoy, attempting too much too soon, confusion, and expensive gym memberships [14]. Our program will include various types of exercises in an effort to provide clients with a workout program they can partake in which is both inexpensive and enjoyable. Our website will include instructional videos to teach clients the proper way to workout (Fig 10). These exercises will be designed such that they can be done at home, eliminating the need of any gym membership.

Figure 10. Videos teach users the correct way to perform an exercise.

Why should you Exercise?

Five benefits of regular physical activity are:

Exercise Controls Weight – exercising regulates a person’s body weight and prevents extreme gain or loss.
Prevents Health Conditions – regular physical exercise boosts the immune system and helps prevent diseases such as heart disease, Type 2 diabetes and obesity.
**Improves Mood** - Exercise improves mental health by preventing depression and promotes positive self-esteem. **Boosts Energy** - Physical activity delivers oxygen and nutrients to help the body work more efficiently. **Promotes Better Sleep** - Exercising helps one fall asleep faster and allows for a good night sleep.

### 3.5. Educational Programs

Educational programs play a vital role in increasing awareness of obesity as a major public health threat. Our main goals in offering educational programs through our application are:

1. To decrease the prevalence of excess weight and obesity
2. To reduce obesity-related diseases
3. To improve healthy eating and physical activity

Nutritional education programs are considered to be effective because they can enable individuals to improve their health and prevent diet-related chronic diseases from occurring. Dietary intervention programs for baby boomers and rural area populations are particularly needed because these groups suffer a larger proportion of diet-related chronic disease morbidity and mortality [1]. Our educational segment of the application focuses on educating people about all the programs that are helpful in achieving a healthy lifestyle.

These educational programs encourage information sharing among people trying to gain control of their weight. Also, these programs enhance health and wellness by educating various kinds of communities.

The key elements of our educational programs shall:

1. Increase awareness and knowledge about obesity as a significant public health risk;
2. Increase early recognition of overweight and/or excessive weight gain-related issues;
3. Enhance awareness of the psychological impact that overweight and obese people experience;
4. Improve supervision of those who are overweight or obese and those with obesity-related diseases;
5. Establish life-long healthy eating;
6. Promote a life-long physically active lifestyle;
7. Provide observational and program evaluations to prevent unwanted weight gain.

### 3.6. Data Gathering & Reporting

Our wellness program will include tools to help customers lose weight and become healthier. Our goal is to build a customized wellness plan for each customer. Due to the fact that individuals have various body types, health issues, food cravings, and diet requirements, we believe a customized program for each individual is required.

#### 3.6.1. BMI Calculator

The Body Mass Index (BMI) is an estimate of body fat; it is based upon height and weight. BMI results are used by doctors because patients with higher BMI’s are at risk for heart disease, high blood pressure and type 2 diabetes. The results of BMI are categorized as underweight, healthy weight, overweight, and obese (Fig11).

![BMI Calculator](image11)

#### 3.6.2. Calories burned from exercise

A calorie deficit is required for weight loss. This means one must burn more calories than he/she consumes. Our program will include a database that contains various exercises and the amount of calories a person can expect to burn. This will allow the customer to choose an exercise program that they enjoy and calculate how much energy they are expending as a result.

### 3.7. Medical Monitoring

Our medically supervised weight-loss and weight-control program fills an existing void in today's market. There exists no company which offers a medically-monitored weight-loss plan featuring all facets of the essential weight loss and weight management necessities (i.e., proper nutrition, exercise, medical monitoring). Our program will enable users to access health advice and view personal goal and real-time progress analysis under the purview of medical professionals from the comfort of the users' own homes or their local libraries. Our program enables individuals living in rural areas access to reliable medical information and monitoring regardless of a patient's physical geographic location.

The medically monitored elements of our program shall include the use of computer software, email, remote advice, and coaching in order to facilitate both professional monitoring of patient condition as well as the provision of remote guidance and support.

Given that there are a number of conditions medically known to accompany obesity, our program will enable participants to regularly monitor and access information as provided by
staffed professionals regarding risk factors associated with cholesterol levels, diabetes indices, blood pressure, heart disease markers, and stroke risk – all elements that generally affect the obese [15].

