Abstract

This paper is intended to present (1) an idea for a new Telemedical product (2) a sample business plan for the product (3) an artifact which can be presented externally for research funding. Because the objective of this paper is to obtain research funding the scope of the business plan will not include a marketing and financial plan.

1. Executive Summary

Healthcare delivery is an increasing concern worldwide. With healthcare costs soaring by 7% each year companies and consumers alike are avidly searching for reductions in health care costs. US healthcare costs attributable to obesity will increase to $344 billion by 2018 accounting to 21% of direct healthcare spending. Obese employees cost employers 20 lost sick days per year [2]. Telemedical can significantly reduce both consumer and provider costs while extending both quality and range of services.

Telemedical technology enables a healthcare provider to connect more consistently with patients by eliminating traditional inhibitors such as scheduling, transportation, and specialty scarcity as well as taking competitive advantage of geographically priced solutions. Telemedical systems support the premise that proactively reaching out to people provides a means for getting them to change behavior in a way that will support a healthier lifestyle. According to the BMI metric, the percentage of the US population that is overweight or obese is among the highest in the world.

As the negative health effects of obesity receive more attention in the national health dialogue and increasing government-sponsored programs such as “Let’s Move!” emphasize the importance of systemic and lifestyle changes, weight management is becoming an increasingly important topic in the US. While the allure of losing weight quickly and with relatively little changes to one’s lifestyle will continue to attract some consumers, the general attitude toward weight loss in America is changing. Educational awareness campaigns, such as those sponsored by the hugely popular National Football League and First Lady Michelle Obama, the increased focus on healthy cooking and exercise in entertainment and rising gym membership rates all point to a shift in the general mentality. Americans are beginning to realize that short of surgery, there are no easy, overnight solutions to weight loss, but rather that fundamental lifestyle changes are a prerequisite.

Telemedical systems support the premise that proactively reaching out to people provides a means for getting them to change behavior in a way that will support a healthier lifestyle. According to the BMI metric, the percentage of the US population that is overweight or obese is among the highest in the world.

As the negative health effects of obesity receive more attention in the national health dialogue and increasing government-sponsored programs such as “Let’s Move!” emphasize the importance of systemic and lifestyle changes, weight management is becoming an increasingly important topic in the US. While the allure of losing weight quickly and with relatively little changes to one’s lifestyle will continue to attract some consumers, the general attitude toward weight loss in America is changing. Educational awareness campaigns, such as those sponsored by the hugely popular National Football League and First Lady Michelle Obama, the increased focus on healthy cooking and exercise in entertainment and rising gym membership rates all point to a shift in the general mentality. Americans are beginning to realize that short of surgery, there are no easy, overnight solutions to weight loss, but rather that fundamental lifestyle changes are a prerequisite.

2. Introduction and Background

Statistics show a dramatic rise of obese and overweight adults in the last decade in the USA making it the number two health concern. Weight control wellness requires daily monitoring of physiological data, direct patient feedback, coaching, and education. Telemedical directly addresses the geographical distance widening between wellness programs and patients through the application of technology; however technology also introduces the problem of digital literacy and effective multimodal communication.

Telemedical programs involve patient education, monitoring, communication, participation, social outreach, and participation.

According to a Euromonitor study “During the past 20 years there has been a dramatic increase in rates of obesity in the USA. By 2008, 37.2% of all Americans aged 15 and over were obese, while a further 42.2% were overweight. These figures imply that just over a fifth of Americans were not overweight [3].” An analysis of the consumer market indicates that approximately 20% - 25% of total US consumers are “fitness consumers”. It is reasonable to conclude that the 20% of Americans who are not overweight are also the same 20% of Americans who are fitness consumers. Adults in the 60+ age range represent one of the fastest growing segments of the fitness consumer market.

The Baby Boomer generation provides an optimum audience for Telemedical with 79 million turning 65 in 2011 and growing at a rate of 10,000 per day [4]. Baby Boomers present a rapidly aging in place population that will migrate from traditional urban concentration centers to a more rural center. Consumers in the rural market are ideal candidates for Telemedical applications.

Home Telemonitoring programs need to use advanced technology to reduce the problem of digital literacy. Wireless Telemonitoring devices - enable taking vital signs measurements at home and in remote locations - Bluetooth blood pressure and other vital signs can be taken and transmitted via cable or satellite television. Telemonitoring devices means a consulting physician can remotely monitor a patient health status and treat issues in real time.

3. Wellness Weight Control Market Assessment

The opportunities for companies to provide a better solution to the nation’s obesity epidemic continues to grow; nearly two thirds (68%) of American adults are obese and overweight and almost one-third (32%) of children and adolescents. According to Experian Simmons consumer panel data, almost 40% of adults — representing 85.5 million consumers — are watching their diet to either lose or maintain weight, a key factor that will continue to drive growth in the weight management market. The recession hit some weight management programs hard but fitness centers like Curves for Women are booming indicating a move to self-managed weight control programs. Weight managed programs such as Weight Watchers and Jenny Craig count 7% of adults as members and 0.5% of adults use online diet clubs. More American men than women are overweight or obese, according to the latest CDC statistics (72% vs. 64% in 2007-2008). Experian Simmons data show clearly that more women than men are trying to lose weight (36% of women vs. 21% of men) or maintain their weight (14% vs. less than 12%). In light of these discrepancies, the weight management industry increasingly is setting its sights on men.

