8-2002

Integrated Software System for the Collection and Evaluation of Wellness Information.

Rebecca Elizabeth Sweeney
East Tennessee State University

Integrated Software System for the Collection and Evaluation of Wellness Information

---

A thesis
presented to
the faculty of the Department of Computer and Information Science
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Master of Science in Computer and Information Science

---

by
Rebecca Sweeney
August 2002

Dr. Terry Countermine, Chair
Dr. Gordon Bailes
Ruth Verhegge

Keywords: Wellness, Assessment, Health, Health System, Computer

ABSTRACT

Integrated Software System for the Collection and Evaluation of Wellness Information

by

Rebecca Sweeney

There is an absence of a complete, easy to use, software system that can evaluate all areas of wellness. Although there are software programs and equipment available to examine certain aspects of wellness, they are incomplete. The solution to the difficulties of assessing wellness is the design and development of a software system that can be used to collect and evaluate wellness information. The system allows for complete reporting as it entails the six major components to wellness: demographics, body composition, lab work, nutritional intake, physical activity, and body measures. The system allows for ease of use by providing a user-friendly environment that provides multiple methods of data entry and utilizes existing software and equipment. A complete and easy to use integrated system will promote the process of evaluating wellness and improving the user's overall health.

CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER 1

INTRODUCTION

The National Wellness Institute defines wellness to be an active process of becoming aware of and making choices toward a more successful existence (National Wellness Institute, website, s.v. "wellness"). In the definition of wellness, several key words are of a great deal of importance in one's goal for wellness. Wellness is defined as an active process, meaning there is no probability of reaching a point in which further improvement is impossible. Wellness is a life-long process. The act of becoming aware involves a continuous effort to seek out more information on how to improve one's wellness. With this information, choices are to be made once a variety of options have been considered. The last key words to focus on in the definition of wellness are a successful existence. This is determined to be the collection of achievements in the overall improvement in life.

As expressed in the National Wellness Institute's definition of wellness, it is an on-going process. There is no well-defined stopping point in which one person can say he or she has reached his or her potential and achieved perfect wellness. The evaluation and improvement of wellness needs to be lifelong habit. Due to the ever-changing, hectic schedules in which people must operate, evaluating and improving wellness is not an easy task. There are numerous aspects of a person's life that must be considered in order to provide an accurate evaluation and provide options for improving the quality of life. With the methodology that is available today, this is a cumbersome process. There is no one central method of evaluating wellness. Methods available focus primarily on one specific task such as evaluating nutrition, physical exercise, or health history. The information required to evaluate wellness includes numerous aspects, such as: the condition of the physical body based on what is consumed in order for it to function and what is consumed in excess; the mental aspect of one's life and one's habits; and past medical history. Due to the hassle of collecting the information needed through various sources and

evaluating the information as a whole, a majority of people do nothing to improve their overall existence. Society has become dependent upon expediency.

The hypothesis of this project maintains that with one central method for the collection and evaluation of wellness information, the number of individuals who will make improving wellness a long-term goal will greatly improve. People do not have time to go to various sources to collect data or be evaluated. People also do not have the time or ability to evaluate the quality of their wellness based on the information gathered. The goal of this project is to provide an integrated system that will provide people with a time effective and accurate analysis of their wellness based on current and past information. This will, therefore, assist in the improvement of the quality of life.

CHAPTER 2

PROJECT DESCRIPTION AND MOTIVATION

Problem

There are two major problems that this project will attempt to resolve. The first problem is that no integrated wellness reporting software system is available today. This is not to say that wellness is not a major issue in today's society. The focus on wellness can be seen in the number of analysis systems available. Many of these systems are discussed in Chapter 3. The problem with the existing analysis systems is that each one only encompasses one area of a person's health. For example, bioelectric impedence will only give results pertaining to body composition. The nutritional analysis software primarily deals with food intake. An integrated system that will allow for the combining of the various data areas needs to be available in order to provide an individual with a comprehensive wellness report.

The second major problem to resolve is the lack of participation in evaluating wellness. This is either a result of the inability to understand evaluations, such as a lab analysis of blood, or the currently time-consuming process of obtaining and evaluating data through several sources. In a society driven by fast service and small lead times, a quick, easy, and accurate system needs to be provided.

Benefits

Although there are problems in the current process of evaluating wellness, the question rises as to whether the problem warrants the development of an integrated system. After examining both the short term and long-term impact of a solution, the possible benefits from an integrated system are extensive. They range from assisting in providing a snapshot wellness profile for an individual; to providing data for a large-scale medical study; to potentially reducing medical costs.

Preventive medicine is an area that has become of great importance in today's society. In the past, emphasis was on traditional medicine, which refers to treating an illness upon the physical signs of its existence. A shift has occurred from traditional medicine to that of preventive medicine, which refers to taking actions that may prevent an illness from occurring. A major reason for this shift is increasing health care costs (Zitlow 2001). This is becoming an increasingly difficult burden for individuals and/or companies.

The focus on preventive medicine can be seen through the behavior of companies and individuals. Many companies are now offering some form of wellness activity or wellness program. Multitudes of companies offer programs such as smoking cessation. Individuals are also placing a great deal of focus on preventive medicine. The number of memberships to health clubs is on the rise, health foods are becoming available in fast food restaurants, and joggers can be seen on a daily basis. Employers and individuals are both realizing that a number of illnesses and deaths are related to lifestyle behaviors concerning what people eat, drink, and do.

The impact of an integrated wellness system on preventive medicine is a factor that justifies the development of this project. One method of preventing illness before it occurs is to examine the past history of an individual. For example, consider the risk of developing lung cancer. The amount a person smokes and the type of tobacco smoked will affect the probability of cancer or some pulmonary disease occurring. The ability to perform a trend analysis on smoking exposure will provide medical professionals with the information to determine the risk and probability of developing lung disease. Also, many people do not truly comprehend the amount of smoke to which they are being exposed. Many people, if not most, do not keep daily journals of how many cigarettes were smoked. Having a program that allows for a long-term analysis may encourage a person to either reduce the amount of exposure to tobacco products or eliminate it. This same principle can be applied to areas such as cardiovascular conditioning. By tracking activity, a person will have the ability to witness the impact that regular exercise plays in his or her overall wellness, and provide motivation to continue an exercise program.

While preventive medicine is a major factor in justifying this type of project, there are many other benefits to consider. One of the benefits is the impact an integrated wellness program may have on an individual with a medical condition. In cases such as diabetes, obesity, eating disorders, and heart conditions, the ability to monitor the condition of the individual is very valuable. Although examinations by physicians are usually completed at six-month to twelve-month intervals, the ability to evaluate one's condition between these visits is beneficial. Also, the ability to provide a physician with daily or monthly wellness reports will only improve treatment. By tracking the history of the condition, and the impact certain behaviors or physical changes have made on the condition, the generated reports will allow for future recommendations to be based on fact instead of educated guesses or assumptions. For example, an individual with diabetes needs to track his or her sugar levels. The ability to associate certain food intakes with sugar levels will provide a subject with physical evidence as to how his or her eating habits affect his or her overall health. The same type of procedure will help a subject suffering from cardiovascular disease. Patients suffering from cardiovascular disease are prescribed changes in food consumption and are placed on a regular exercise regiment. The ability to track improvement and/or the impact of certain behaviors can only be beneficial in these cases.

The last major benefit that may be obtained from an integrated system is the ability to provide an individual with motivation. Simply said, people do a majority of the things they do in order to achieve something they do not possess. This principle is a major factor for those who attempt to start a regular exercise regiment or a change in food consumption. The dropout rate for a regular exercise program is high. Unfortunately, many people expect a major weight change or body composition change within a short amount of time after the start of an exercise or diet program. A healthy exercise program will not produce these types of expected results in a short period of time. Significant changes should be a long-term goal. A benefit from implementing the proposed integrated wellness program is that it will provide an individual with

the ability to observe short-term improvements. The theory that justifies this project is that an individual will continue an exercise program if the exercise program is impacting and improving such areas as body weight and cholesterol levels.

Outline of Solution

The goal of the project is to develop an integrated system that will allow for the assessment of wellness for an individual. It is imperative that the resulting wellness system is complete. Because the purpose of this program is to provide wellness reporting that encompasses all factors, unlike the software and/or forms that are available today, a complete system that includes all areas is part of the project plan. The system developed with this project needs to be easy to use, easy to understand, and easy to input the required data. As discussed in the introduction chapter, time is a resource that most individuals do not have in excess. As a result, the majority of the information required by the system, such as nutritional analysis and body composition, will have both the capabilities of keyboard entry and file upload. In addition, it will be a goal that the finished project be designed with a familiar Windows interface. This is based on the concept that people are more apt to work on a system that feels familiar to them. The last major consideration, as with all software development, is the issue of further expandability of functions. With the documentation of this project, this should be a feasible goal.

CHAPTER 3

LITERATURE AND EQUIPMENT REVIEW

Several software programs and pieces of equipment were reviewed as part of this project. As discussed in Chapter 2, there are several software packages available for the analysis of individual aspects of wellness. Although they cannot provide a complete wellness evaluation, they do provide insight into one particular area. It would be beneficial to the project to utilize these components and integrate them into the proposed wellness system.

Nutritional Analysis Software

Nutrition can be defined in several ways. Webster defines nutrition as the act or process of nourishing or being nourished. Webster also defines nutrition as the sum of the processes by which an animal or plant takes in and uses food substances (Webster's Dictionary, 10th ed., s.v., "nutrition"). Another definition states nutrition as the involvement of various chemicals and physiological activities that transform food elements into body elements (Oxford English Dictionary, 14th ed., s.v. "nutrition"). Regardless of the specific definition, nutrition has been established as a vital aspect in the functioning of the human body. Essentially, nutrition defines the fuel, and the composition of that fuel, that is used to run a human body.

A focus on nutrition has existed for a great deal of time. As a result, several software programs have been developed to analyze the nutritional value obtained from the foods a person consumes. A majority of these software packages are well tested and could be of benefit to this project. Instead of repeating a process that has become refined over time, it is the goal of this project to use an existing package to provide the nutritional information required.

A review of several of the nutritional analysis programs currently available was completed. An evaluation was made with several factors taken into consideration. A major factor during the evaluation was whether the program provided the information necessary for the

nutritional aspect of the project. Another factor considered was the accuracy of the derived information. This dealt with how and with what information the output was derived. The ease and user friendliness of the software was also considered. A major question to answer was: How easy is the software to use for a person who is not a computer or nutrition expert? The purpose of this project is to reduce the difficulty in assessing wellness that is now being encountered. A complicated software program would only make individuals more reluctant. Because the wellness program presented in this paper will require information derived from a nutritional software package, a concern was placed on how the software generates reports and how easily the derived information can interface with another software package. The last, and in some cases most important issue, was the cost of the nutritional software. This type of software will not be beneficial to end-users if they cannot comfortably afford it.

The review of the nutrition software programs was comprised of a comparison that had already been completed that included a simulated test run of the software. The comparison used for this review was completed by the *Journal of the American Dietetic Association* in August 1995. The test run of the software was completed for those software packages that made demonstration modules available. The following review addresses the questions previously stated as major concerns.

The first software to evaluate is the Food Processor that was chosen for this project. This software was developed by ESHA Research. This program received an excellent rating for the amount of data included in its database. Overall, only 0.3% of the data entered was missing from the database used by this program to calculate results (Lee et al. 1995). The Food Processor allowed for the entry of name brand foods which, in a world where the popularity of fast food is continually on the rise, is a great benefit. With the amount of data available, and the availability of name brand foods, the accuracy of the Food Processor received the highest ranking. In order to report the findings of the nutritional analysis, Food Processor provided both an onscreen, graphic report and the capabilities of copying the report into the windows clipboard. The

availability of readable information will greatly improve the interfacing between the nutritional software and the proposed software developed by this project. The user friendliness of the Food Processor software was also rated highly. The program is windows based, therefore, providing the user with a familiar feel of operation. The task of searching for foods is also accommodating. A demonstration version of this software is available and verified the findings from the *Journal of the American Dietetic Association* report (Lee et al. 1995). As a final factor, the cost of software was comparable to the others involved in this review.

The second software to review is Nutritionist IV. This software was developed by First Data Bank. The program received an excellent rating for the amount of data included in its database, although lower in rank than the Food Processor. In comparison, 5.6% of the data entered was missing from this database as compared to the 0.3% with the Food Processor (Lee et al. 1995). In order to report the findings of the nutritional analysis, Nutritionist IV provided both a visual report and an ASCII data file that was a requirement of this project. The user interface did not provide a friendly environment. Nutritional analysis programs require a user to enter the types of foods consumed during the day. The task of entering these into the software becomes difficult without a good editor. Although the system is windows based, which provides a user with a familiar feel in operation; the difficulties in entering foods resulted in the Nutritionist IV having a lower rank than that of the Food Processor for usability (Lee et al. 1995). No demonstration version of the software was available and, therefore, no additional analysis could be performed other than the above-mentioned report.

The final software program to review is the Nutritional Software Library IV. This software was developed by Computrition Incorporated. The program received a good rating for the amount of data used for its database and its accuracy in computation. Approximately 15% of the data entered was missing from the database (Lee et al. 1995). This is a high percentage as compared to the Food Processor and Nutritionist IV. With such a high data discrepancy, the Nutritional Software Library does not provide a highly reliable source. This software does

provide an ASCII data file that was a requirement for the nutritional software. The Software Library received a poor rating for user friendliness (Lee et al. 1995). It was described as being difficult to navigate, which would only result in user reluctance to the system. Difficulties in editing food consumption also occurred. No demonstration version of the software was available.

Body Composition Evaluation

The major components of the human body are fat, muscle, and bone. The percentage of which of these a body is made up is important in the overall assessment of wellness. Standard height and weight charts cannot provide an accurate statement about an individual's health relating to weight. For example, a person may weigh more than the average based on the height and weight standards but still be considered to have a healthy body fat percentage. The excess weight could be additional muscle mass. As a result of the possibility of inaccurately assessing wellness based on weight alone, scientific measurement in the evaluation of body composition is required for this project. Three methods of completing this task were considered. They include bioelectric impedence, hydrostatic weighing, and skinfold measuring. The selected method of measurement is bioelectric impedence.

Bioelectric impedence involves the use of a small electric current to assess body composition. Electrodes are attached to an individual's hands and feet. A mild and painless electric current is then passed through the body. The time it takes the electric current to course from the hands to the feet is recorded. The information gathered during this process is then used to evaluate the make-up of the body. For example, because lean tissue contains a high level of water, the electric current will travel more quickly through a person with greater lean body mass. The advantage of bioelectric impedence is that it is a fast, easy, and painless method that is accurate when done properly. The training needed for the examiners is minimal. In addition, most equipment used for bioelectric impedence has the ability to output the results to a file which

in turn will reduce the amount of data entry into the proposed wellness program. The disadvantage of bioelectric impedence is the state a subject needs to be in during the test. The level of hydration must be controlled by not eating or drinking four hours before the test. The equipment is also costly.

Hydrostatic weighing is the most accurate method of determining body composition. This process of evaluating body composition requires the use of an underwater laboratory. The person being evaluated is seated in a chair that is attached to a scale suspended over a special tank. The subject must exhale completely and is then submerged underwater. The examiner of the test records the subject's weight on the scale. The comparison of the weight underwater and the weight taken normally can be used to evaluate body composition. The major advantage of hydrostatic weighing is the high rate of accuracy, validity, and reliability. Although accuracy is a valuable advantage, there are several disadvantages with this type of test that make it unfavorable for this project. Hydrostatic weighing is not highly available. This is an important factor in this project because the purpose is to make the process of evaluating wellness simple. The equipment required for the process is expensive. In addition, a highly trained technician is mandatory. The final disadvantage is that those who have taken the test expressed being uncomfortable in the water and having difficulty completely exhaling underwater. Due to the numerous disadvantages and the impact they have on the goal of this project, hydrostatic weighing was rejected for evaluating body composition for this project.

The last option considered in evaluating body composition was skinfold measuring. This process of evaluating body composition involves using calipers to measure the skin and subcutaneous fat thickness at selected sites. This has been a widely used process that produces accurate results when properly performed. The advantages to this method include the low cost of the equipment and its accuracy if used correctly. The main disadvantage is the amount of error that is probable with the use of the calipers. A great deal of time and practice is

required in order to provide proper training for those administering the test. If the same technique is not used in all tested areas, the results will be invalid.

Activity Monitoring

The activity level of an individual is an important area of study for the project. The activity level of a person plays a major impact in overall health. Increased physical activity is commonly recommended for those suffering from heart conditions. As a result, the requirement to know the physical activity level a person maintains is very important. Questions exist as to whether a person lives a sedentary lifestyle, a moderately active lifestyle, or a highly active lifestyle. When asked the question of what level of physical activity people lead, many have difficulties in accurately answering the question. The need for an activity monitor, which provides physical evidence as to activity levels, is substantial.

The equipment selected for an activity monitor is the Tritrac-R3D, manufactured by Reining International. Only one other activity monitoring system was considered, the Caltrac system. Caltrac is a simple monitoring device and is essentially a prelude to the Tritrac. As a result, it was not considered to be an activity monitoring system for this project and Tritrac was selected. There are essentially two basic components to the Tritrac system: the hardware that is worn by an individual and the software that downloads and derives conclusions based on the data collected. The hardware is a monitor that is similar in size to pagers. Once initialized with the use of the software program, the monitor can be worn in the same fashion as a pager and will collect data until the collected data are downloaded to the software. The software will run on a Windows-based system. Although it is menu driven, it is very self-explanatory in the navigation of the menus.

The Tritrac monitor can observe a subject's activity by recording the motion level at user-selected intervals. These intervals may range from one to fifteen minutes, depending on the desire of the individual. With a new battery, a Tritrac unit may record for up to sixty days. By

taking readings on intervals at a substantial duration of time, accurate activity behaviors can be determined. The interval time is initialized with the use of the software program. Once the data have been collected, the monitor communicates with a PC in a similar fashion as a printer communicates with a PC. A cable runs from the monitor into the printer port on the computer. Once hooked-up and with minor menu options selected, the data from the monitor are downloaded into the software program. During this process, the data are removed from the monitor, thereby allowing the monitor to be used in another session.