Our system will employ a video conferencing system which enables participants the ability to interface with medical practitioners, allowing the medical professional an opportunity to physically view the patient and provide real time assistance, support and analysis.

As a result of the employment of such technology, our system boasts an ability to immediately assess a program participant's immediate risk factors as related to weight, given that medical professionals will be able to physically view the participant as well as his/her health information simultaneously. As visual observation is an essential component of most physical examinations, the ability to discuss non-emergency conditions online with program participants may enable medical professionals to determine key patient information quickly and reduce potential misinterpretations that may be caused by language barriers or an inadvertent error committed by the program participant when completing the initial health questionnaire.

This split screen technology allows medical practitioners to discuss issues with the patient while simultaneously observing his/her body language and physical attributes. For example, a patient who feels fatigued may be advised that he should add additional protein to his/her diet. Yet, that same patient, when viewed through a video chat, may enable a medical professional to suspect an iron deficiency as a result of the yellow color of the patient's eyes.

It will, of course, be necessary that the medical communications are prefaced with a directive advising the program participant that the professional advice is provided as guidance and is not intended to be acted upon without follow-up consultation with the program participant's primary care physician.

4. Conclusion

Our application aims to improve obese and overweight patients’ health using electronic communication as the medium. The nutrition dimension of our application provides distinctive ways to maintain a healthy diet. The social support segment is designed to provide an interactive way to participate in a weight-control program. The psychiatric/psychological counseling element provides an innovative methodology for the provision of treatment to mentally affected overweight or obese individuals while also enabling the provision of preventive treatment to obese individuals among the baby boomer population and those located in rural areas. Through the exercise segment, we aim to provide our patients an enjoyable approach to weight-loss and weight-control activities. The educational programs dimension seeks to provide knowledge regarding various weight-control programs and ways to maintain a healthy lifestyle. The data gathering and reporting attribute will utilize select tools to help patients lose weight and become healthier by engaging them in customized wellness plans. Medical monitoring enables observation and identification of potential health risks and progress assessment throughout the program. All of the dimensions of our application are uniquely designed to pave the way for a healthy lifestyle for overweight and obese patients regardless of their individual demographic.

5. Future Work

The following components will be added to Version 2 of our website in order to enhance the effectiveness of our program.

5.1. Meal Tracker

Meal tracker is a component that enables customers to record their eating habits allowing them as well as nutritionists to track individual progress. Logging meals will enable the recognition of trends in an individual's eating habits and will also provide accountability of the user for their individual food choices. It is anticipated that the knowledge that one must record one's meals will likely lead the individual to make better choices when eating. A food log is a good reference point because a customer can access information for the specific week during which weight loss was sustained in order to view what meals were consumed. Research shows that keeping a food journal allows a person to double their weight loss efforts [16].

5.2. Weight Tracker

Everyone who has gained weight does not necessarily know when or why it happened. Weighing oneself regularly, allows one to measure his/her progress and adjust eating and exercise habits accordingly. Customers will enter their current weight on a weekly basis. We will provide our customers with a report on how much they have lost and how much more they have to lose in order to reach their goal.

5.3. Comprehensive Progress Report

Another future endeavor of our website will be to provide a reporting page that allows users to receive a compiled report of the measurements they have inputted (i.e. BMI, weight, blood pressure, hours exercised, etc.) the report will allow users to drill down to a particular day and view their statistics for that particular point in time (Fig12). Further analysis of reporting software would be required. Products such as SAP Crystal Reports could provide for a viable reporting solution.
5.4. Revenue Streams

In order to keep our website running and provide customers with our services, we will need to consider multiple revenue streams. The following are some sources that we are interested in.

Advertising Networks – the owner of the website would first sign-up with a company which provides advertising services, providing such with various code snippets to add to the website code which, in turn, produces relevant advertisements. Each time a person clicks on the link, the website owner earns a certain amount of money.

Affiliate Marketing – is when two or more companies connect with each other in order to promote a product or service. The website provider adds the products to their website in exchange for a commission. We could partner with local food delivery services and allow customers to order healthy meals from these companies.

Membership Fees – After reviewing similar nutritional websites, we believe that customers will easily pay $9.95 per month in order to use our premium services. These services include: video conferencing with a live medical practitioner, ability to chat with other members, an individualized meal plan, and access to record their daily meals.

References