In February 2010, the Obama Administration took on the nation’s obesity epidemic, announcing an ambitious initiative — already one year in the making — that aims to eliminate childhood obesity within a generation. Rather than focusing on the food side of the equation — a political quagmire due to special interest groups— the Administration wisely calls its new campaign, which was introduced by First Lady Michelle Obama, “Let’s Move!” (www.letsmove.gov) and focuses on consumer education, physical activity, and improved access to healthy foods. New York city mayor Michael Bloomberg took on the food industry head on – first targeting fast food - by making it a requirement to post calorie content on menus. Later, in 2012 he banned the sale of single serving jumbo drinks.

3.1 Weight Control Products

Although consumer health products have been widely advertised for decades, the growing desire among millions of American consumers for healthier living is beginning to create interest for these products – especially those from vitamins and dietary supplements and weight management – among content producers, not just advertising departments. The US recession continued to slow consumer spending on weight control but by 2011 the market began to show signs of renewed to expand (Figure 1 Weight Management Product Market Size).

A slew of new television programs premiered that focus on helping people design and follow healthy lifestyles. One topic that many of the new programs have centered around is the nation’s growing obesity epidemic. Programs such as The Biggest Loser, Extreme Makeover: Weight Loss Edition and Heavy are drawing strong ratings and highlighting the fact that over one-third of the US population is obese, according to the commonly used BMI metric. These programs are based around providing viewers with information on healthy weight loss and weight management tactics, in which significant attention is paid to nutrition and supplementation.

The Biggest Loser capitalized on its growing popularity as a source for education and encouragement in the country’s fight against obesity in 2011. The program, which features severely overweight contestants competing to lose the most weight, rolled out a line of meal replacement slimming products in April 2011. In mid-2011, the show’s production company NBC Universal announced that a joint product launch with the nation’s leading drugstore, Walgreen Co. The Biggest Loser line, available exclusively at Walgreen’s stores, features meal replacement shakes and bars, which are touted as a healthy alternative to fast food for busy consumers. The Biggest Loser franchise now includes the meal replacement slimming line, two weight-loss resorts, and a weight-loss cruise.

In 2011, for the seventh time in the last decade, sports nutrition led all US consumer health major categories in year-on-year retail value sales growth. Despite its history as a shadow industry, thought to thrive only among the most hardcore athletes and bodybuilders and tainted by a perception of accepting and even embracing untested and often illicit substances as common ingredients, sports nutrition has made remarkable strides in consumer awareness and bettering its reputation. As the fitness and wellness movements continue to grow, even embracing untested and often illicit substances as common ingredients, sports nutrition has made remarkable strides in consumer awareness and bettering its reputation.
3.1 Obesity Cause Factor

Increased Food Consumption – Americans daily food consumption has increased 30% since 1970. The Food Industry has deliberately created and marketed foods that are nutritionally unsound.

Not Enough Exercise – Americans watch more TV and live sedentary lives.

Socioeconomic Factors – people who live near clusters of fast food restaurants weight up to 12 pounds more than other individuals.

Genetics – early research suggests there may be genotype appropriate diets.

3.2 Exercise and Fitness Consumers

The fitness and exercise market is estimate at approximately 23% of adults in the USA which also collates to the percent of adults who are not overweight or obese. A 2007 study by Packaged Facts defines “Fit Consumers” as Simmons National Consumer Survey (NCS) respondents who report that they exercise at least three times a week and participates in at least one sport “every chance they get”. The principal primary research source is the fall 2006 Simmons National Consumer Survey (NCS). The 2007 Packaged Facts study places the Fit Consumer market at 49.7 million adults or 23 % of the adult population with 36 % over the age of 50. The percent of adults who consider themselves Fit Consumers follows a general trend of American society towards wellness, healthier diet and nutrition, and exercise who see a healthy lifestyle as the greatest promoter of medical well being. The Packaged Facts estimate of the Fit Consumer income will be $5 trillion by 2011. “Although Fit Consumers are less likely to be obese in clinical terms, they are more likely than other consumers to watch their diet in order to lose weight. Dieting to maintain weight also is more common among Fit Consumers. [P2]” Moreover, the percent of Fit Consumers is increasing due several reasons. Employers continue to seek ways to lower medical costs through wellness programs and providing access to health clubs both onsite and through benefit programs. Fit Consumers are also early and eager adaptors of fitness technology. With adults over 50 already accounting for 36 % of the Fit Consumer market Baby Boomers are rapidly swelling the ranks “Over the past 15 years, the defining characteristic of industry change has been the growth in the population of older health club members. In 2005, there were 8 million members over the age of 55, an increase of 314% over 1990.”Almost 10 % of the Baby Boomers belong to health clubs and that number is estimated to expand by 400,000 per year in the US alone [3].".

3.2.1 Top 2 Fitness clubs

3.2.1.1 Curves International, Inc.

(www.curves.com), a privately held company, is the largest and fastest growing fitness chain with approximately 10,000 franchised Curves for Women fitness center locations worldwide and four million members. The company claims its 30-minute workout can burn up to 500 calories; it also offers a new diet and nutritional plan called Curves Weight Management Plan as well as an online nutritional program called Curves Complete. Hoover’s estimates the company’s 2009 revenues at $2.0 billion.

3.2.1.2 24 Hour Fitness Worldwide, Inc.

(www.24hourfitness.com) owns more than 425 athletic clubs in 17 states and boasts more than three million members. Sales of the privately held chain were estimated by Forbes at $1.3 billion in 2007. The company enjoys strategic partnerships with major consumer brands and has partnered with NBC’s popular reality TV show, “The Biggest Loser,” for the last five seasons.