The Tritrac software is a menu driven program. The menu options are limited to only those needed to acquire the data from the monitor and are self-explanatory in nature. Settings for the monitor, such as interval lengths and information specific to the individual wearing the unit, are initialized within the software program. With the communication between the hardware and software being initiated with a cable, the software will initialize the unit. No buttons or settings changes are available on the monitor itself. After the collection of the data from the monitoring unit, calculations pertaining to the activity of the individual are made. A user may view the results on screen or have an ASCII file generated.

There are several advantages to this system: one being the ability of ASCII file generation. As discussed at many points, simplicity on the user's side is of major importance. With the generated file, a user will not have to input the data into the proposed wellness program. Only the file name will need to be provided by the user. Another advantage of this system is the ability to portray the activity level of an individual. In most cases, a person cannot realistically estimate his or her physical activity. The questions to address are: who has the capability of observing his or her behaviors throughout the day? Can most individuals accurately detail the amount of walking he or she completes during work hours? Although organized exercise activities are much easier to evaluate, normal activity levels during the day are not.

CHAPTER 4

DEVELOPMENT OF THE INTEGRATED WELLNESS SYSTEM

The integrated system for wellness evaluation developed by this project consists of two major components, the wellness database and a driver program. The database is responsible for maintaining the records of all user accounts. The database was implemented with Microsoft Access 2000. Access creates relational databases that are comprised of tables and the relationships between those tables. The wellness database consists of forty-six tables containing over four hundred data points. The driver program is responsible for requesting data from a user, saving the data to the database based on the rules governed by the database, and displaying the data in a report format. The driver program was developed by Microsoft Visual C++. The program consists of forty-seven dialog boxes for data entry and nine reports for generation. There are minor components included within the system. The Food Processor software and Health Habits and History software are used for the analysis of nutritional intake. The Tri-Trac activity monitor is used for the analysis of caloric expenditure. These components were presented in Chapter 3.

This chapter discusses the two major components of the integrated wellness system, the database and the driver program. Appendix A contains the information used to generate the database and the design of the database itself. Appendix B contains snapshots from the driver program and the reports generated.

Database Design

The database designed for the wellness system is comprised of forty-six tables containing over four hundred data points. The development of the database involved evaluating the data required for a complete wellness system, creating the conceptual model ER diagram, and implementing the conceptual model into a relational database.

Evaluation of Data Required

The first phase of the database development was to determine what information is needed to provide a complete wellness report. Because this is where other software programs have failed in the past, close attention was paid to this step of database development. Members of the faculty of the Applied Human Science Department of East Tennessee State University were consulted during this phase. After discussions with the faculty, and completing the software and equipment review discussed in Chapter 3, six major information categories were determined: demographics, body composition, lab work, nutrition, physical activity, and body measures.

The information to be contained within each information category was also defined during this step of database development. Several sources were consulted during this process. The primary source for data points was forms. Forms related to the various information categories were collected. Appendix A, pages 35-36, contains several of the forms evaluated during this process. Software programs were consulted for data points. Many of the data points contained within the database were generated from the software evaluated in Chapter 3. Equipment output was also evaluated for data points. Information generated from equipment such as the Tri-Trac was used for the generation of desired data points.

Once a complete list of desired data was generated, several questions were raised in order to fine-tune the data points to be maintained in the wellness program. Can there be multiple values of the same data at any given point in time? Is a historical trending of the data values required? Is the information easily available? How will the data be stored? Do the data need to be date stamped? A complete list of the data points generated and the desired characteristics of the data can be examined in Appendix A, pages 37-46.

Creation of the Conceptual Model

The information generated from the process of data development was then placed into a conceptual model, the Entity Relationship Model. The use of the ER model forces a designer to

consider the database as a whole. Any information conflicts can be identified when creating this model. The development of the model also assists in later design phases. Appendix A, pages 47-56 contain the ER model designed for this project.

Implementation of the Conceptual Model to the Relational Database

The final phase of the development of the database was to implement the conceptual ER model into a usable database. A relational database was selected for the wellness system. Data contained within a relational database is stored in tables.

The implementation of the relational database involved creating a table for every entity in the ER model and creating either a table or a foreign key within an existing table for every relationship. All rules such as functional dependency were applied during the process of converting the conceptual model into a relational database. The tables generated during this phase of the database development can be found in Appendix A, page 57.

Wellness Information Categories

Six information categories were developed during the database design phase. The following details both a description of the data listed under each category and how the information is maintained within the database.

There are five major components included in the demographics information category: general information, illnesses, family history, behavior patterns, and substance usage. General information pertains to such static information as name, address, phone number, birth date, and gender. Illnesses pertain to both chronic and acute diseases suffered by the user. Family history pertains to chronic diseases suffered by immediate family members. Behavior patterns pertain to such aspects of life as stress, sleep, and diet. Substance usage pertains to usage of tobacco, alcohol, and over-the-counter medications. Only current values are maintained in the database

for demographics. The information category demographics is comprised of twenty-six tables in the relational database. Approximately ninety-two data points are contained within those tables.

The body composition information category pertains to the values derived from a bioelectric impedence test. This testing procedure is discussed in Chapter 3. The information generated from the exam will provide the general make-up of a user's body. Information such as how much of the body weight is comprised of lean mass and how much is comprised of water is included in body composition category. The wellness database stores current values for body composition and stores all past values. This is completed through the use of current table and a historical table. Each new record is date stamped. The information category body composition is comprised of two tables in the relational database. Approximately fifty-four data points are contained within those tables.

The lab work information category pertains to the values derived from blood work analysis completed by a qualified professional. The information generated from the exam will provide information to a user's blood analysis. Information such as white blood count level and red blood count level are included in the lab work category. There are two levels of lab work available in the database. The initial level is basic information that can be generated from a minor blood analysis. The second level information is drawn from a full lab analysis. The wellness database stores current values for both lab work levels and stores all past values. This is completed through the use of a current table and a historical table. Each new record is date stamped. The information category lab work is comprised of four tables in the relational database. Approximately fifty-six data points are contained within those tables.

The nutrition information category pertains to the values derived from one of two external software programs available in the wellness system, the Food Processor (Food Processor for Windows 1999) and the Health Habits and History Questionnaire (Health Habits and History-Dietsys Analysis Software Version 3.0 1993). The software packages provide an analysis of nutritional intake. The Food Processor analyzes current nutritional intake. The HHHQ

Questionnaire analyzes average consumption over a limited time period. The information generated from the software will provide the nutrients, and their corresponding nutritional levels, that a user is consuming. The wellness database stores current values for nutrients and stores all past values. This is completed through the use of current tables and historical tables. Each new record is date stamped. The information category nutrition is comprised of two tables in the relational database. Approximately one hundred twenty-six data points are contained within those tables.

The physical activity information category pertains to the values generated from the Tri-Trac activity monitor discussed in Chapter 3 or a listing of activities engaged in regularly during the week. The information contained within the physical activity category provides a description of a user's physical activity level such as caloric consumption and frequency of activity. The wellness database stores current values for physical activity and stores all past values. This is completed through the use of a current table and a historical table. Each new record is date stamped. The information category physical activity is comprised of four tables in the relational database. Approximately thirty-five data points are contained within those tables.

The body measures information category pertains to elements of the body that can be measured and require monitoring. Included in this category is weight, height, body type, blood pressure, and resting heart rate. The wellness database stores current values for body measures and stores all past values. This is completed through the use of a current table and a historical table. Each new record is date stamped. The information category body measures is comprised of six tables in the relational database. Approximately thirty-eight data points are contained within those tables.

Driver Program Design

The wellness database discussed in the previous sections is not visible to a user of the wellness system. Part of the ability to mask the database is the implementation of a driver

program. The driver program is a Windows-based program that allows an individual to add, modify, and view data in a user-friendly environment. The driver program is named Wellness Center and will be referenced as such for the remainder of the text.

User Interface

The Wellness Center program is a Windows-based program that uses Windows components such as a menu bar, tool bar, dialog boxes, and a view area. The program is similar in design to the numerous Windows programs that individuals tend to use on a daily basis, such as Word and Excel. This was crucial to the implementation of this project as a major goal is ease of use. A person is more likely to use a program that seems similar and comfortable. Appendix B, pages 59-82 contain snapshots of the Wellness Center program interface.

Navigation within Program

A user may navigate in the Wellness Center program by way of the menu bar, tool bar, or hot keys. A user can either use one method or a combination of all three. All methods will take a user to the same end result. As with the user interface, this is the same method of navigation as most Windows based programs.

Functionality Available

There are several functions available in the Wellness Center program. A user can enter data into any of the six information categories. In many cases, a user can enter data by using the keyboard or by uploading a data file. Data loaded into the program are checked for validity in order to avoid corruption in the database. A user can view the data contained within the database. This is available through the report generation function of the Wellness Center program. Reports will contain both current and historical values. Reports can either be viewed on the screen or sent to the printer. Help is available within the Wellness Center program. A

user can view the help files as needed. A user can also refresh any report being viewed on the screen. This is helpful when data are being entered and the user wishes to include the new data in the report being viewed.

Entry into System

The Wellness Center program requires a user to log into the system via a user ID and password. It is the responsibility of the administrator of the database to initialize the user accounts. The user ID must be a non-blank sequence of alpha and/or numeric characters. The password must follow a similar pattern. Once user ID and password have been entered, the combination of ID and password is verified as a valid account. If no such account exists, the program will terminate. If the account does exist, the user will be allowed entry into the program.

Upon entry into the system, the wellness database will be accessed. The driver program will only open those records contained within the tables that pertain to the user logged into the system. This restricted access both prevents the corruption of another individual's data and increases the speed in which the program can run. If all records were accessed, the time required to traverse the database would be greatly increased. All records are opened at start-up of the program. Although this presents a slight wait period as the database is being accessed, it restricts the delay time required for access to the start-up of the program.

Data Entry

Data entry is an integral component to the implementation of the integrated wellness system. Each information category has a section of the program designed for obtaining the necessary information. In order to provide an efficient and user-friendly method for data entry, several options are available to a user.

Keyboard entry is the simplest and the most commonly used method for data entry. Information must be entered via the keyboard. Although the method is commonly used, it is not the most efficient. Keyboard entry allows for incorrect data to be entered due to simple typographical errors. Many of these errors are undetected due to a user's unfamiliarity with the information being entered. In order to provide a more viable system, the ability to upload a data file is also available for data entry.

Information categories demographics, body composition, lab work, nutrition, physical activity, and body measure provide data entry via the keyboard. Dialog boxes pop-up on command requesting the desired data. A user can enter data by using the edit boxes located on each dialog box. Once this task has been completed, software validity checks are performed against the data entered by the user. Checks are performed to determine if required data are entered and if the data entered falls within a standard range. If any validity check fails, the user is alerted and is re-prompted for valid data.

Information categories body composition, lab work, nutrition, and physical activity provide the ability to enter data into the system by file transfer. In the case of body composition, lab work, and physical activity, a user is prompted for the name and location of the data file to process. If no valid data are detected, the user is alerted that there is an invalid file format. If valid data are detected, the information is stored into the database.

Although nutrition does provide file transfer capabilities, it is unique in its method of file transfer. As discussed in chapter 3, there are various nutritional analysis software programs available today. It was determined that there was no need to reinvent something that already exists. As a result, the Food Processor program and Health Habits and History program were integrated into the Wellness Center program. A user can run either program. The data files generated from the external software program are processed by the driver program and data is entered into the database.

All categories, with the exception of demographics, are designed to provide historical trending. As new records are entered, the last record loaded into the database is transferred to a historical table and the new record is stored in the current table. The ability to maintain a historical trending is critical to the reporting abilities of the program.

Report Generation

The Wellness Center program has the ability to generate reports for all major data categories. Reports can be viewed through two methods. One method available is to display the information on the computer screen. This illustration is completed through edit boxes and data labels. The second method available is to send the desired report to the printer.

A total of eight reports can be generated from the Wellness Center program. The reports are listed as user profile report, demographics report, body composition report, lab work report, nutrition report, physical activity report, body measures report, and percent change analysis report. The demographics and user profile report detail current values contained in the database. The body composition report, lab work report, nutrition report, physical activity report, and body measures report detail both current values for the category and the last three sets of recorded values maintained in the historical table. The final report, denoted as percent change analysis report, compares the current value to the last historical record for all data in which historical trending has been applied. If the data have changed more than the percent entered by the user, a check box denotes the change. This functionality is very attractive in that a user can set his or her parameters and guidelines for evaluation.

CHAPTER 5

SUMMARY

Outcome of Project

There are two questions that must be addressed at the conclusion of this project. The first question to address is: were the objectives met? The most effective manner in which to address this question is to restate the problems discussed in Chapter 2. The first problem was the nonexistence of a software program that provided the functionality of a complete wellness system. It was determined that several wellness driven programs existed but did not encompass all aspects of wellness. The integrated software system completed for this project encompasses six information categories. All information pertaining to the six categories is contained within one database and is easily accessible. The second problem dictating the need for this project is the lack of individual participation in monitoring and evaluating wellness. The lack of participation is greatly due to the difficulty in completing such a task. An individual would have been required to go to several sources for the information required and would have had to review each source of data separately. There are several features of the integrated software system that resolve this issue. All data are maintained in one database. A user has the ability to enter data using keyboard, file transfer, or a combination of these two methods. The program is a Windows-based program which provides a familiarity to many users. The reports generated can be viewed both on screen or sent to a printer.

The second question to address is: what benefits can be obtained from this project? A major benefit obtained is the ability of an individual to monitor an existing medical condition. Reports generated by the program display both current values and historical values. Both displays include the date in which the information was loaded into the system. The reports allow for a user to monitor the progress of the troubled values, such as cholesterol level. Although this will not necessarily eliminate a medical condition, it can prevent deterioration by allowing the

user to closely monitor the value and observe any dangerous changes. The reports generated will also be beneficial in determining the impact of other activities on troubled values. For example, exercise is understood to lower cholesterol. An individual can review the impact of physical activity to his or her cholesterol level.

Detection of a medical condition is also a benefit achieved from implementing an integrated software system. Values are displayed from the present and the past. Negative trending, whether a higher or lower value, can be seen with the reports generated. Many times doctors only discuss values that are out of a standard range. No comparison is generally made to past records. The use of the wellness software system will allow a user to detect any deterioration in values even if the standard ranges are met. This may allow for the avoidance of health problems by promoting a lifestyle change.

Motivation to continue a health lifestyle is provided with the system. An individual can see positive changes in values. Although the changes may be minor, a positive change in value may be all that is necessary to motivate an individual to continue a lifestyle change.

The last benefit achieved from the integrated software system is the positive impact on preventive medicine. An integrated system provides an easy and more effective manner in which wellness can be evaluated. Using the principle that as the process becomes easier, more individuals will participate, it is assumed that the number of people making wellness assessment a life-long commitment will increase. Although this assumption cannot be verified for several years, it provides a channel in which it can happen. The impact the integrated system will have on preventive medicine essentially encompasses the benefits described above: the deterioration of a medical condition that can be prevented, an upcoming medication condition that can be detected and hopefully avoided, and an individual will be more motivated to live a healthy life.

Future Developments

Although the original goals designated for this project have been achieved, there are

future developments that can greatly increase the benefits obtained from an integrated wellness system. The developments in discussion are those that will provide a more in-depth analysis and those that would provide greater access to the system itself.

A new functionality to the program that would be desired is an analysis of the interdependencies among data. The project in its current state maintains disjoint data groupings. Lab work is compared only to historical lab work. There are cases in which a variable in one data group is related to a variable contained within another. By providing a cross-analysis, a user can realize the full impact of one action to the various wellness values.

Another application that would provide benefit is to allow a comparison between the user and the population contained within the database. All data are stored in one central location. Although a user can only access his or her data, there is the capability of demonstrating to the user where he or she falls within the population and provide motivation where needed. This functionality would also be beneficial to the database administrator as statistics could be developed for the population of the database.

The last improvement to the system that will be discussed is the program's applicability to the web. The use of the Internet provides a great deal of ease in accessing data through remote locations. A desired functionality would be to maintain the wellness database on a server. All users would have the capability of accessing his or her data from any computer that provides Internet access. This could be used, for example, to download information directly from a doctor's office and to allow a doctor to view a patient's complete wellness report.

The implementation of the additions to the program is very feasible. The wellness program has been developed to allow for maintenance to both existing functions and the addition of new functions. It would be beneficial to continue development of the integrated wellness system.

BIBLIOGRAPHY

Food Processor for Windows [Computer Software]. 1999. Salem, OH: ESHA Research.

Health Habits and History Questionnaire-Dietsys Analysis Software Version 3.0 [Computer Software]. 1993. Bethesda, MD: National Cancer Institute.

Lee, Robert, David Nieman & Marvin Rainwater. 1995. Comparison of Eight Microcomputer Dietary Analysis Programs with the USDA Nutrient Data Base for Standard Reference. Journal of the American Dietetic Association. August: 858-867.

Microsoft Access 2000 [Computer Software]. 2000. Redmond, WA: Microsoft Corporation.

Microsoft Developer Studio Visual C++ [Computer Software]. 1997. Redmond, WA: Microsoft Corporation.

National Cancer Institute. 1993. Health Habits and History Questionnaire. Bethesda, MD: National Cancer Institute.

National Cancer Institute. 1993. Personal Computer System Packet. Bethesda, MD: National Cancer Institute.