3.3 Weight Management Programs

A 2010 study by Packaged Foods the Weight Management consumer market to be 39 % of adults or 85.5 million consumers segmented into Weight Loss Consumers (WL) 28.0 % and Weight Management Consumers 12.9 % with some consumers overlapping. A 2009 report by the American Public Health Association estimates the health costs associated to obesity will increase to $344 billion by 2018 or 21 % of direct health care spending.

Individuals using a do-it-yourself program rely on their own judgment, group support, and products such as diet books and websites for advice. Fit consumers, who are also early adopters of technology, prefer following do-it-yourself programs.

Non-clinical programs include those offered through Weight Watchers International, Jenny Craig, Curves International, and other chains or independent providers that provide dietary counseling, exercise programs, and/or behavioral modification programs that do not include direct medical supervision to individuals. Some programs are geared toward weight loss only, while others are geared toward both weight loss and weight maintenance. Some programs require participants to use the program’s food or supplements.

Clinical programs generally are meant for those who are severely overweight or have medical problems. They are run by trained medical professionals who monitor patients for progress and possible side effects. These programs may or may not be commercially owned. Services are provided in a healthcare setting (such as a hospital, clinic or physician’s office), by licensed health professionals, such as physicians, nurses, dietitians or psychologists. In addition to offering services such as nutrition education, exercise programs, and behavior change therapy, clinical programs may also use other weight loss methods, including very low-calorie diets, prescription weight loss drugs, and bariatric surgery, to treat severely obese patients.

3.3.1 Top 3 Weight Management Programs

3.3.1.1 Weight Watchers International, Inc.

[NYSE: WW] (www.weightwatchers.com) is the world’s largest weight management program. Its services and products are built upon weight management plans comprising nutritional, exercise, and behavioral tools and approaches. In 2009, the Weight Watchers program generated revenues of $1.4 billion, a 9.1% decrease from 2008 revenues.

3.3.1.2 Jenny Craig, Inc.

(www.jenny Craig.com), a subsidiary of Nestle S.A., offers weight management programs that consist of prepackaged meals along with personalized consultations either through its roughly 600 Jenny Craig Centers nationwide, or at home through 247/ telephone lines. The company says its focus is not to keep individuals in the program forever, but to move them successfully through its program so that they develop long-term strategies for a healthy lifestyle.

3.3.1.3 Nutrisystem, Inc.

[NASDAQ: NTRI] (www.nutrisystem.com) sells monthly programs of pre-packaged meals (breakfasts, lunches, dinners, and desserts) that are delivered to consumers’ homes; several different programs are available for different dietary needs. It also sells its weight management programs through Costco, Sam’s Club and Wal-Mart, and in partnership with television-monitoring service. Despite expanded distribution, the soft economy led Nutrisystem’s revenues to drop 23.3 % in 2009, to $528 million, compared with $688 million the prior year.

3.4 Medical and Commercial Assessment

The medical community agrees that Telemedicine (eHealth, Telehealth, Telemedical, Telemonitoring) has yet to gain momentum in the domestic market [1]; this begs the questions (respective to Telemedicine) where is the medical community’s focus. The methodology employed in this study was (1) a sample population of top 400 Telemargical Google hits (2) the top 50 hits for the primary eight dimensions of Wellness through Weight Control. The study revealed the majority the focus is on professional studies or publicity (337 out of 400) as compared to any eHealth offering (63 out of 400) as shown in Figure 2 Breakdown of Focus.

Additional quantitative analysis this indicates this pattern of focus in fairly consistent across the dimensions with the exception of Psychiatric Treatment.

The two most telling characteristics related to eHealth and Weight Control is how the clinical community views eHealth and how the non-clinical community views eHealth. The medical community defines its offerings as medical care, primarily conducted by physicians. The nonmedical community views as a commercial venture (Weight Watchers, Jenny Craig, etc.). Neither community has created a holistic approach – a roadmap or lifestyle – as Wellness in the same manner a hospital offers complete Wellness solutions for standard medical care.

3.5 Pharmaceutical

The two primary weight loss drugs used today are sibutramine, marketed by Abbot Laboratories under the prescription brand name Meridia, and orlistat, marketed by Genentech USA in 120 mg capsules under the prescription brand name Xenical. Orlistat is also marketed by Merck/Medco as Slendrine in an over-the-counter 60 mg version with the brand name Alli. It increases the levels of brain chemicals that help reduce appetite. Orlistat/Xenical is in a new class of anti-obesity drugs known as lipase inhibitors. Lipase is the enzyme that breaks down dietary fat for use by the body.

Over-the-counter (OTC) diet aids include non-prescription diet pills, chewable “candies,” and herbal supplements. Other nonprescription diet aids typically make claims that they suppress appetite or increase metabolism. Many of these were eventually banned by the FDA or the banned active now contains a dietary supplement blend of B-complex vitamins, chromium, green tea extract and ginseng.

3.6 Top Weight 3 Control Pharmaceutical Firms

3.6.1 Herbalife Ltd.

[NYSE: HFL] (www.herbalife.com) is a holding company involved in multilevel marketing. Through Herbalife International, it manufactures and distributes weight control products including meal replacements, snacks, nutritional supplements, energy drinks, and even skincare products. Worldwide revenues approached $2.4 billion in 2009.