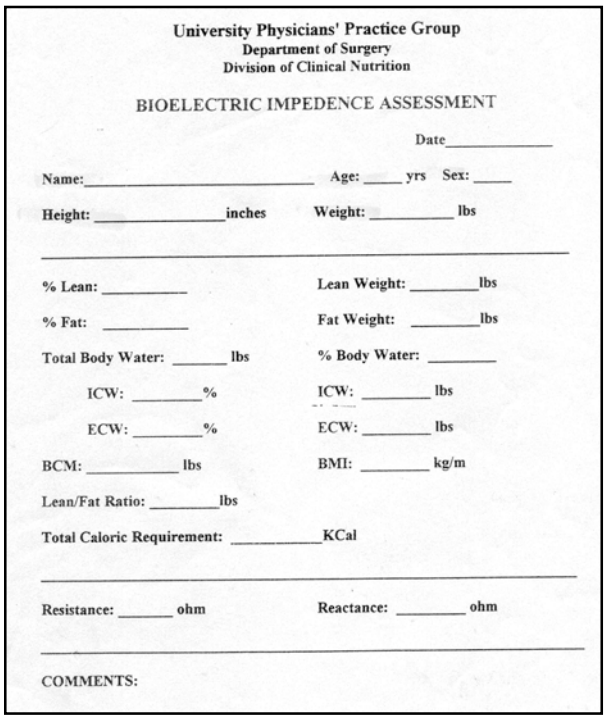
Zitlow, Kelly. 2001. Double-Digit Health Care Cost Increases Expected to Continue in 2002 [on-line]. Hewitt; available from http://was.hewitt.com/hewitt/resource/newsroom/pressrel/2001/10-29-01.htm; Internet; accessed May 1, 2002.

APPENDICES

APPENDIX A

DATABASE DESIGN

Forms and Reports Used to Develop Data Points



University Physicians' Practice Group
Department of Surgery
Division of Clinical Nutrition

BIOELECTRIC IMPEDENCE ASSESSMENT

Date_____

Name:_____ Age: ____ yrs Sex: ____

Height: _____inches Weight: _____ lbs

% Lean: _____ Lean Weight: _____lbs

% Fat: _____ Fat Weight: _____lbs

Total Body Water: _____ lbs % Body Water: _____

ICW: _____% ICW: _____ lbs

ECW: _____% ECW: _____ lbs

BCM: _____ lbs BMI: _____ kg/m

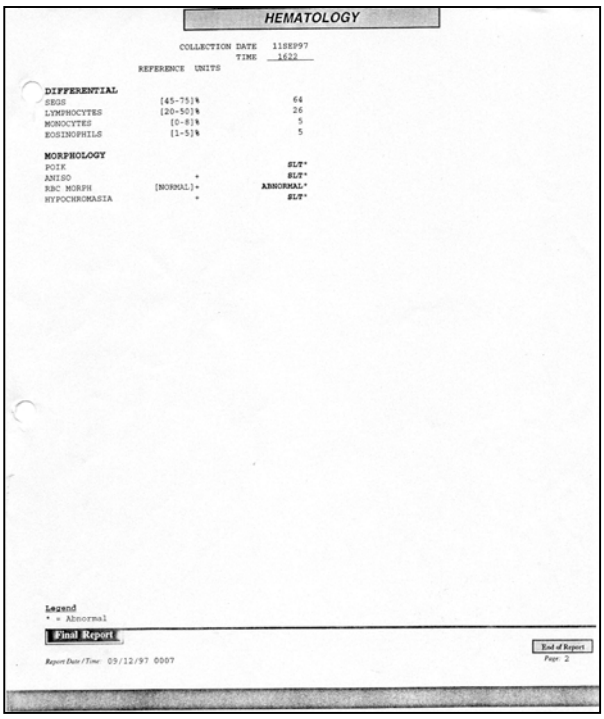
Lean/Fat Ratio: _____lbs

Total Caloric Requirement: _____KCal

Resistance: _____ ohm Reactance: _____ ohm

COMMENTS:

Fig. 1. Bioelectric Impedence Form



HEMATOLOGY

COLLECTION DATE 11SEP97
TIME 1622

	REFERENCE	UNITS	
DIFFERENTIAL			
SEGS	[45-75]%		64
LYMPHOCYTES	[20-50]%		26
MONOCYTES	[0-8]%		5
EOSINOPHILS	[1-5]%		5
MORPHOLOGY			
POIK			SLT*
ANISO		*	SLT*
RBC MORPH	[NORMAL]	*	ABNORMAL*
HYPOCHROMASIA		*	SLT*

Legend
* = Abnormal

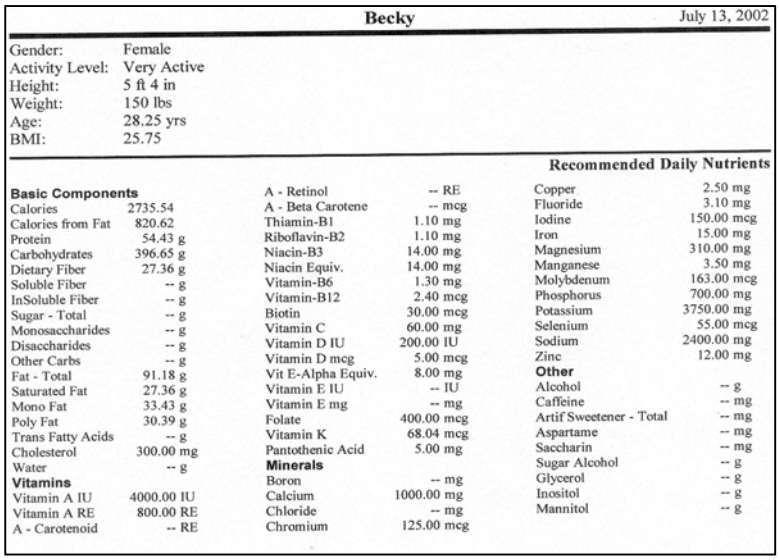
Final Report

End of Report

Report Date/Time: 09/12/97 0007

Page: 2

Fig. 2. Lab Analysis Form

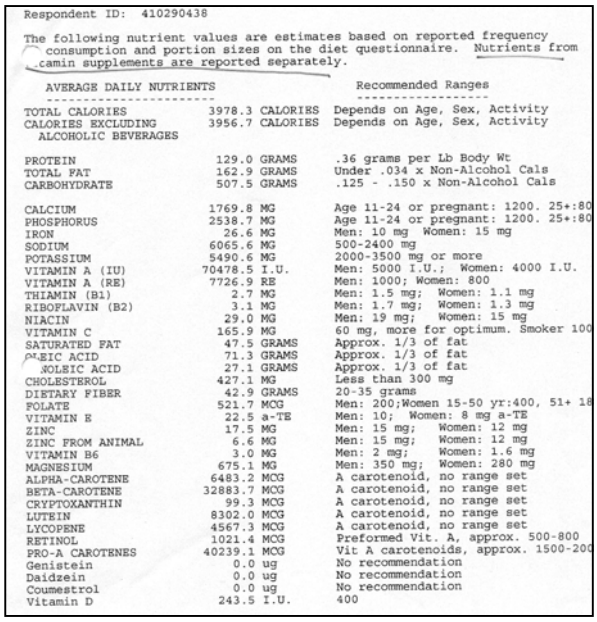


Becky July 13, 2002

Gender: Female
Activity Level: Very Active
Height: 5 ft 4 in
Weight: 150 lbs
Age: 28.25 yrs
BMI: 25.75

					Recommended Daily Nutrients
Basic Components		A - Retinol	-- RE	Copper	2.50 mg
Calories	2735.54	A - Beta Carotene	-- mcg	Fluoride	3.10 mg
Calories from Fat	820.62	Thiamin-B1	1.10 mg	Iodine	150.00 mcg
Protein	54.43 g	Riboflavin-B2	1.10 mg	Iron	15.00 mg
Carbohydrates	396.65 g	Niacin-B3	14.00 mg	Magnesium	310.00 mg
Dietary Fiber	27.36 g	Niacin Equiv.	14.00 mg	Manganese	3.50 mg
Soluble Fiber	-- g	Vitamin-B6	1.30 mg	Molybdenum	163.00 mcg
InSoluble Fiber	-- g	Vitamin-B12	2.40 mcg	Phosphorus	700.00 mg
Sugar - Total	-- g	Biotin	30.00 mcg	Potassium	3750.00 mg
Monosaccharides	-- g	Vitamin C	60.00 mg	Selenium	55.00 mcg
Disaccharides	-- g	Vitamin D IU	200.00 IU	Sodium	2400.00 mg
Other Carbs	-- g	Vitamin D mcg	5.00 mcg	Zinc	12.00 mg
Fat - Total	91.18 g	Vit E-Alpha Equiv.	8.00 mg	**Other**	
Saturated Fat	27.36 g	Vitamin E IU	-- IU	Alcohol	-- g
Mono Fat	33.43 g	Vitamin E mg	-- mg	Caffeine	-- mg
Poly Fat	30.39 g	Folate	400.00 mcg	Artif Sweetener - Total	-- mg
Trans Fatty Acids	-- g	Vitamin K	68.04 mcg	Aspartame	-- mg
Cholesterol	300.00 mg	Pantothenic Acid	5.00 mg	Saccharin	-- mg
Water	-- g	**Minerals**		Sugar Alcohol	-- g
Vitamins		Boron	-- mg	Glycerol	-- g
Vitamin A IU	4000.00 IU	Calcium	1000.00 mg	Inositol	-- g
Vitamin A RE	800.00 RE	Chloride	-- mg	Mannitol	-- g
A - Carotenoid	-- RE	Chromium	125.00 mcg		

Fig. 3. Food Processor Report

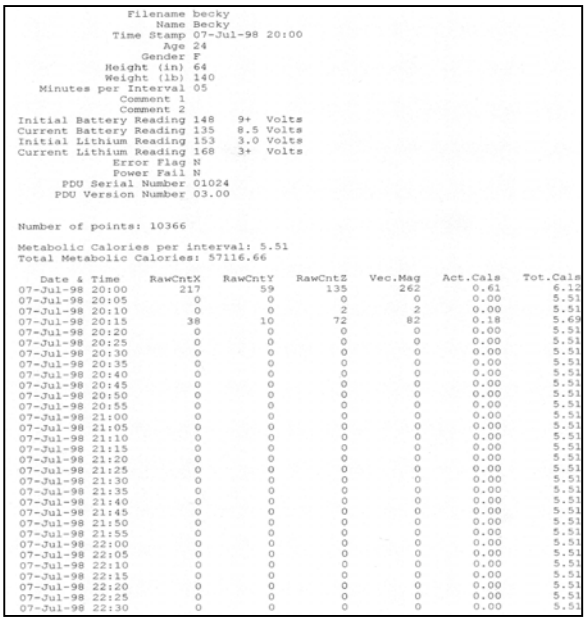


Respondent ID: 410290438

The following nutrient values are estimates based on reported frequency consumption and portion sizes on the diet questionnaire. Nutrients from camin supplements are reported separately.

AVERAGE DAILY NUTRIENTS		Recommended Ranges
TOTAL CALORIES	3978.3 CALORIES	Depends on Age, Sex, Activity
CALORIES EXCLUDING ALCOHOLIC BEVERAGES	3956.7 CALORIES	Depends on Age, Sex, Activity
PROTEIN	129.0 GRAMS	.36 grams per Lb Body Wt
TOTAL FAT	162.9 GRAMS	Under .034 x Non-Alcohol Cals
CARBOHYDRATE	507.5 GRAMS	.125 - .150 x Non-Alcohol Cals
CALCIUM	1769.8 MG	Age 11-24 or pregnant: 1200. 25+:80
PHOSPHORUS	2538.7 MG	Age 11-24 or pregnant: 1200. 25+:80
IRON	26.6 MG	Men: 10 mg Women: 15 mg
SODIUM	6065.6 MG	500-2400 mg
POTASSIUM	5490.6 MG	2000-3500 mg or more
VITAMIN A (IU)	70478.5 I.U.	Men: 5000 I.U.; Women: 4000 I.U.
VITAMIN A (RE)	7726.9 RE	Men: 1000; Women: 800
THIAMIN (B1)	2.7 MG	Men: 1.5 mg; Women: 1.1 mg
RIBOFLAVIN (B2)	3.1 MG	Men: 1.7 mg; Women: 1.3 mg
NIACIN	29.0 MG	Men: 19 mg; Women: 15 mg
VITAMIN C	165.9 MG	60 mg, more for optimum. Smoker 100
SATURATED FAT	47.5 GRAMS	Approx. 1/3 of fat
OLEIC ACID	71.3 GRAMS	Approx. 1/3 of fat
LINOLEIC ACID	27.1 GRAMS	Approx. 1/3 of fat
CHOLESTEROL	427.1 MG	Less than 300 mg
DIETARY FIBER	42.9 GRAMS	20-35 grams
FOLATE	521.7 MCG	Men: 200;Women 15-50 yr:400, 51+ 18
VITAMIN E	22.5 a-TE	Men: 10; Women: 8 mg a-TE
ZINC	17.5 MG	Men: 15 mg; Women: 12 mg
ZINC FROM ANIMAL	6.6 MG	Men: 15 mg; Women: 12 mg
VITAMIN B6	3.0 MG	Men: 2 mg; Women: 1.6 mg
MAGNESIUM	675.1 MG	Men: 350 mg; Women: 280 mg
ALPHA-CAROTENE	6483.2 MCG	A carotenoid, no range set
BETA-CAROTENE	32883.7 MCG	A carotenoid, no range set
CRYPTOXANTHIN	99.3 MCG	A carotenoid, no range set
LUTEIN	8302.0 MCG	A carotenoid, no range set
LYCOPENE	4567.3 MCG	A carotenoid, no range set
RETINOL	1021.4 MCG	Preformed Vit. A, approx. 500-800
PRO-A CAROTENES	40239.1 MCG	Vit A carotenoids, approx. 1500-200
Genistein	0.0 ug	No recommendation
Daidzein	0.0 ug	No recommendation
Coumestrol	0.0 ug	No recommendation
Vitamin D	243.5 I.U.	400

Fig. 4. HHHQ Questionnaire Report



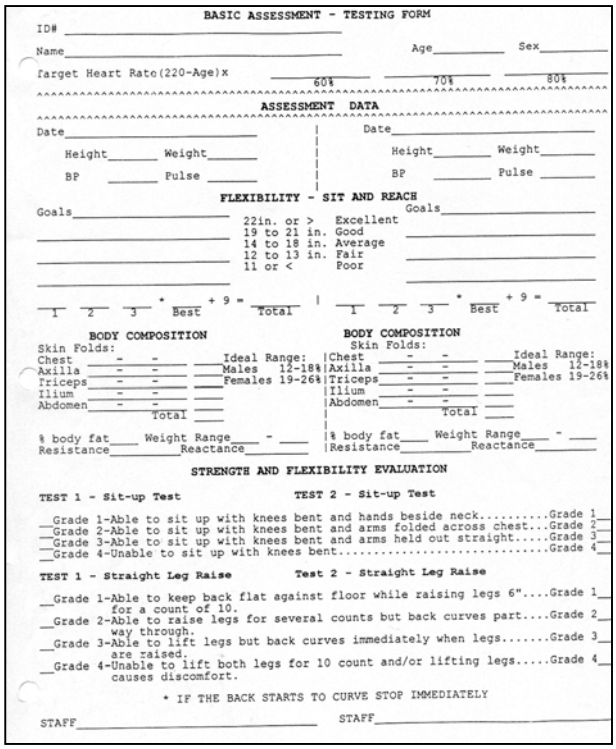
Filename becky
Name Becky
Time Stamp 07-Jul-98 20:00
Age 24
Gender F
Height (in) 64
Weight (lb) 140
Minutes per Interval 05
Comment 1
Comment 2
Initial Battery Reading 148 9+ Volts
Current Battery Reading 135 8.5 Volts
Initial Lithium Reading 153 3.0 Volts
Current Lithium Reading 168 3+ Volts
Error Flag N
Power Fail N
PDU Serial Number 01024
PDU Version Number 03.00

Number of points: 10366

Metabolic Calories per interval: 5.51
Total Metabolic Calories: 57116.66

Date & Time	RawCntX	RawCntY	RawCntZ	Vec.Mag	Act.Cals	Tot.Cals
07-Jul-98 20:00	217	59	135	262	0.61	6.12
07-Jul-98 20:05	0	0	0	0	0.00	5.51
07-Jul-98 20:10	0	0	2	2	0.00	5.51
07-Jul-98 20:15	38	10	72	82	0.18	5.69
07-Jul-98 20:20	0	0	0	0	0.00	5.51
07-Jul-98 20:25	0	0	0	0	0.00	5.51
07-Jul-98 20:30	0	0	0	0	0.00	5.51
07-Jul-98 20:35	0	0	0	0	0.00	5.51
07-Jul-98 20:40	0	0	0	0	0.00	5.51
07-Jul-98 20:45	0	0	0	0	0.00	5.51
07-Jul-98 20:50	0	0	0	0	0.00	5.51
07-Jul-98 20:55	0	0	0	0	0.00	5.51
07-Jul-98 21:00	0	0	0	0	0.00	5.51
07-Jul-98 21:05	0	0	0	0	0.00	5.51
07-Jul-98 21:10	0	0	0	0	0.00	5.51
07-Jul-98 21:15	0	0	0	0	0.00	5.51
07-Jul-98 21:20	0	0	0	0	0.00	5.51
07-Jul-98 21:25	0	0	0	0	0.00	5.51
07-Jul-98 21:30	0	0	0	0	0.00	5.51
07-Jul-98 21:35	0	0	0	0	0.00	5.51
07-Jul-98 21:40	0	0	0	0	0.00	5.51
07-Jul-98 21:45	0	0	0	0	0.00	5.51
07-Jul-98 21:50	0	0	0	0	0.00	5.51
07-Jul-98 21:55	0	0	0	0	0.00	5.51
07-Jul-98 22:00	0	0	0	0	0.00	5.51
07-Jul-98 22:05	0	0	0	0	0.00	5.51
07-Jul-98 22:10	0	0	0	0	0.00	5.51
07-Jul-98 22:15	0	0	0	0	0.00	5.51
07-Jul-98 22:20	0	0	0	0	0.00	5.51
07-Jul-98 22:25	0	0	0	0	0.00	5.51
07-Jul-98 22:30	0	0	0	0	0.00	5.51

Fig. 5. TriTrac Report



BASIC ASSESSMENT - TESTING FORM

ID# _____

Name_____ Age_____ Sex_____

Target Heart Rate(220-Age)x _____ 60% _____ 70% _____ 80%

ASSESSMENT DATA

Date_____ | Date_____

Height_____ Weight_____ | Height_____ Weight_____

BP _____ Pulse _____ | BP _____ Pulse _____

FLEXIBILITY - SIT AND REACH

Goals_____ | Goals_____

22in. or > Excellent
19 to 21 in. Good
14 to 18 in. Average
12 to 13 in. Fair
11 or < Poor

1 2 3 * Best + 9 = Total | 1 2 3 * Best + 9 = Total

BODY COMPOSITION

Skin Folds:
Chest _____ - _____ - _____ Ideal Range:
Axilla _____ - _____ - _____ Males 12-18%
Triceps _____ - _____ - _____ Females 19-26%
Ilium _____ - _____ - _____
Abdomen _____ - _____ - _____
Total _____

% body fat____ Weight Range____ - ____
Resistance_____Reactance_____

BODY COMPOSITION

Skin Folds:
Chest _____ - _____ - _____ Ideal Range:
Axilla _____ - _____ - _____ Males 12-18%
Triceps _____ - _____ - _____ Females 19-26%
Ilium _____ - _____ - _____
Abdomen _____ - _____ - _____
Total _____

% body fat____ Weight Range____ - ____
Resistance_____Reactance_____

STRENGTH AND FLEXIBILITY EVALUATION

TEST 1 - Sit-up Test **TEST 2 - Sit-up Test**

__Grade 1-Able to sit up with knees bent and hands beside neck.....Grade 1__
__Grade 2-Able to sit up with knees bent and arms folded across chest...Grade 2__
__Grade 3-Able to sit up with knees bent and arms held out straight.....Grade 3__
__Grade 4-Unable to sit up with knees bent.....Grade 4__

TEST 1 - Straight Leg Raise **Test 2 - Straight Leg Raise**

__Grade 1-Able to keep back flat against floor while raising legs 6"....Grade 1__
for a count of 10.
__Grade 2-Able to raise legs for several counts but back curves part....Grade 2__
way through.
__Grade 3-Able to lift legs but back curves immediately when legs.....Grade 3__
are raised.
__Grade 4-Unable to lift both legs for 10 count and/or lifting legs.....Grade 4__
causes discomfort.

* IF THE BACK STARTS TO CURVE STOP IMMEDIATELY

STAFF_____ STAFF_____

Fig. 6. Body Composition Form

Description of Data Points

Table 1. Demographics Data Definition

DEMOGRAPHICS

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute of)	Relation (Attribute Of)
Name		(Composite)	KB	N	N	Person	
First		string	KB	N	N	Person	
Middle Init		string	KB	N	N	Person	
Last		string	KB	N	N	Person	
Identification Number		string	KB	N	N	Person	
Address		(Composite)	KB	N	N	Person	
Street Address		string	KB	N	N	Person	
City		string	KB	N	N	Person	
State		string	KB	N	N	Person	
Zip		string	KB	N	N	Person	
Work Phone		string	KB	N	N	Person	
Home Phone		string	KB	N	N	Person	
E-Mail		string	KB	N	N	Person	
Birthdate		(Composite)	KB	N	N	Person	
Month		int	KB	N	N	Person	
Day		int	KB	N	N	Person	
Year		int	KB	N	N	Person	
Age		int	Calc.	N	N	Person	
Gender		enum	KB	N	N	Person	
Educ. Level		string	KB	N	N	Person	
Condition (Chronic)		string	KB	Y	Y	Chronic Disease	
Diagnosis Date (Chronic)	mth/yr	date	KB	N	N		Suffers Chronic
Treatment (Chronic)		string	KB	Y	Y		Suffers Chronic
Complication (Chronic)		string	KB	Y	Y		Suffers Chronic
Condition (Acute)		string	KB	Y	Y	Acute Disease	
Occurrence Date (Acute)	mth/yr	date	KB	N	N		Suffers Acute
Duration (Acute)		int	KB	Y	Y		Suffers Acute
Complications (Acute)		string	KB	Y	Y		Suffers Acute
Relationship (Family Hist)		string	KB	Y	Y		Is Related
Condition (Family Hist)		string	KB	N	Y		Is Related
Status (Smoker)		char	KB	N	N		Consumes
Avg Cigarettes Per Day		int	KB	N	N		Consumes
Duration	weeks	int	KB	N	N		Consumes
Brand		text	KB	N	N		Consumes
Time Elapsed Since Last Usage	weeks	int	KB	N	N		Consumes

Table 1. (Continued)

DEMOGRAPHICS

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute of)	Relation (Attribute Of)
Status (Chewing)		char	KB	N	N		Consumes
Avg. Dips/Day		int	KB	N	N		Consumes
Duration	weeks	int	KB	N	N		Consumes
Brand		text	KB	N	N		Consumes
Time Elapsed Since Last Usage	weeks	int	KB	N	N		Consumes
Status (Cigars)		char	KB	N	N		Consumes
Avg Pipes / Cigars Per Day		int	KB	N	N		Consumes
Duration	weeks	int	KB	N	N		Consumes
Brand		text	KB	N	N		Consumes
Time Elapsed Since Last Usage	weeks	int	KB	N	N		Consumes
Frequency (Dieting)		int	KB	N	N	Dieting	
Avg Length (Dieting)	weeks	int	KB	N	N	Dieting	
Date of Last Diet (Dieting)		date	KB	N	N	Dieting	
Effects (Dieting)		string	KB	N	N	Dieting	
Type (OTC)		string	KB	N	Y	OTC Preparation	
Frequency (OTC)		int	KB	N	Y		Takes
Duration (OTC)	weeks	int	KB	N	Y		Takes
Duration (Alcohol)	weeks	int	KB	N	Y		Consumes
Frequency (Alcohol)	days/wk	int	KB	N	Y		Consumes
Amount (Alcohol)	oz	int	KB	N	Y		Consumes
Type (Alcohol)		string	KB	N	Y	Alcohol	
Pattern (Sleep)		bool	KB	N	N	Sleep	
Avg. Hrs Per Night (Sleep)	hours	float	KB	N	N		Acquires
Variation (Sleep)	hours	int	KB	N	N		Acquires
Level (Stress)		enum	KB	N	N	Stress	
Effect (Stress)		enum	KB	N	Y		Suffers
Relief (Stress)		enum	KB	N	Y		Suffers

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input
* HISTORY - denotes if there is a need to store past values
* MULTI-VALUE - denotes if more than one current value exists at a time

Table 2. Body Composition Data Definition

BODY COMPOSITION

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Lean Mass Composition		(Composite)	File/KB	Y	N	Historical Body Composition & Current Body Composition
Weight	lbs	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Optimal Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Fat Composition		(Composite)	File/KB	Y	N	Historical Body Composition & Current Body Composition
Weight	lbs	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Optimal Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Body Water Composition	lbs	(Composite)	File/KB	Y	N	Historical Body Composition & Current Body Composition
Weight		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Optimal Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
ICW	lbs	(Composite)	File/KB	Y	N	Historical Body Composition & Current Body Composition
Weight		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Optimal Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
ECW	lbs	(Composite)	File/KB	Y	N	Historical Body Composition & Current Body Composition
Weight		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Optimal Percent		float	File/KB	Y	N	Historical Body Composition & Current Body Composition
BCM	lbs	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
BMI	kg/m	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Lean / Fat Ratio	lbs	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Total Caloric Req.	Kcal	float	File/KB	Y	N	Historical Body Composition & Current Body Composition

Table 2. (Continued)

BODY COMPOSITION

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Weight	lbs	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Height	in	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Length	in	float	File/KB	Y	N	Historical Body Composition & Current Body Composition
Resistance	ohm	int	File/KB	N	N	Historical Body Composition& Current Body Composition
Reactance	ohm	int	File/KB	N	N	Historical Body Composition & Current Body Composition

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input
* HISTORY - denotes if there is a need to store past values
* MULTI-VALUE - denotes if more than one current value exists at a time

Table 3. Lab Work Data Definition

LABS

Description	Units	Level	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Glucose	MG/DL	1	float	File/KB	Y	N	Historical Initial Lab Work & Current Initial Lab Work
Cholesterol	MG/DL	1	float	File/KB	Y	N	Historical Initial Lab Work & Current Initial Lab Work
HGB	G/DL	1	float	File/KB	Y	N	Historical Initial Lab Work & Current Initial Lab Work
HCT	%	1	float	File/KB	Y	N	Historical Initial Lab Work & Current Initial Lab Work
Sodium	MMOL/L	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Potassium	MMOL/L	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Chloride	MMOL/L	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Creatinine	MG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Calcium	MG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Phosphorus	MG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Magnesium	MG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Iron	MCG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Total Protein	GM/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Albumin	G/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Triglycerides	MG/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
MCV	FL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
MCH	PG	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
MCHC	G/DL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
WBC	CUMM	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Lymphocytes	%	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
RBC	MILL	2	float	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work
Hypochromasia	+	2	string	File/KB	Y	N	Historical Secondary Lab Work & Current Secondary Lab Work

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input

* HISTORY - denotes if there is a need to store past values

* MULTI-VALUE - denotes if more than one current value exists at a time

Table 4. Nutrients Data Definition

NUTRIENTS

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Calories	cal	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Protein	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Carbohydrates	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Dietary Fiber	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Sugar - Total	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Saturated Fat	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Mono Fat	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Poly Fat	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Cholesterol	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Water	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin A RE	RE	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Thiamin - B1	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Riboflavin - B2	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Niacin Equiv.	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin - B6	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin - B12	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Biotin	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin C	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin D IU	IU	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin D mcg	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vit E - Alpha Equiv	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin E IU	IU	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Vitamin E mg	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Folate	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients

Table 4. (Continued)

NUTRIENTS

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Vitamin K	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Pantohenic Acid	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Calcium	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Chloride	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Chromium	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Copper	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Fluoride	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Iodine	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Iron	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Magnesium	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Manganese	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Molybdenum	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Phosphorus	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Potassium	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Selenium	mcg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Sodium	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Zinc	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Alcohol	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Caffeine	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Artif Sweetener - Total	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Aspartame	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Saccharin	mg	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Sugar Alcohol	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients

Table 4. (Continued)

NUTRIENTS

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Trans Fatty Acids	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Omega 3 Fatty Acids	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Omega 6 Fatty Acids	g	float	File/KB/SW	Y	N	Historical Nutrients & Current Nutrients
Sweets (servings)		int	KB	Y	N	Historical Avg. Food Servings & Current Avg. Food Servings
Milk (servings)		int	KB	Y	N	Historical Avg. Food Servings & Current Avg. Food Servings
Meat (servings)		int	KB	Y	N	Historical Avg. Food Servings & Current Avg. Food Servings
Vegetable (servings)		int	KB	Y	N	Historical Avg. Food Servings & Current Avg. Food Servings
Fruit (servings)		int	KB	Y	N	Historical Avg. Food Servings & Current Avg. Food Servings
Bread (servings)		int	KB	Y	N	Historical Avg. Food Servings& Current Avg. Food Servings

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input
* HISTORY - denotes if there is a need to store past values
* MULTI-VALUE - denotes if more than one current value exists at a time

Table 5. Physical Activity Data Definition

PHYSICAL ACTIVITY

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Activity Type		string	KB	Y	N	Historical Activity & Current Activity
Intensity		string	KB	Y	N	Historical Activity & Current Activity
Heart Rate	bpm	int	KB	Y	N	Historical Activity & Current Activity
Frequency	min	float	KB	Y	N	Historical Activity & Current Activity
Total Metabolic Calories	cal	float	File	Y	N	Historical Metabolic Reading & Current Metabolic Reading
Metabolic Cals Per Interval	cal	float	File	Y	N	Historical Metabolic Reading & Current Metabolic Reading
Interval	min	float	File	Y	N	Historical Metabolic Reading & Current Metabolic Reading

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input
* HISTORY - denotes if there is a need to store past values
* MULTI-VALUE - denotes if more than one current value exists at a time

Table 6. Body Measures Data Definition

BODY MEASURES

Description	Units	Data Type	Source	History	Multi-Value	Entity (Attribute Of)
Height	inches	int	KB	Y	N	Historical Body Size & Current Body Size
Length	inches	int	KB	Y	N	Historical Body Size & Current Body Size
Weight	lbs	int	KB	Y	N	Historical Body Size & Current Body Size
Body Type		enum	KB	Y	N	Historical Body Size & Current Body Size
Blood Presssure		----	----	Y	N	Historical Heart Metrics & Current Heart Metrics
Systolic		int	KB	Y	N	Historical Heart Metrics & Current Heart Metrics
Distolic		int	KB	Y	N	Historical Heart Metrics & Current Heart Metrics
Resting Heart Rate	bpm	int	KB	Y	N	Historical Heart Metrics & Current Heart Metrics
Back Flexibility		int	KB	Y	N	Historical Physical Attributes & Current Physical Attributes
Grip Strength		int	KB	Y	N	Historical Physical Attributes & Current Physical Attributes
Hamstring Flexibility		int	KB	Y	N	Historical Physical Attributes & Current Physical Attributes

* UNITS - unit of measurement * DATA TYPE - type used for storage * SOURCE - means of input
* HISTORY - denotes if there is a need to store past values
* MULTI-VALUE - denotes if more than one current value exists at a time

ER Diagram

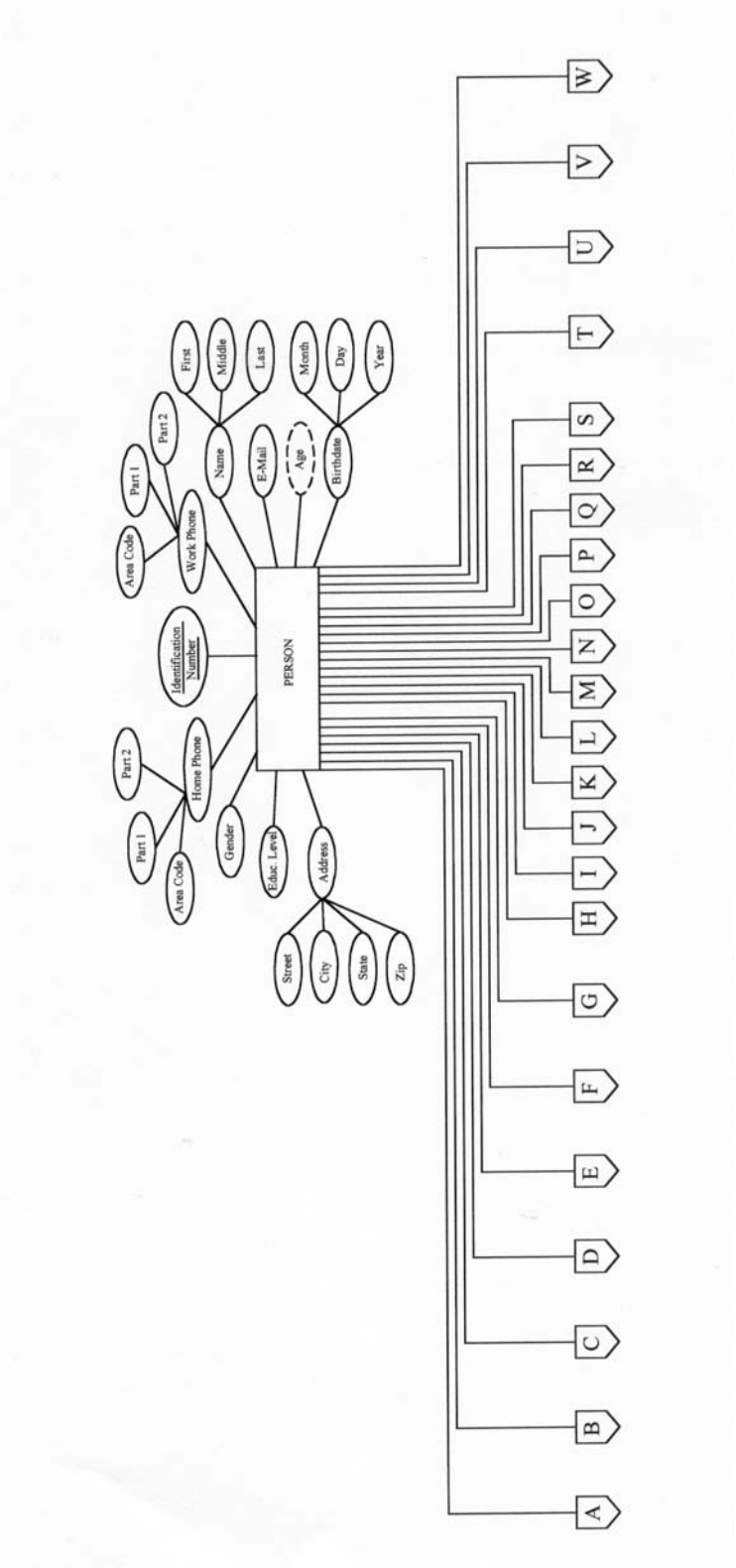


Fig. 7. ER Diagram

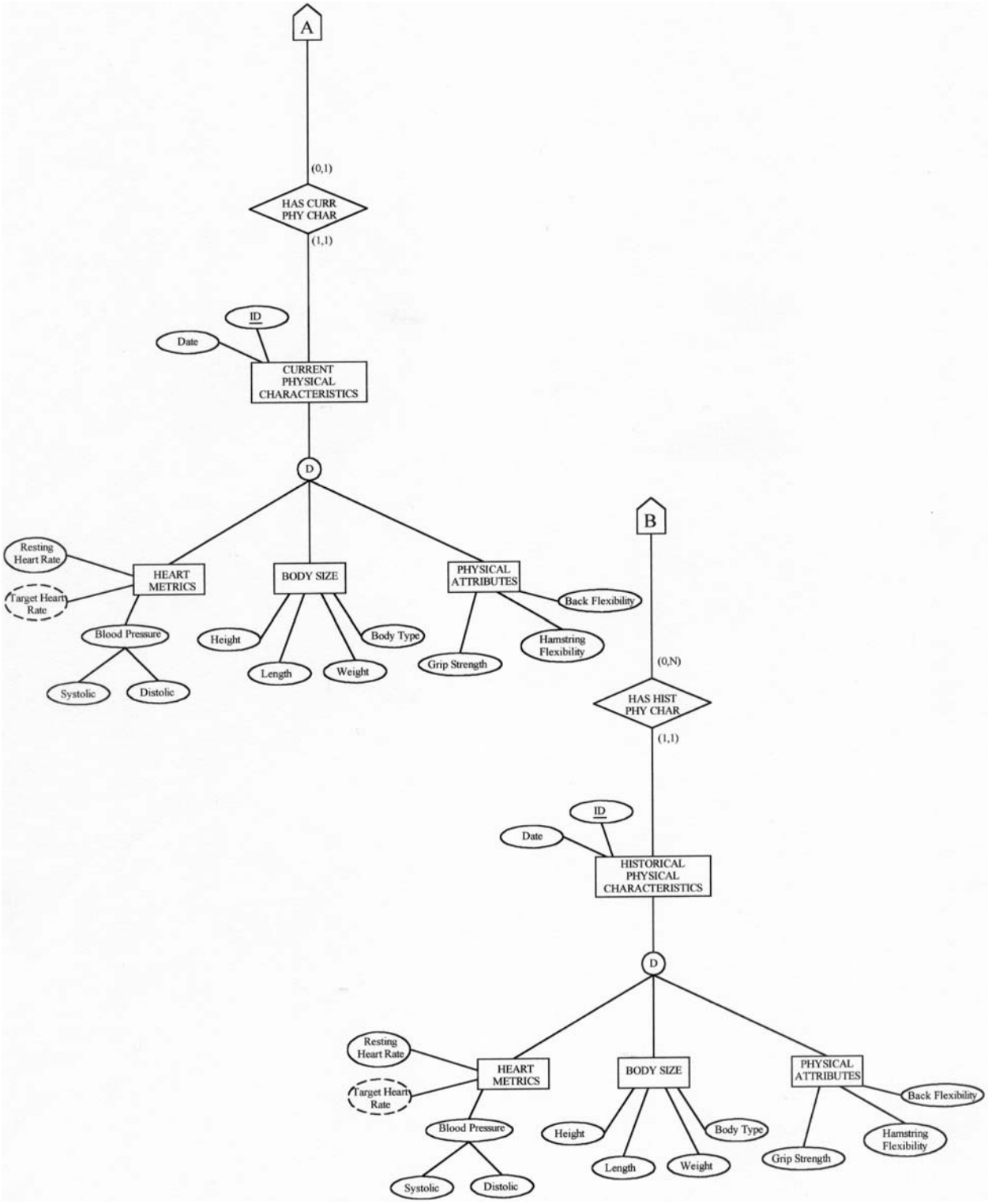


Fig. 7. (Continued)