3.6.2 Slim-Fast Foods Co.

(www.slim-fast.com) markets ready-to-drink liquid weight loss formulas and meal bars. The company’s website offers free personalized menu and fitness plans, a weight loss calculator, advice from dietitians, and a community message board for dieters. A subsidiary of Unilever, Slim-Fast is estimated by Hoovers to have annual sales of approximately $700 million.
3.6.1.3 GlaxoSmithKline Plc

GSK is one of the world’s largest pharmaceutical companies. Its Consumer Healthcare division markets the OTC version of the fat-inhibiting drug orlistat under the brand name Alli (pronounced Ally) (www.myalli.com). Alli was launched in the U.S. market in June 2007. U.S. sales of Alli reached about $145 million in 2009, a 28% increase over $113 million in 2008.

3.7 Clinical and Non Clinical Programs

Clinical and non-clinical programs exist to address the 3 pillars (diet, exercise, behavior modification) combined with weight control. Some programs aggregate specific services into a system which is offered at a competitive price.

3.8 2009 Worldwide Retail Market

Kantar Information estimates the 2009 worldwide value of the weight loss and diet management market at $26.0 billion (Table 1 Market Size in $ Billion).

<table>
<thead>
<tr>
<th>Food &amp; Drink</th>
<th>Programs &amp; Services</th>
<th>Drugs</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.2</td>
<td>4.8</td>
<td>1.9</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 1 Market Size in $ Billion

Diet food and drinks - comprising weight loss bars and snacks, drinks, frozen meals, and diet desserts - are the largest category, with $18.2 billion (73% of the total) in worldwide sales. Next are weight loss programs and services at $4.8 billion (18%) worldwide. Weight loss drugs and natural therapies together account for $1.9 billion (about 7%), and surgical interventions generate approximately $500 million (2%) in worldwide revenues.

3.9 Consumer Habits

The Experian Simmons 2009 Survey shows that 83% of WL and WM consumers are trying to eat healthier vs. 64% of consumers. WL and WM consumers also more actively pursue the 3rd pillar of weight control behavior modification – to internalize eating habits. WL and WM consumers are more likely to shop on-line or at specialty food stores. WM and WL consumers also use the internet more often – 44% to 39% - than regular consumers.

3.10 Market Analysis Summary

Healthcare spending on obesity – diabetes, heart disease, gastric bypass surgery, etc. However, there is no established leader to integrate all three segments into a complete provider.

4 Product Architecture

4.1 Overview

The market for eHealth Wellness includes the Nutrition Guru, Diet Engine, Social Buddy, Eye on You, Personal Log, Teleconference, and Scorecard tools.

4.2 Features & Functionality

Nutrition is a cornerstone of weight control. eHealth Wellness through Weight Control proposes to integrate the three major market segments to address the three pillars of weight control into a single, unified product offering. The theme or message which exists in the medical community and public awareness is Wellness; the non clinical market is more narrowly focused on diet, a component of wellness. The leap from diet to wellness is accomplished through Telemedical – integrating medical practitioners into the wellness lifecycle. eHealth Wellness through Weight Control wellness lifecycle is delivered through the nine dimensions - Nutrition, Diet, Social Support, Psychiatric Treatment, Exercise, Education, Telemonitoring, Telehealth, and Analytics.

4.3 SWOT Analysis

Strengths

- Ideal in a rural setting
- Can be used 24 x 7
- Consultations, diagnostics, therapeutic
- A follow up tool.

Weaknesses

- Reliability of communication channels
- Technology and requires some technical expertise

Opportunities

- eHealth could help health in supplying quality, fast, and economical services to rural patients
- A way to attract more clients from isolated areas
- Promote additional services

Treats

- “Surgeon Syndrome” which is conservatism to all technologies
- Few clients are currently using eHealth; most eHealth systems are used for administration and education[10]

4.4 Multi-Dimensional Wellness

Diet is nutrition put into action – words put into deeds! eHealth Wellness through Weight Control offers self-help through online nutrition counseling with health care professionals, online cooking classes, articles about nutrition, nutrition facts, and literature about healthy food. Health care professionals will assist clients in developing nutrition plans that fit their medical condition and provide regular guidance to keep clients on track and help them learn to be accountable to achieve goals. There are no geographical boundaries - you can use it wherever you are and no age boundaries – people from all ages can find it effective. Nutrition Guru is an intelligent, web-enabled educational tool.

Diet is nutrition put into action – words put into deeds. eHealth Wellness through Weight Control offers many tools to help clients. First, an analysis is conducted through a guided question and answer session using the intelligent “Diet Engine” which will collect information about the client. For special needs, a qualified nutritionist will review the analysis with the client. Second, special needs clients can obtain individualized diet plans. The Diet Engine can also offer complete diet solutions based on a client health profile and preferences. Third, clients are assisted in putting their diet plan into action. The Nutrition Guru can assist clients in how to source ingredients for their diet and how to prepare meals.
Clients can also order prepared meals through the Web Store. Clients can interact with our physicians or with their own physicians for prescriptions or special devices when necessary.

**eHealth Wellness through Weight Control**’s “Eye on You” Bluetooth enabled devices collect blood pressure, pulse, blood oxygen, glucose, and weight measurements and are available to both the client and attending medical staff for Telemonitoring. Analytic Scorecards can provide instant feedback and track events.

In the research on weight control, it is well known that behavioral modification is an important component of weight loss. Short-term behavioral modification is usually accomplished by the attending (artificial) providers; however weight control is a long-term issue and more natural support systems have proved more effective than artificial support systems. Results of pilot projects show that over 40% of the sample identified family members as both the most and least helpful in attempts to control weight [4]. *eHealth Wellness through Weight Control* helps clients join existing social networks, find a weight control buddy, or create their own network through our “Social Network”. *eHealth Wellness through Weight Control’s* Social Network helps clients create a support network thought the use of blogs, social media, message board, and the Teleconference system. Using the Social Network, clients can find their own Diet Buddy and support groups. Clients can join and participate in live meetings without regard to physical location. If they have a family member or close friend who is not close proximity, they can form their own buddy system. Clients can also call the on call staff at any time for support or video conference with a health provider.

Obesity is the second largest public health concern in the United States today; often behind the obesity lays a binge eating disorder and under the binge eating disorder can lie additional issues requiring physiological treatment. Managed health care makes things worse by only addressing a single issue at one time [6]. *eHealth Wellness through Weight Control’s* Wellness Architecture tackles obesity by treating all three issues simultaneously. While the engaging the Nutrition Guru, Diet Engine, Social Buddy, Eye on You tools for the obesity, clients can engage psychologist directly using Teleconference to treat underlying disorders and conditions.

At its most basic, losing weight is about burning more calories than you consume. There are some simple rules for follow. To lose on pound, you must burn about 3,500 more calories than you consume. First, calculate your BMR using our Eye on You tools. Second, create an activity journal using your Personal Log. Third, record your activities and log your diet. Fourth, use our Scorecard Engine to determine your exercise programs. *eHealth Wellness through Weight Control’s* Wellness Architecture offers pre-build exercise routines including strength training, yoga, dance-based aerobics, cycling, and more. In addition, you can engage an exercise physiologist with our Teleconference tools to build an individualized routine. Continue to use the Eye on You to monitor and record your activities while using the Scorecard to track and interpret results.

### 4.3 Web and Dedicated Channel Client Interface Design

*Figure 5 eHealth Home Page*

The home page for eHealth Wellness through Weight Contol.com (Figure 5) allows for single sign-on for all users, both clients and practitioners alike. The map will dynamically filter content by state.
The User Portal (Figure 6) is the centerpiece of the user experience. The portal integrates the complete toolset available into an intuitive user experience. My eHealth Tools includes the Nutrition Guru, Diet Engine, Social Buddy, Eye on You, Personal Log, Teleconference, and Scorecard tools.

My Motivation and My Buddy provide behavior modification assistance. My Motivation is a multi-media reminder capable of video, photo, or text. My Buddy is an online chat session cable of text, video, and sound transmission and is integrated with Your Calendar to provide Meeting Meet-up Reminders.

My Personal Log (Figure 7) is a dashboard with plots your target, planned (projected progress) and actual weight.

My Meal Plan is an interactive planning tool which allows the user to plan their meals and exercise program and is integrated with Your Calendar and the Diet Engine (Figure 8).

The Diet Engine provides additional detail for each meal. My Meal Plan allows drill down functionality (Figure 9) showing both list and dashboard nutrition information. Nutrition information is provided from the Nutrition Guru tool. Drill though and dashboard technical functionality is provided from the Analytics Engine.

The Analytics Engine will also produce a Shopping List (Figure 10) that can be printed, saved as a PDF, or sent to a smart phone. Combined with the Telemedical functionality a physician or other practitioner and interact with the patient.
My Exercise Plan is integrated with the My eHealth Tool’s Exercise Center allowing the user to choose from the Exercise Center database of activities. User can select an exercise (Figure 8) for additional information and video demonstration.

Figure 11 Selection from the Exercise Center database

Once the user has planned their exercise program, they can record progress which can be viewed in My Exercise Plan (Figure 12).

Figure 12 My Weekly Fitness Routine

The Exercise Center has a detailed data entry point (Blue Tooth enabled for certain measures), BMI entry point, and a weight loss tracker (Figure 13).

Figure 13 Data Entry for Exercise Center

The final dashboard for tracking user progress is the Scorecard (Figure 14).

The Scorecard, driven by the Analytics Engine, is dynamic OLAP driven dashboards that can be present any metric (measure) for tracking.

4.4 Application Design

4.4.1 Overview

The technical architecture for a robust Telemedical system necessitates a three tier solution: presentation, web, and data/application (Figure 15).

Figure 15 Technical Architecture

The primary delivery channel is web-based – including web enable mobile devices; however, certain demographics – particularly infirm or elderly, can utilize a secondary deliver channel via interactive cable television channels access with a remote control (Figure 16).

Figure 16 Multi-Tier Product Architecture

The web and mobile based architecture is based primarily on a SOA model using JAVA, XML, and RDBMS technologies. The Java applications use dynamic content delivery services via a metadata storage model. HIPPA compliant Electronic Patient Record is enabled using standard RDBMS technologies with query and update capabilities via web browser. Mobile telemedicine is enabled by use of smart phones and tablet computers anywhere cellular service is available thus rendering the application web or television independent. Java and XML provide an extendable platform technology easily portable to various client, web, RDBMS, Network, and OS technologies. The portable architecture allows for easy paring with medical care providers for partnership for Telemedical dimensions (medical consultation, physiatrist care, etc) and as well as marketing channel partnerships (insurance providers, corporate wellness programs) and application partners (thus enabling the build vs. buy conversation of application development).

The Web Presentation layer consists of the web browser with client side extensions (JavaScript, etc). The cable TV interface is via an interactive dedicated channel. The middle layer, or Transmission layer, consists of wired cable for broadband and TV, satellite for mobile broadband and TV, public WI-FI, and cellular. The Application Layer hosts can either be physical or virtual hosts for both JAVA application and RDBMS servers. Server-side architecture eases maintenance and servicing costs does not require client side updates.