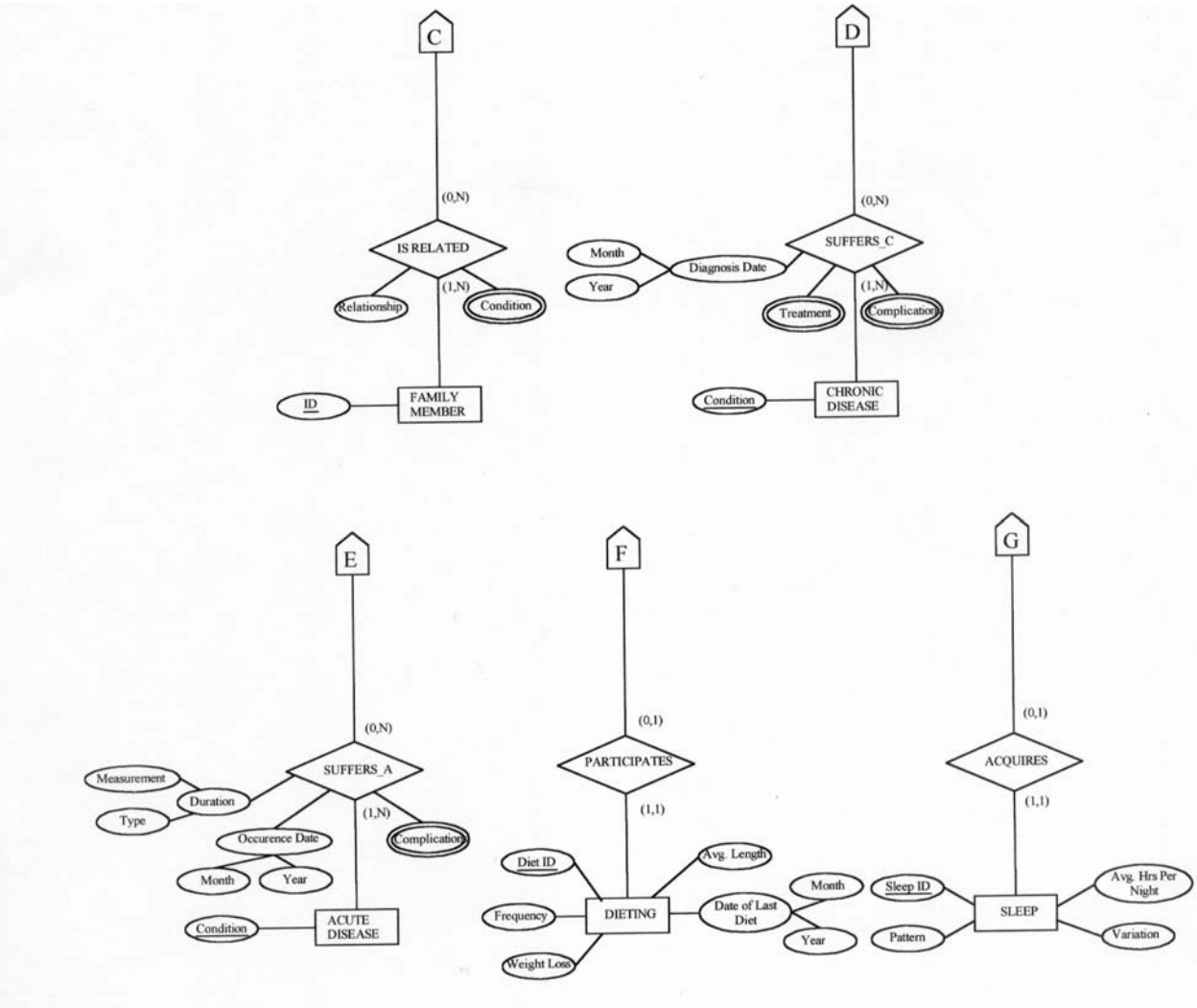


Fig. 7. (Continued)

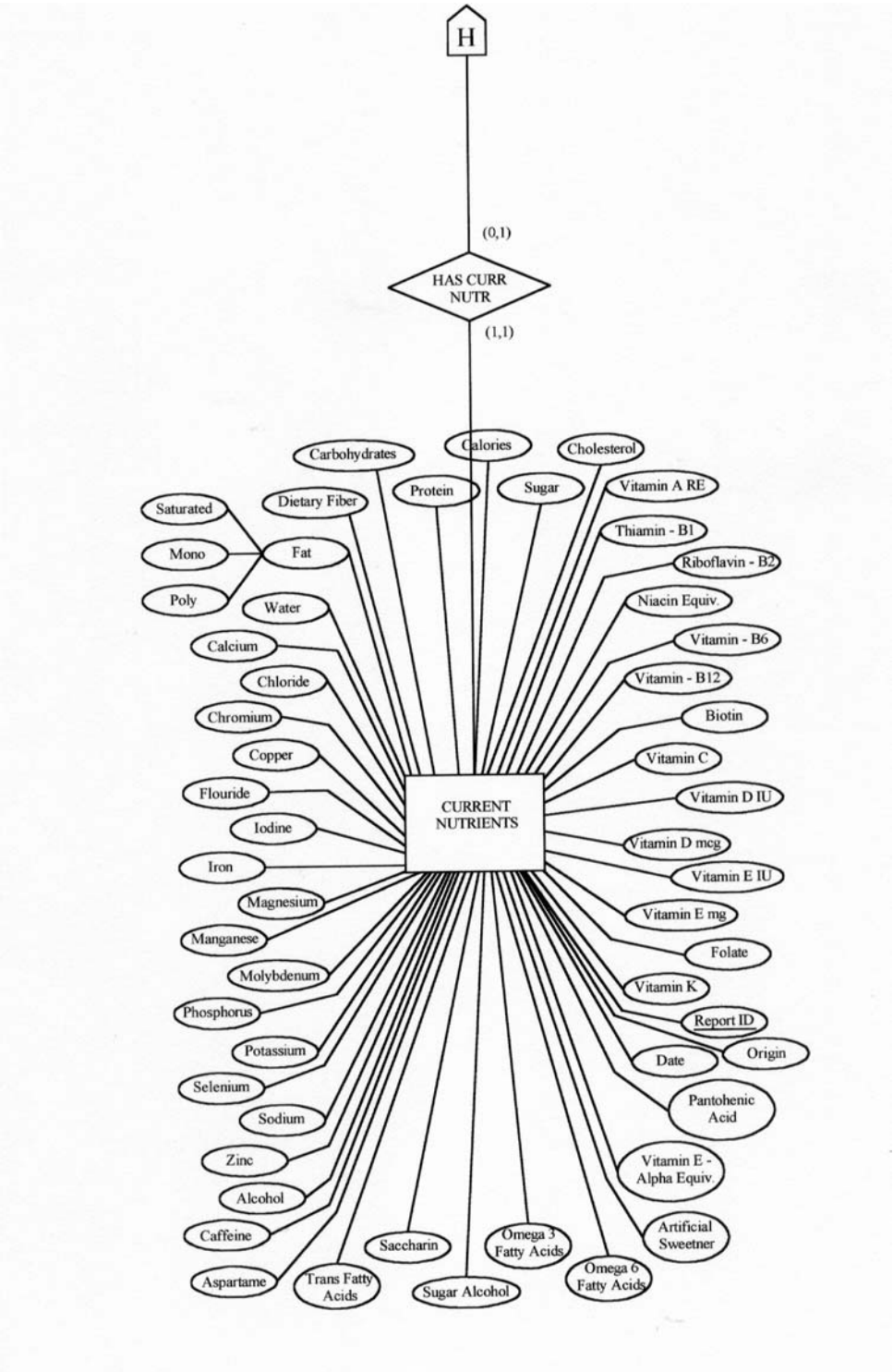


Fig. 7. (Continued)

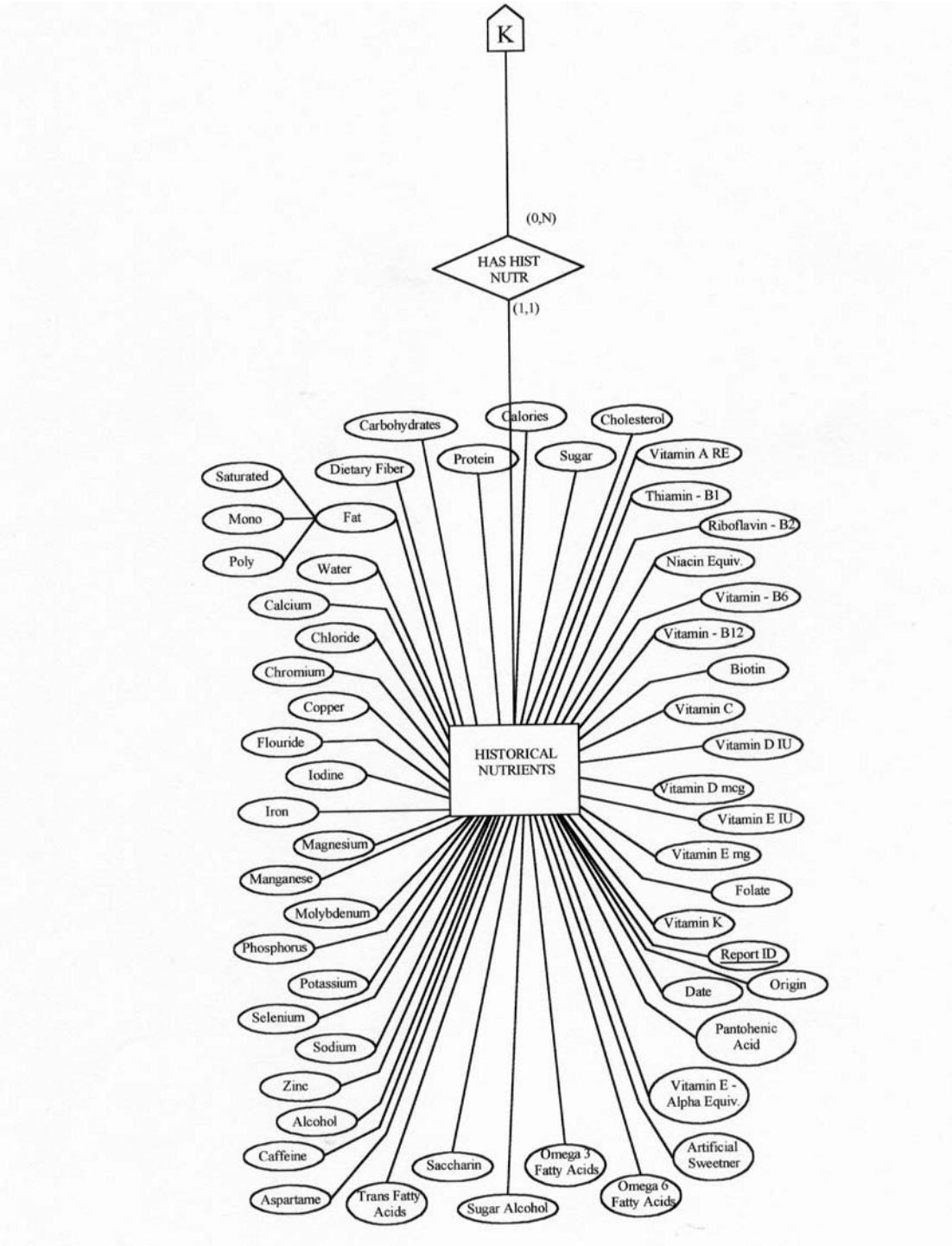


Fig. 7. (Continued)

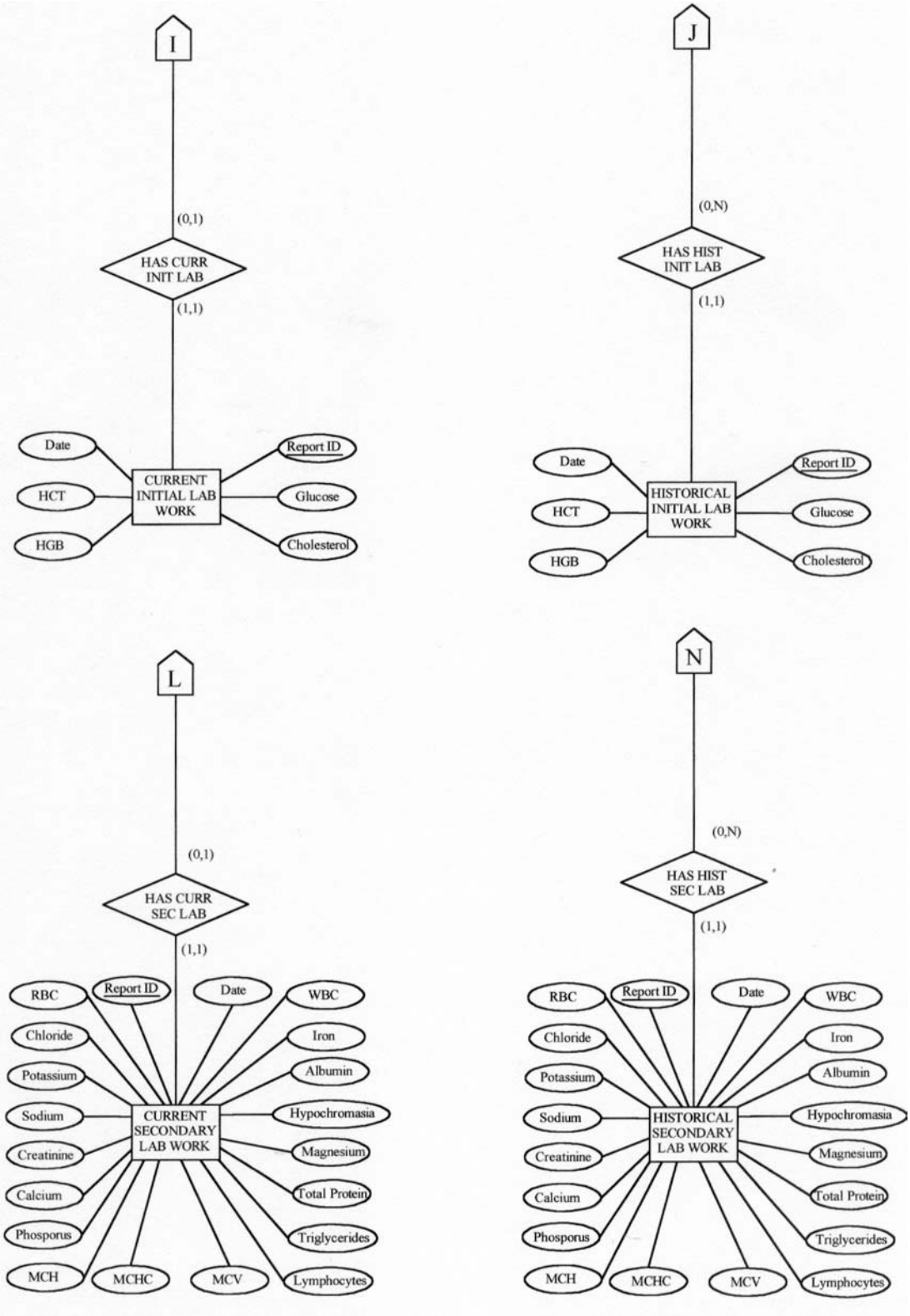


Fig. 7. (Continued)