The flexible nature of the presentation layer allows different clinical scenarios such as in-hospital and remote Telediagnosis data analysis promoting in-hospital collaboration and remote Teleconsultation as well. An additional feature is the ability of the presentation tier to be used on emergency situations outside traditional healthcare centers and ensures continuous medical monitoring. By employing multi-lingual content management user interface language barriers can be reduced for both the client (patient) and healthcare provider and without re-development of application software. The Java Development Kit (JDK) and the Abstract Window Toolkit graphical APIs have been employed, in order to preserve backward compatibility with older browsers while ensuring portability on Java Virtual Machines with a limited set of APIs (e.g. JVM implemented on PDA devices).
on the selected device is generated by the server, the page template is stored in the metadata repository and populated with data and images retrieved from the data store. A Java Applet allows the user to rotate and zoom, etc.

The server side application architecture is Java Servlets (Apache Tomcat) which are called by the http (web) server to process incoming requests from client browsers. User access is via a content driven web portal which drives content (client applications vs. clinical). Application calls are then made to retrieve XML style sheets which then trigger JDBC database calls to both a content manager database for security privileges and data retrieval. Data is generalized to include data, documents, images, or videos.

The data tier contains data stores, related API, and non-content related application components. The data stores include (1) Content Manager for populating XML style sheets (2) BLOB favorable data store for storing images, video and text (3) LDAP for security management and (4) RDBMS for analytic data retrieval, customer management, and ERP solution for management the business. RDBMS and Business Intelligence software will manage query and memory caching. For application components not using a Business Intelligence component, the use stored procedures to promote performance will be utilized for read, update, delete, and select operations. See Figure 17 Internal Application Architecture.

### 4.5 Entity Relationship Diagram

The complete ERD is shown in Figure 17 Application ERD. An table identifier of F is a transaction log that could be used as fact tables in the data warehouse design, tables with table identifier of D are reference tables that could be used the data warehouse. Payment and Payment Method tables can be replaced with an API to a payment application. The Data Dictionary in sections 5.1 does not have the data warehouse table identifiers.

#### 4.5.1 Data Dictionary (Tables)

<table>
<thead>
<tr>
<th>Table Name</th>
<th>Table Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity</td>
<td>Servers as a linking table between subject areas requiring Video or Photo reference material. Also links customer table to all fact tables. Meals, Exercises, Social Meetups, Medical consultations, and related are considered activities. Activities are used in Scorecarding to contrast to Weight Changes.</td>
</tr>
<tr>
<td>Actors</td>
<td>Helper table for video subject area. Allows for prompting based on personality. For example, show all videos by Jane Fonda.</td>
</tr>
<tr>
<td>Customer</td>
<td>Main client table allows joining to outside databases and API. Also main subject area.</td>
</tr>
<tr>
<td>Event Types</td>
<td>Types of Events.</td>
</tr>
<tr>
<td>Event</td>
<td>Main table for Event subject area. Events can be any promotion. Also allow direct data entry by user; for example “vacation”. Scorecard can contrast effect of Event on Weight.</td>
</tr>
<tr>
<td>Exercise</td>
<td>Transaction table for logging all exercise activities.</td>
</tr>
<tr>
<td>Fee Schedules</td>
<td>Schedule of Fees for Events</td>
</tr>
<tr>
<td>Food Categories</td>
<td>Lookup or helper table for Food table, contains all types of Foods for nutrition information.</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Main table for Nutrition Guru.</td>
</tr>
<tr>
<td>Ingredients</td>
<td>Lookup table for Recipe Subject area.</td>
</tr>
<tr>
<td>Meal</td>
<td>Transaction table for meals consumed.</td>
</tr>
<tr>
<td>Meal Types</td>
<td>Lookup table for types of meals.</td>
</tr>
<tr>
<td>Meal</td>
<td>Main subject table for Diet Engine.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table Name</th>
<th>Table Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Profile</td>
<td>Contains customer physical profile. Used with Weight Log to monitor the customers physical dimensions over time. Measure the effect or weight loss/gain.</td>
</tr>
<tr>
<td>Payment Methods</td>
<td>Payment Methods for Events. Helper table for Payments.</td>
</tr>
<tr>
<td>Payments</td>
<td>Transaction table for Payments. API to accounting system.</td>
</tr>
<tr>
<td>Program Actor XREF</td>
<td>Cross Reference table for Video Programs and Actors used to reduce table sizes and increase performance.</td>
</tr>
<tr>
<td>Recipe</td>
<td>Main table of recipes. Allows direct query for building meals or creating shopping lists.</td>
</tr>
<tr>
<td>Recipe Ingredients</td>
<td>Helper table for recipe subject area. Reduces size of recipe table. Used in shopping list query.</td>
</tr>
<tr>
<td>Registration</td>
<td>Registration table for Events.</td>
</tr>
<tr>
<td>Resource Types</td>
<td>Helper table for resources.</td>
</tr>
<tr>
<td>Resources</td>
<td>Used to manage resource allocation for scheduling. Used as an API to management interface for provider schedules.</td>
</tr>
<tr>
<td>Schedule</td>
<td>Main schedule table for integrating Events and My Calendar.</td>
</tr>
<tr>
<td>Schedule Detail</td>
<td>Transaction detail table for recording schedules</td>
</tr>
<tr>
<td>Video</td>
<td>Lookup table for videos or photo names.</td>
</tr>
<tr>
<td>Video Program Types</td>
<td>Helper or Lookup table for video programs.</td>
</tr>
<tr>
<td>Video Programs</td>
<td>Main subject are table for all video offerings.</td>
</tr>
<tr>
<td>Weight</td>
<td>Transaction table for recording customer weight.</td>
</tr>
</tbody>
</table>

Table 3 Data Dictionary
4.5.2 Nutrition Guru

The Nutrition Guru module (Figure 18) is very simple composed of only three tables. It is presented as a major feature in the user interface but also supports Diet Engine and Recipe Engine Modules.

![Figure 18 Nutrition Guru Engine](image)

4.5.3 Diet Engine

The Diet Engine (Figure 19) module incorporates Nutrition, Recipe, and Meal components; the Analytic Engine generates shopping lists by queries the meals entered into the scheduling details tables with ingredients. The Diet Engine can also access videos for cooking classes through the Exercise Module.

![Figure 19 Diet Engine](image)

4.5.4 Personal Log

The Personal log is programatically driven not table driven. Log entries are written to the file system as text files and then reformatted for editing or viewing.

4.5.5 Exercise Engine

The Exercise Engine (Figure 20) maintains the primary relationship to the video modules although inserting the VideoID key into any other module video could be queried directly. The exercise table also contains an ActivityID key so activities which have been actualized can be recorded the Activity fact (history) table.

![Figure 20 Exercise Engine](image)

4.5.6 Analytics Engine

The Analytics Engine is a Cognos Business Intelligence 10.2 which also provides reports, scorecard, dashboard, and metrics manager. With the additional third party mapping products functionality can be extended to include “slice and dice” OLAP functionality on a geographical basis thus allowing for business partner, practitioner, and marketing research. Unlike the application engines which are programatically related, the Cognos Framework metadata allows for all database objects including session parameters, tables, views, functions and triggers to be dynamically allocated and related at runtime using dynamic SQL generation. Canned reports, scorecards, and dashboards are created with professional developer studios and SDK. There is an ad hoc query tool for the partner community (practitioner, business partner, marketing, finance, etc) but it is cost prohibitive for the general public (end users).

4.5.7 Eye on You

Eye on You should be further researched under Build or Buy Next Steps. Eye on You is dependent on hardware (Bluetooth enabled devices) for vital sign measurements; these devices are all couples with their own transmission and data storage containers which will need to be integrated and an API provided.

4.5.8 Social Buddy

Social Buddy is a chat engine and should be further researched under Build or Buy Next Steps.

4.5.9 Teleconference

Teleconference should be further researched under Build or Buy Next Steps.

4.5.10 My Calendar

The My Calendar Engine (Figure 21) will populate the Schedule Details table with event details can be pushed to a smart phone. The Analytic Engine reads from Schedule Details table and can be overlaid with Weight Loss to look for trends. It may also be used as an API to provider source systems for provider integration.

![Figure 21 My Calendar Engine](image)

4.5.11 Event

The Event Engine (Figure 22) will capture the event data and send it to the Schedule Details table into a Data Mart for analysis. The Event Engine reads from Schedule and can be overlaid with Weight Loss to look for trends. It may also be used as an API to provider source systems for provider integration.

![Figure 22 Event Engine](image)
The Event Engine (Figure 22) allows for any event to be loaded. It is integrated with Activity, Registration, Schedule and Payment modules. Payment Module can be replaced with an API to an existing eCommerce system.

4.6 Data Warehouse: Reporting and Analytics

The data warehouse should be implemented in two phases with data volume, application performance, and budget as the decision points. Users will essentially always query the application tables and the fact table patricians corresponding to their data. Session parameters can be used in place of physical partitioning. However practitioner or business partner research will execute full table scans which as volume increases will result in contention necessitating physical relocation of the RDBMS data store.

The application database is essentially a standard data warehouse application. Revolved many reads (queries) and record writes (inserts) but limited updates and deletes. This eliminates the need for separate RDBMS engines optimized for either transactions or data warehousing. The Data, Nutrition, and Exercise engines all query application tables and perform no insert, update, or delete operates typical of a transaction application. It is only once the user triggers an activity – selecting meal, event, or exercise – that a write event then triggers an insert to a Log (fact) table. Whenever a activity plan (from a form) is “realized” the application code calls a database trigger (function) and inserts a row into the fact table based on the data contained in the form.

This architecture design eliminates the need for traditional ETL functionality. A snowflake design – as opposed to a star schema – allows for smaller dimension tables, more nimble queries, and for greater flexibility in the application engine programming. For example, in the analytic snowflake for Meals, D_Tips is snowflake joined to D_Receive. D_Nutrician also contains TipID as a foreign key; this allows the application engine Nutrition Guru to query tips without including any recipe tables.

Meal Subject Area

The Meal Subject area (Figure 23) is a multi-fact snowflake design consisting of the Food and Meal fact tables and Recipe, Food, Customer and Meal Dimensions. The snowflake can easily be flattened into a star schema through the use of views or standard ETL process of loading separate tables to separate the application tables from a data warehouse.

Activity Subject Area

The Activity Subject Area (Figure 24) is a simple two fact table star schema. It is composed of the activity and weight fact table and customer, weight, exercise, meal, and event dimensions.

4.6.1 Weight Subject Area

The Weight Subject Area (Figure 25) is a star schema with a single Weight fact table with Customer and Profile dimensions. The My Profile table contains multiple numeric attributes of the Person entity however they are additive so they belong to a Dimension not a Fact. They are slowly changing (weight, age, etc.) with time so qualify as a Type 2 Slowly Changing Dimension.