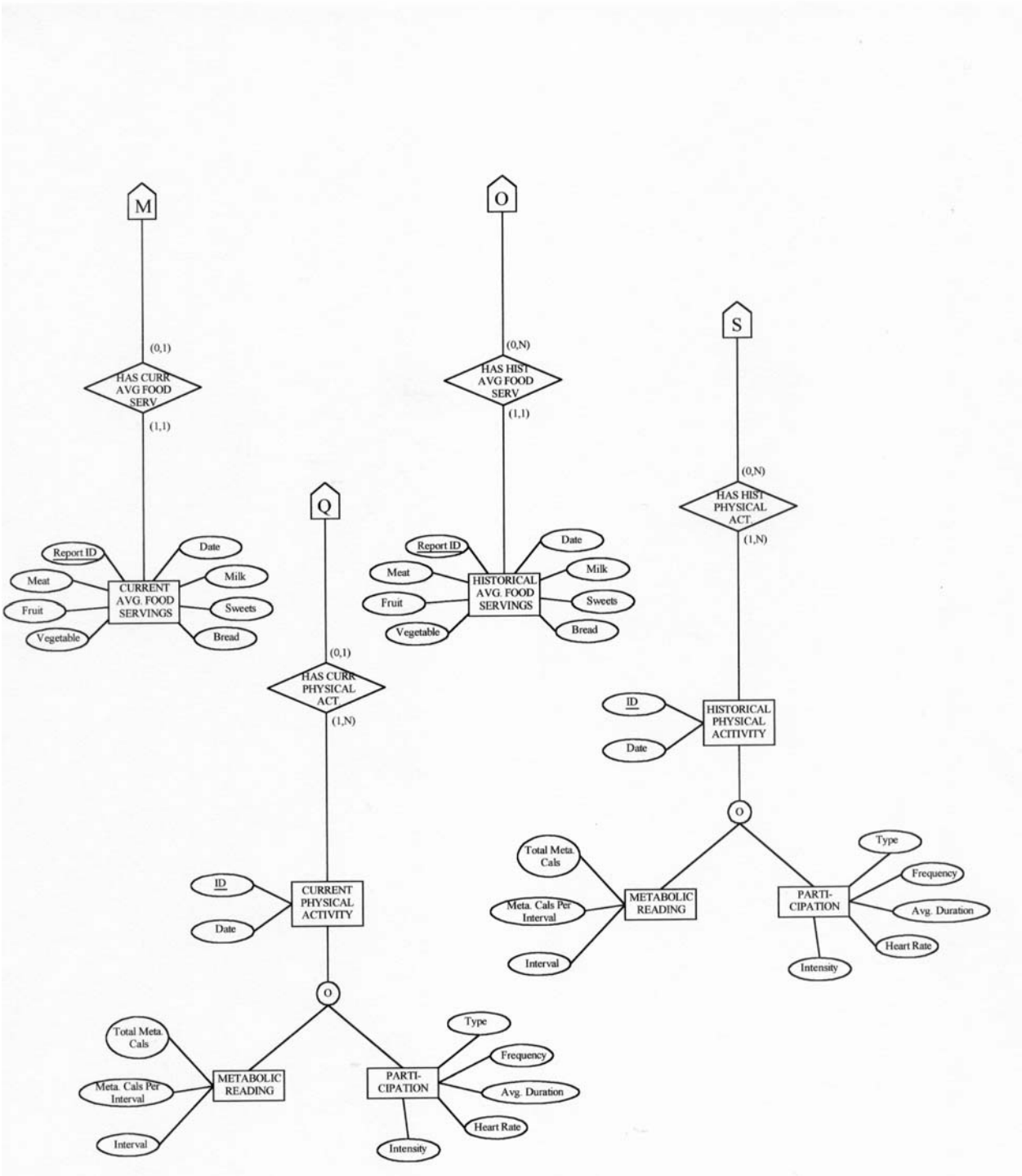


Fig. 7. (Continued)

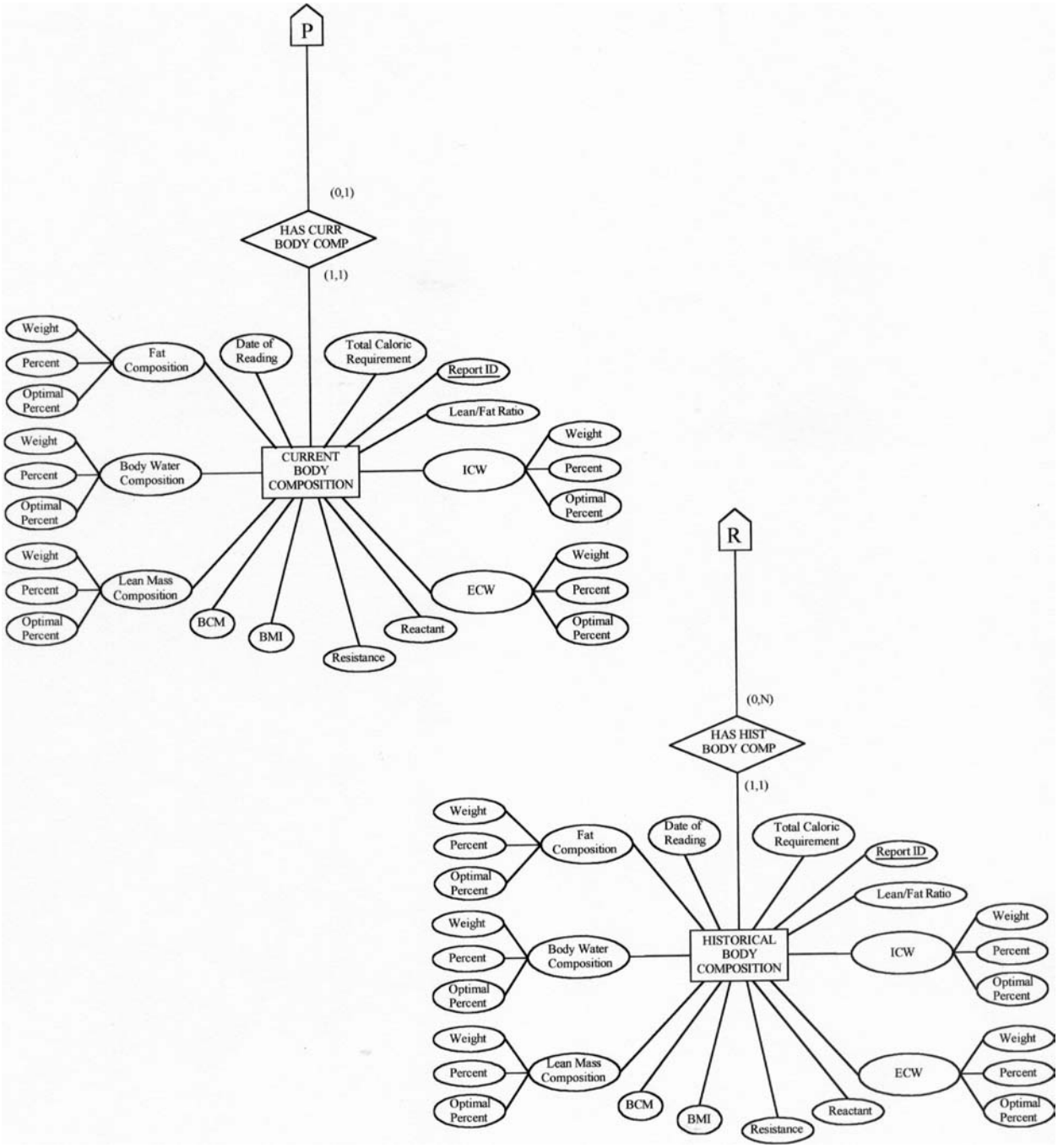


Fig. 7. (Continued)

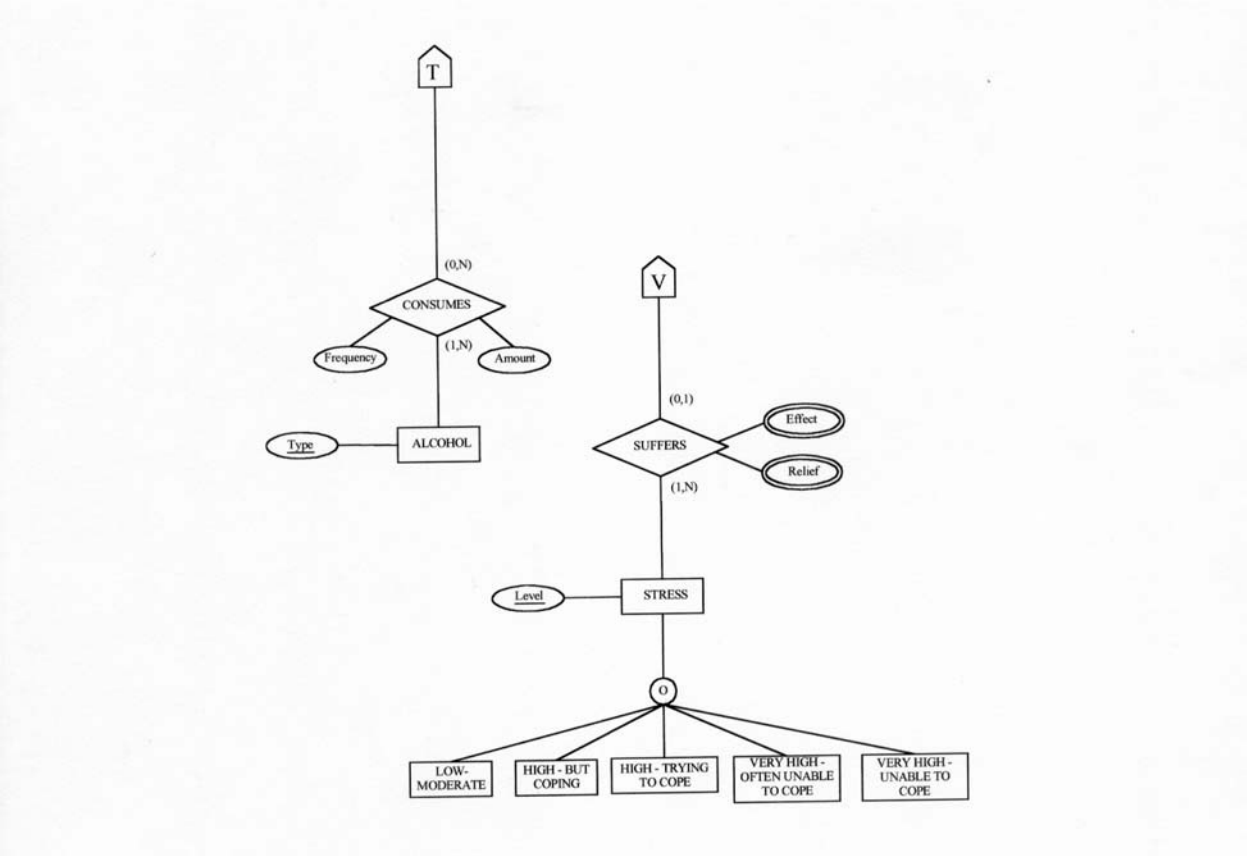


Fig. 7. (Continued)

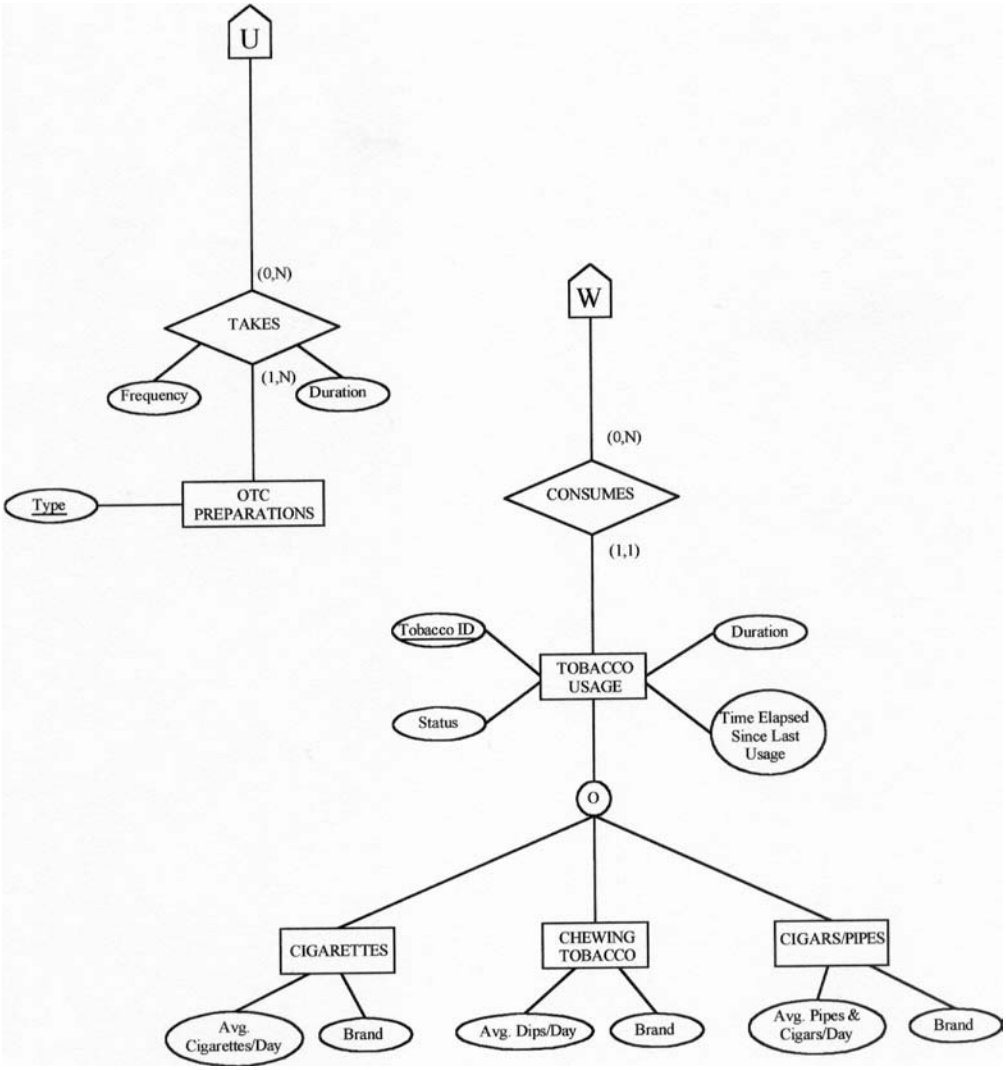


Fig. 7. (Continued)