4.7 Network & Server Design

DMZ contains Firewalls, Proxy, External Web Servers, etc. DMZ forwards requests to Web Server

Web Tier

Application Server (Tomcat)

Application Gateway

Web Server

Content Store

DB Broker

Content Manager

Storage Data

Video

Electronic Records

Analytic Engine

ER HIPPA Date Store

DMZ contains Firewalls, Proxy, External Web Servers, etc. DMZ forwards requests to Web Server

Figure 26 Internal Application Architecture

1. Standard DMZ is place between the internal network and application. DMZ will authorize access based on the IP and User Name. Control is then passed to Web Server.
2. ISAPI HTTP Web Server. Windows 2008 Server with ISAPI allows multiple threads with smaller RAM footprint than CGI. Web Server routes request to same host Application Gateway.
3. Application Gateway (Figure 26) sends incoming request to LDAP server for authorization and user profile. After LDAP return the Gateway Dispatcher forwards the request on an Application Server Dispatcher. The Application Server Dispatcher matches the request to and XML template and forwards the request to the Content Manager Service via in internal IP/TCP SOA Bus. The Content Manager Service retrieves the data from a RDBMS Content Store and populates the template and returns the request to the Application Server Dispatcher.
4. The Application Server Dispatcher then sends the request to the appropriate service for processing.
5. The JAVA Servlet processes the request and sends it back to the Application Server Dispatcher than then forwards the completed request to the end user via Web Tier.

4.8 Application Fault Tolerance and Scalability

The application is not re-disaster recovery enabled but it is required to be fault tolerant with no single point of failure and is required to both horizontally and vertically scalable for performance (Figure 27).

![Application Fault Tolerance Diagram]

Figure 27 Application Fault Tolerance

1. A load balancing router in the network tier round robin requests between multiple web servers. In the event of server failure, the router will cease to forward packets until the failure is resolved and the web host resumes SNMP contact.
2. All application dispatchers maintain IP routing tables with server roles and ranking.
3. Primary Application Server runs the Content Manager. Only 1 Content Manager can be active at one time and can use only one Content Store. In the event of a failure the secondary Content Manager will become active. Active Users will be dropped and will need to re-authorize.
4. RDBMS is responsible for maintaining parallel data store replication.
5. Application Servers running the internal SOA Bus can scale horizontally providing both fault tolerance and scalability.

5 Conclusion

Our market analysis was conducted by reviewing existing research and direct research has shown the existing Telemedical marketplace is heavily under-utilized in delivering medical solutions. Up to 85% of market activities are oriented towards Telemedical studies; the remaining 15% are largely involved in administration and education. The only substantial eHealth offerings to date are offered in the commercial market and are dominated by Weight Watchers and Jenny Craig neither of which are part of the Telemedicine community. eHealth Wellness through Weight Control’s unique integrated Wellness Architecture is positioned to establish itself as a dominant market leader. A question remains “Build or Buy” for product development. Alli.com has an interesting database of diet meals but difficult user interfaces and poor scoring – they could be an interesting partner. The combination of superior design (build), leveraging existing products (buy), with select partnerships in both the product market as well as distribution channel could produce a market leader with time to market in less than 2 years.

6 Next Steps

There are several main areas which need additional development over the course of 1 – 2 additional semesters. The scope of this project – develop a business case – for a Telemedical project is well suited for an interdisciplinary approach involving the Nursing and MBA faculties. First, the development of a marketing and financial plan is appropriate for the MBA program. Second, content development for the site and the program is well suited for the graduate nursing program. Third, this project is well suited for MBA-Nursing faculty if one exists; although traditional MBA marketing faculty is ideally suited to develop the “traditional” marketing plan components the nature of this project encourages a medical marketing approach involving medical channels that are largely untouched by straightforward MBA programs. Fourth, the technical development of a working prototype with a goal of 80% working functionality is ideal for the IT faculty. Fifth, branding and web site “user interface” design should be considered a joint effort between all three faculties and consideration should be given as to retaining design (as opposed to development) specialist – advertising or communication faculties may house these talent areas. Sixth, the MBA and IT teams should jointly research and estimate the Build vs. Buy components.

7 References

<table>
<thead>
<tr>
<th>Ref</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. St. Mark Vanderwerf, Ten Critical Steps for a Successful Telemedical</td>
<td>Fit Consumer in the US: Tapping into the Active Lifestyles of Sports and Fitness Participants, August 2007, Packaged Facts</td>
</tr>
<tr>
<td>Beth C. Marcoux, Leslie L. Trenknerb and Irwin M. Roseneck</td>
<td>Social Networks and Social Support in Weight Loss, 29/11/1999 *University of Michigan, University of Minnesota and *California State University at Long Beach *(U.S.A.)</td>
</tr>
</tbody>
</table>

8 Review of Literature

<table>
<thead>
<tr>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Future Costs of Obesity, November 2009, United Health Foundation</td>
</tr>
<tr>
<td>Beth C. Marcoux, Leslie L. Trenkner and Irwin M. Rosenstock</td>
</tr>
<tr>
<td>Chris Silva, Telemedicine coverage now mandated in Virginia, 04/19, 2010</td>
</tr>
<tr>
<td>Consumer Health in the US, April 2012, Euromonitor International</td>
</tr>
<tr>
<td>Fit Consumer in the US: Tapping into the Active Lifestyles of Sports and Fitness Participants, August 2007, Packaged Facts</td>
</tr>
<tr>
<td>Recent Telehealth News Relevant to Northeast – May 29, 2012</td>
</tr>
<tr>
<td>Simmons Market Research, Fall 2006</td>
</tr>
<tr>
<td>Bureau National Consumer Survey</td>
</tr>
<tr>
<td>Telehealth Business Models, March 2006, University of Alaska Statewide Health Programs</td>
</tr>
</tbody>
</table>