Relational Database Tables

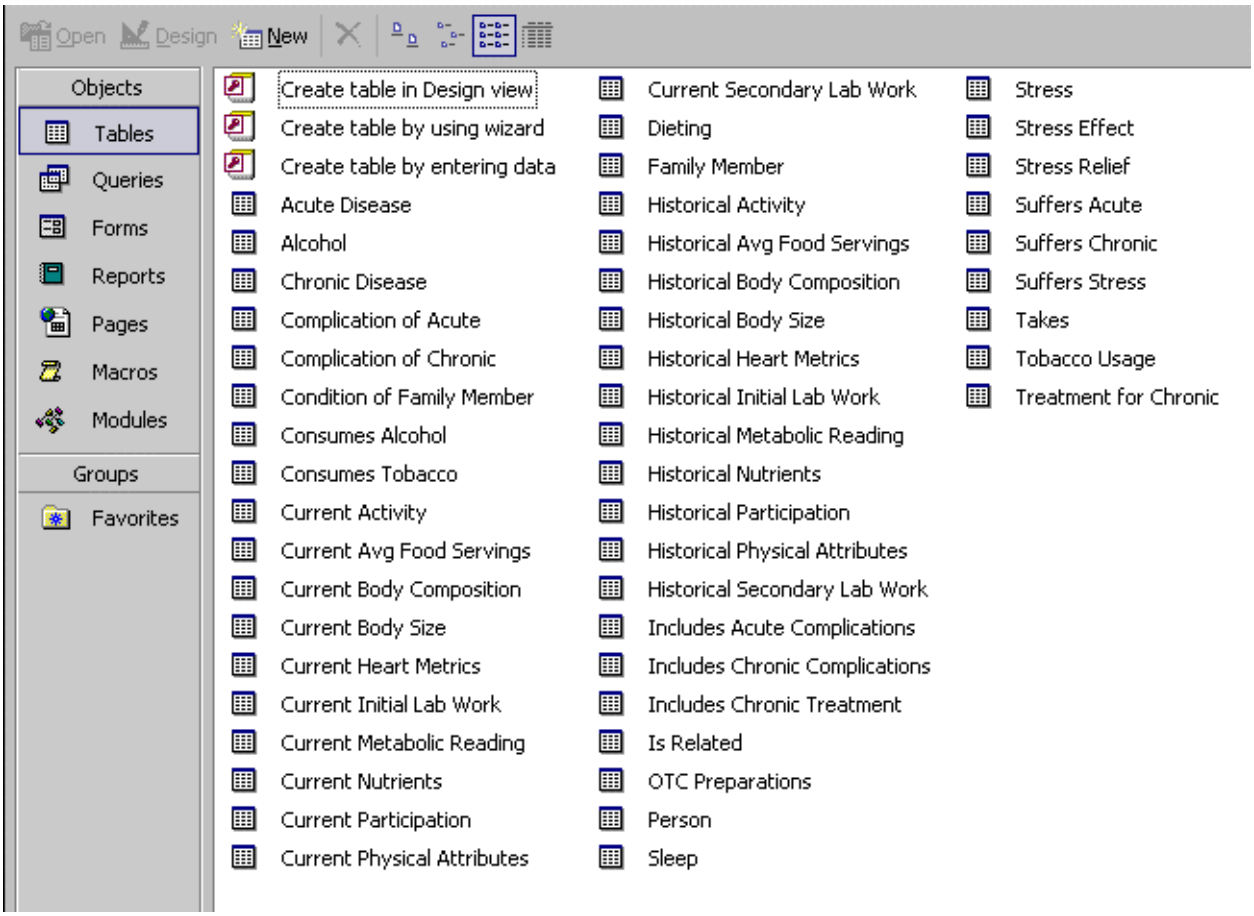


Fig. 8. Tables Contained in Relational Database

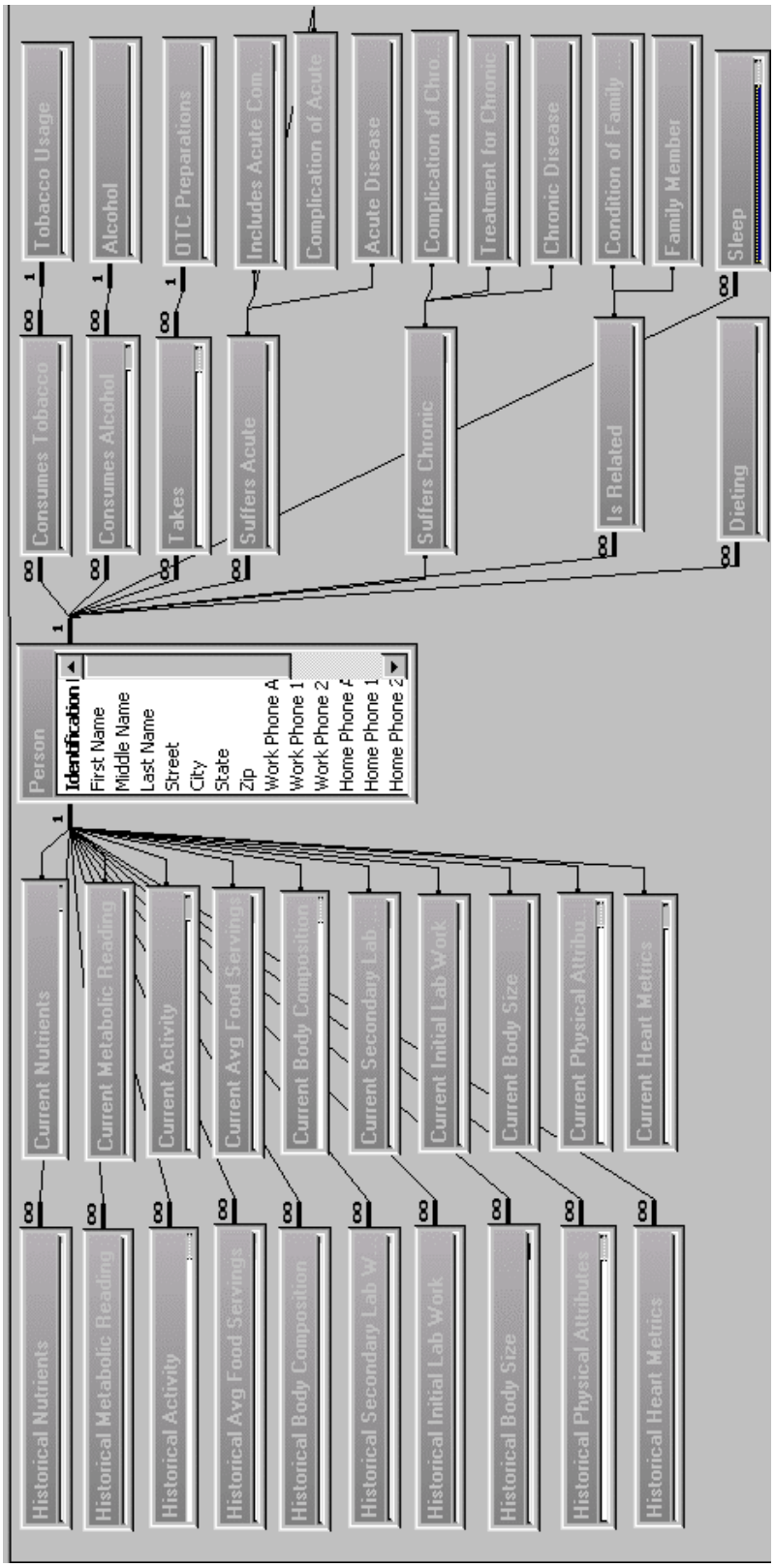


Fig. 9. Relationships Defined Between Database Tables

APPENDIX B

DRIVER PROGRAM DESIGN

User Interface

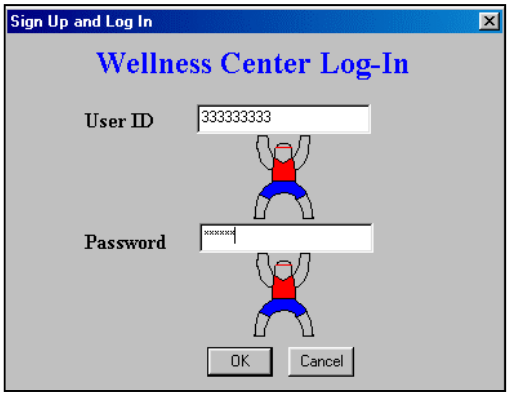


Fig. 10. Log-In Screen

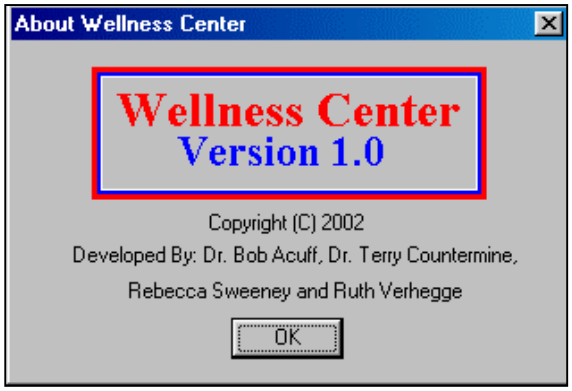


Fig. 11. About Wellness Screen

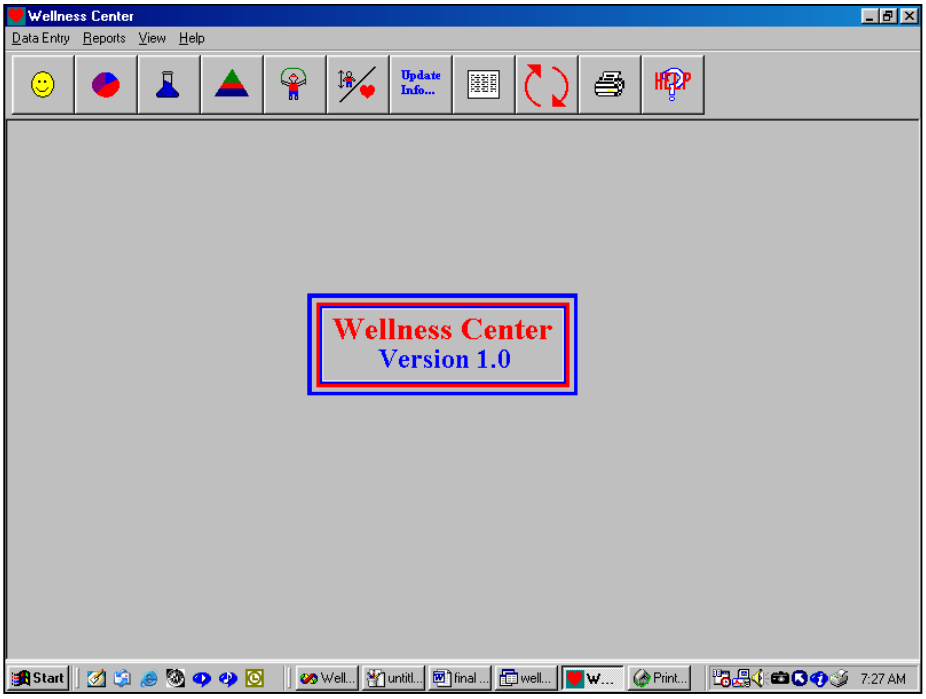


Fig. 12. Main User Screen

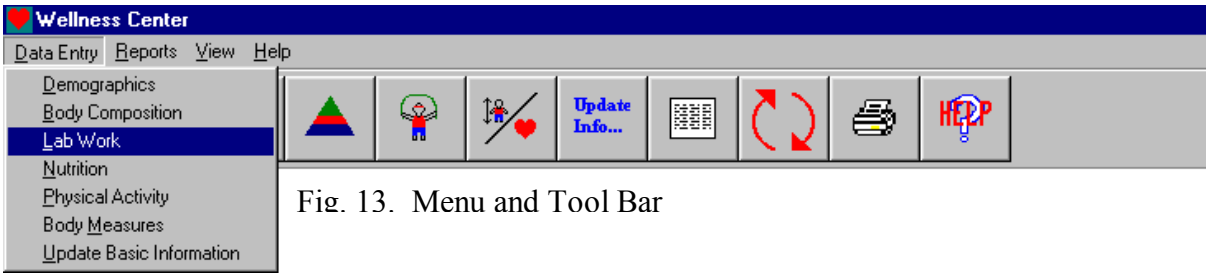


Fig. 13. Menu and Tool Bar

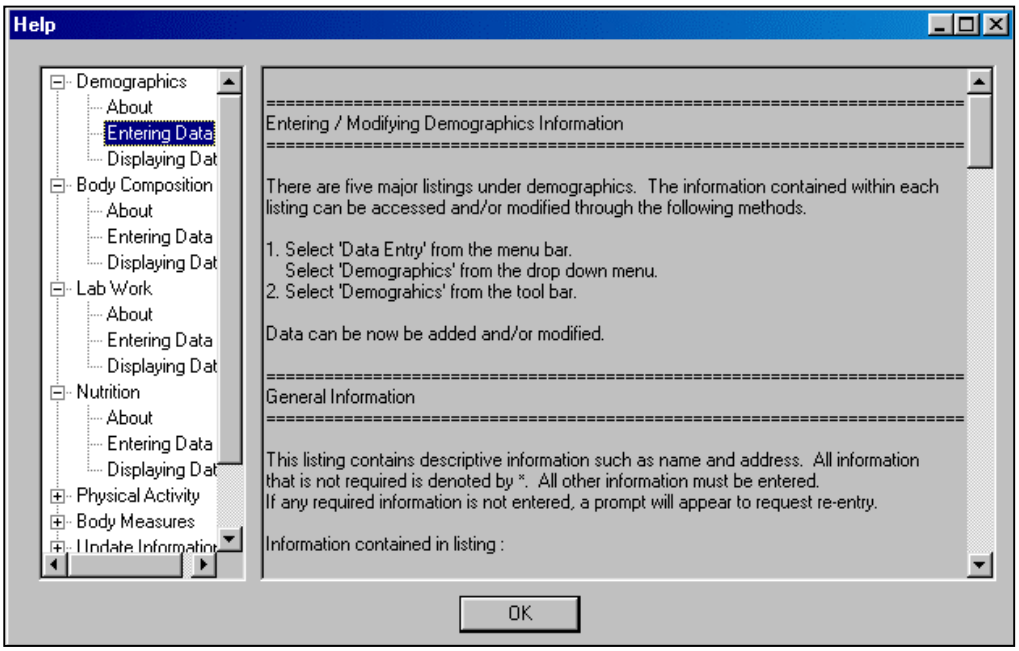


Fig. 14. User Help Files

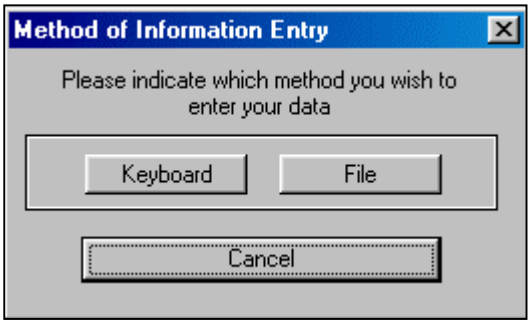


Fig. 15. Methods Available for Data Entry

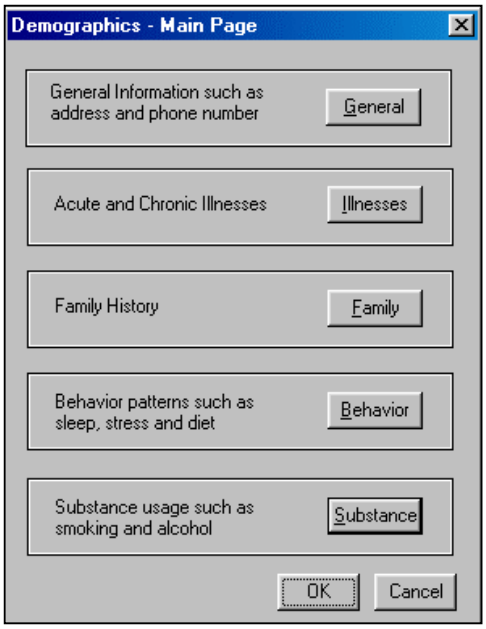


Fig. 16. Demographics - Main Page

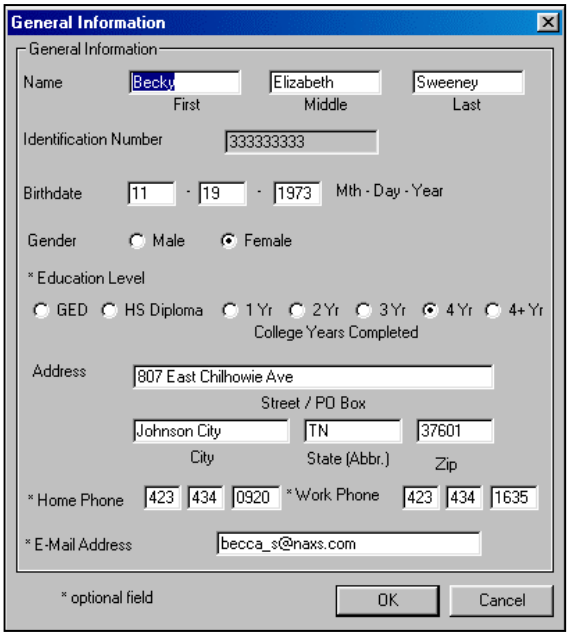


Fig. 17. Demographics – General Information

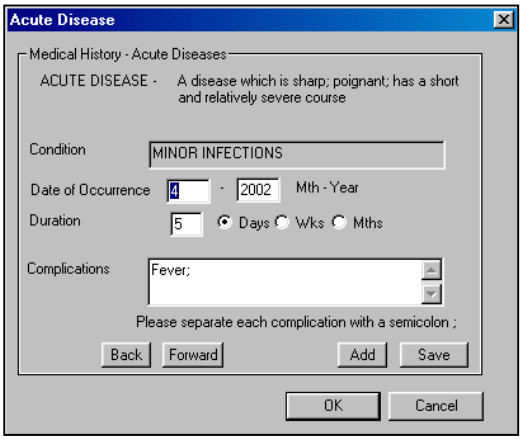


Fig. 18. Demographics – Acute Disease

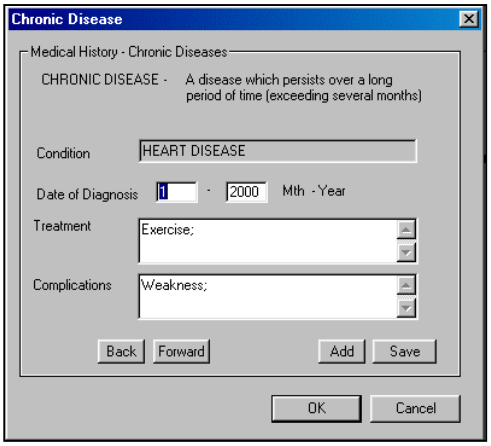


Fig. 19. Demographics – Chronic Disease

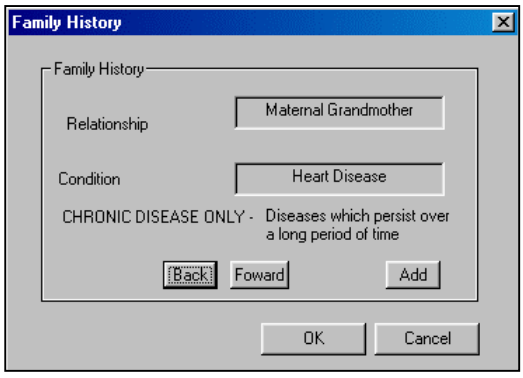


Fig. 20. Demographics – Family History

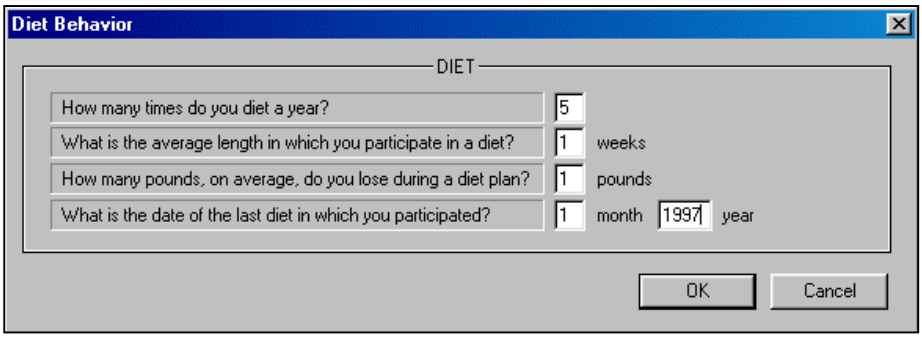


Fig. 21. Demographics – Diet Behavior

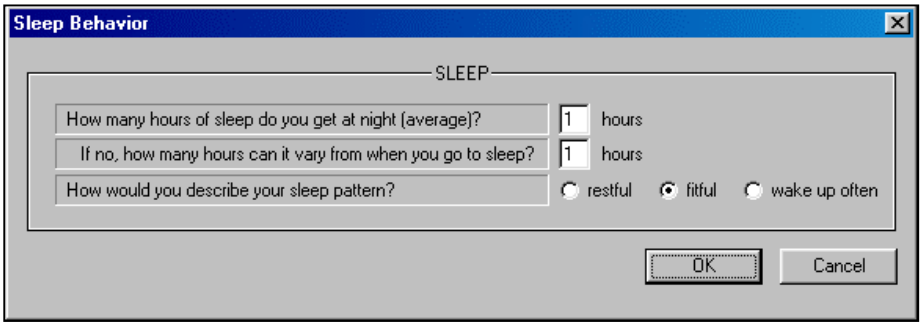


Fig. 22. Demographics – Sleep Behavior

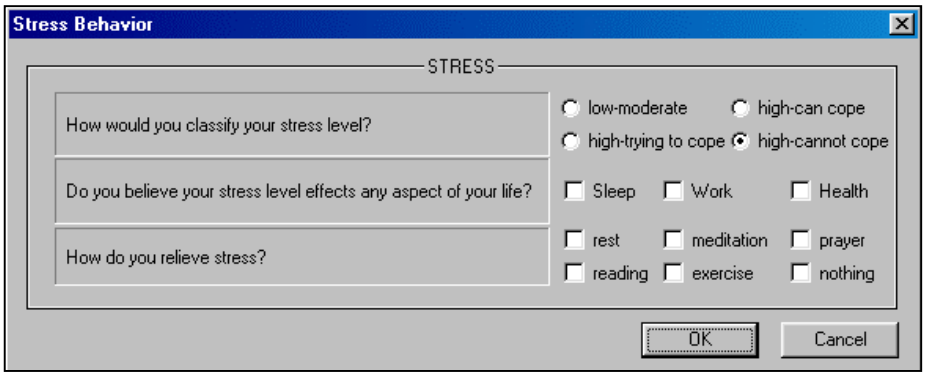


Fig. 23. Demographics – Stress Behavior

Fig. 24. Demographics – Tobacco Usage

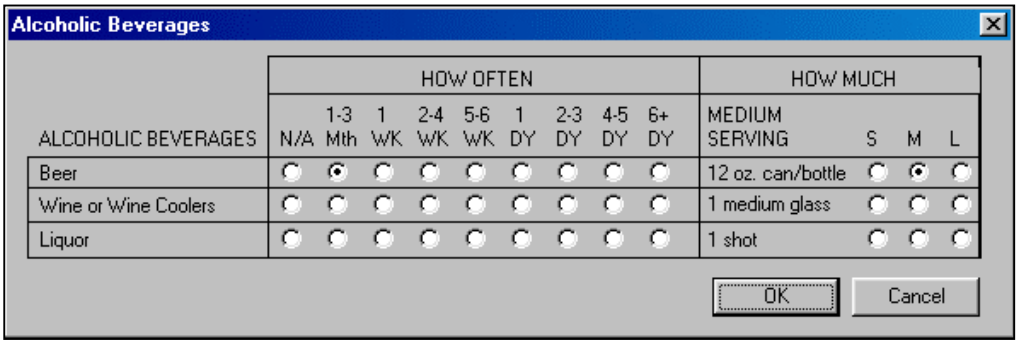


Fig. 25. Demographics – Alcohol Usage

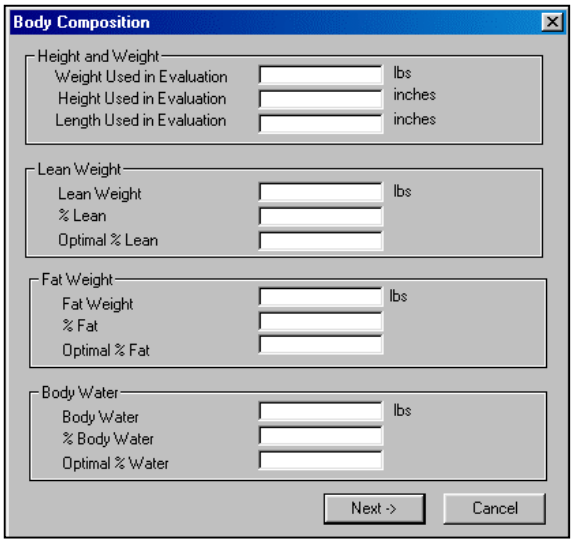


Fig. 26. Body Composition – Page 1

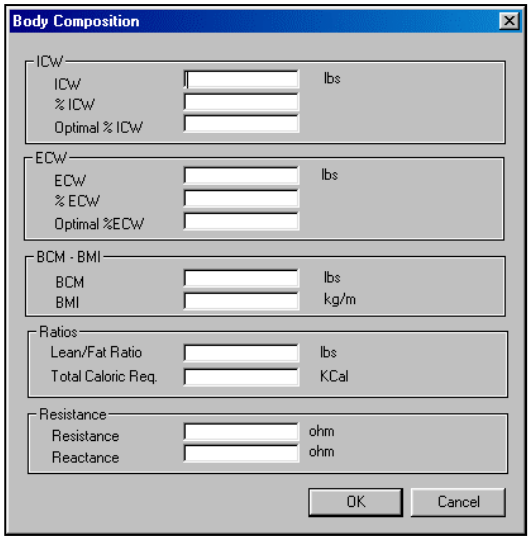


Fig. 27. Body Composition – Page 2

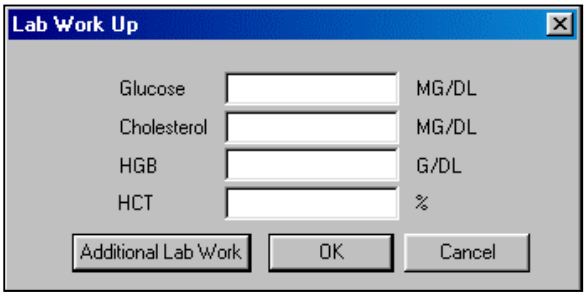


Fig. 28. Lab Work – Initial Lab Work Up

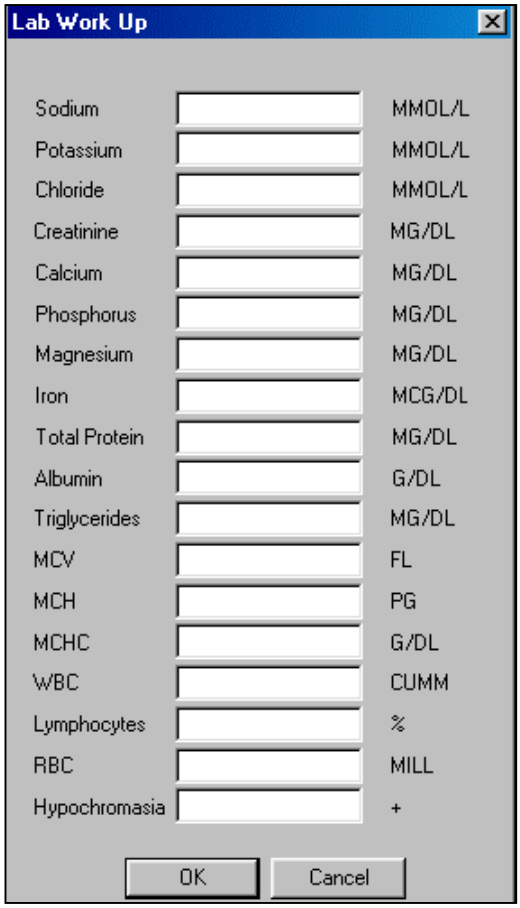


Fig. 29. Lab Work – Secondary Lab Work Up

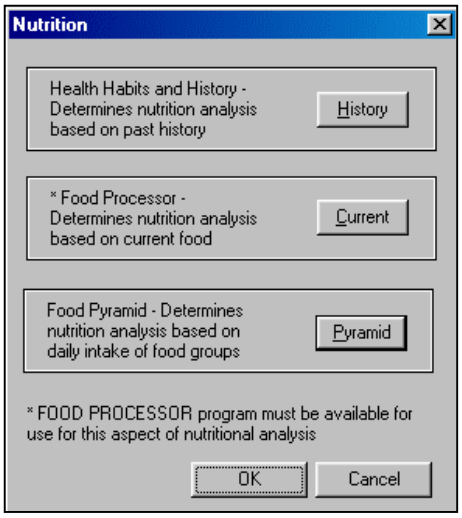


Fig. 30. Nutrients – Main Page

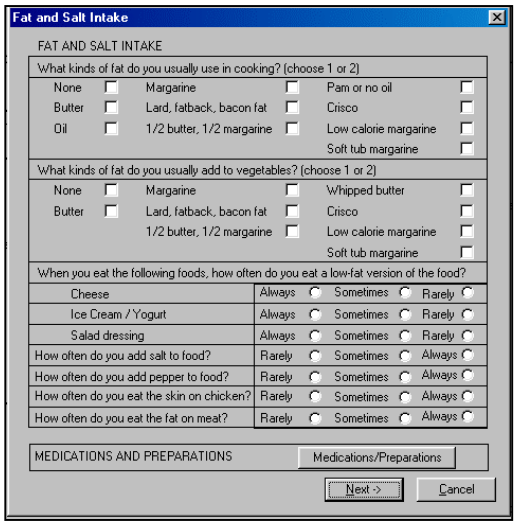


Fig. 31. Nutrients – Sample HHHQ Questionnaire

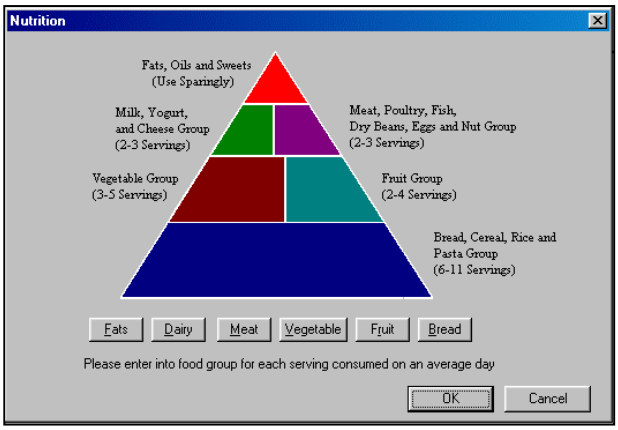


Fig. 32. Nutrients – Food Pyramid

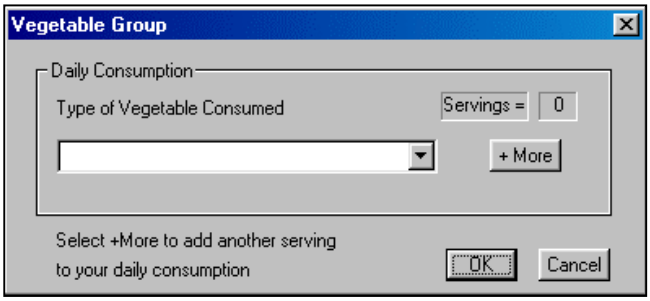


Fig. 33. Nutrients – Food Group Consumption

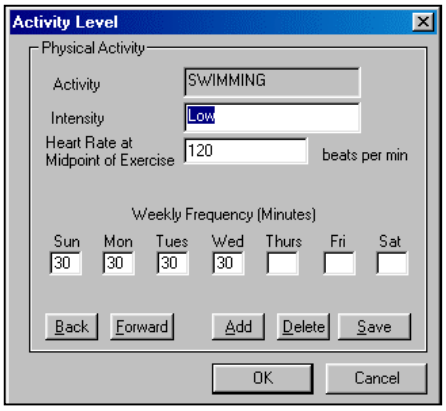


Fig. 34. Physical Activity

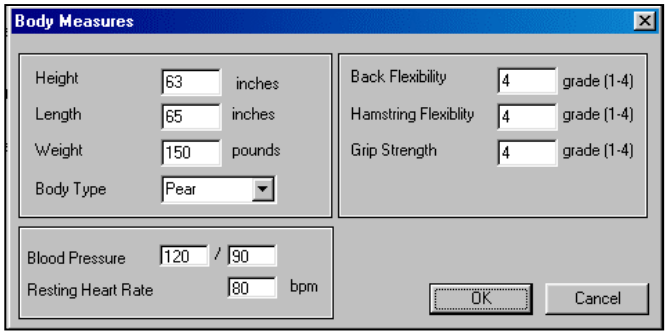


Fig. 35. Body Measures

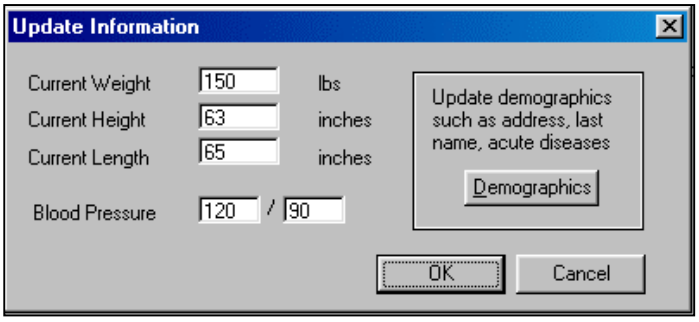


Fig. 36. Update Basic Information

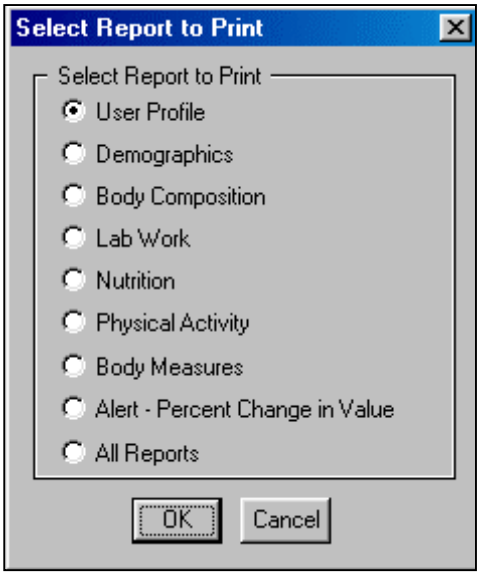


Fig. 37. Print Options

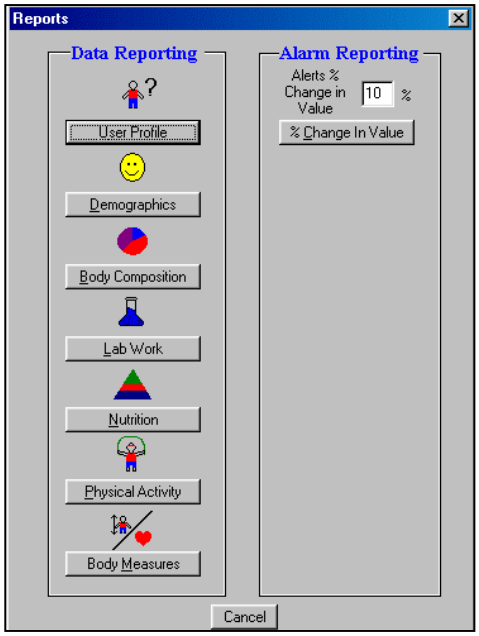


Fig. 38. Report Options

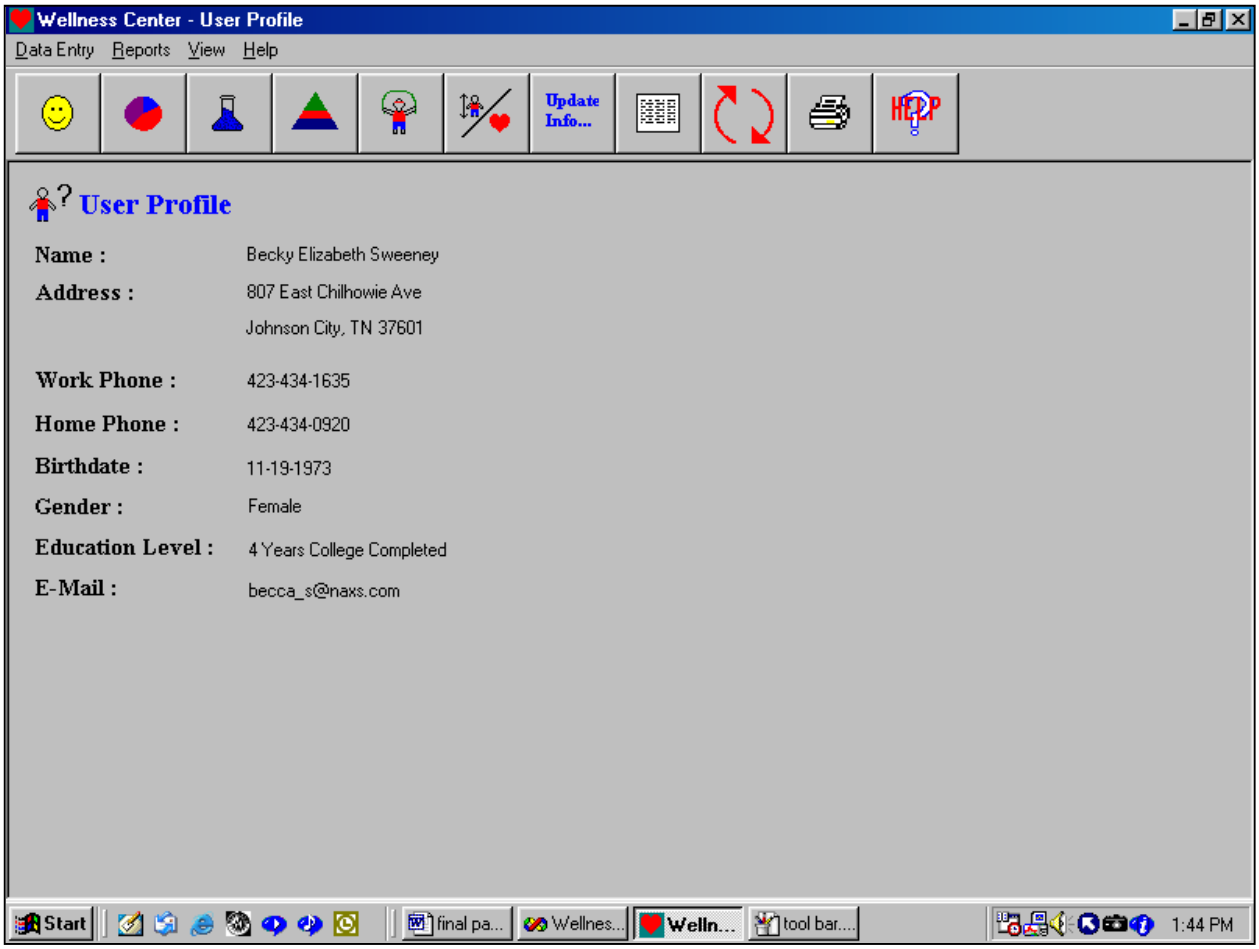


Fig. 39. User Profile Report – On Screen

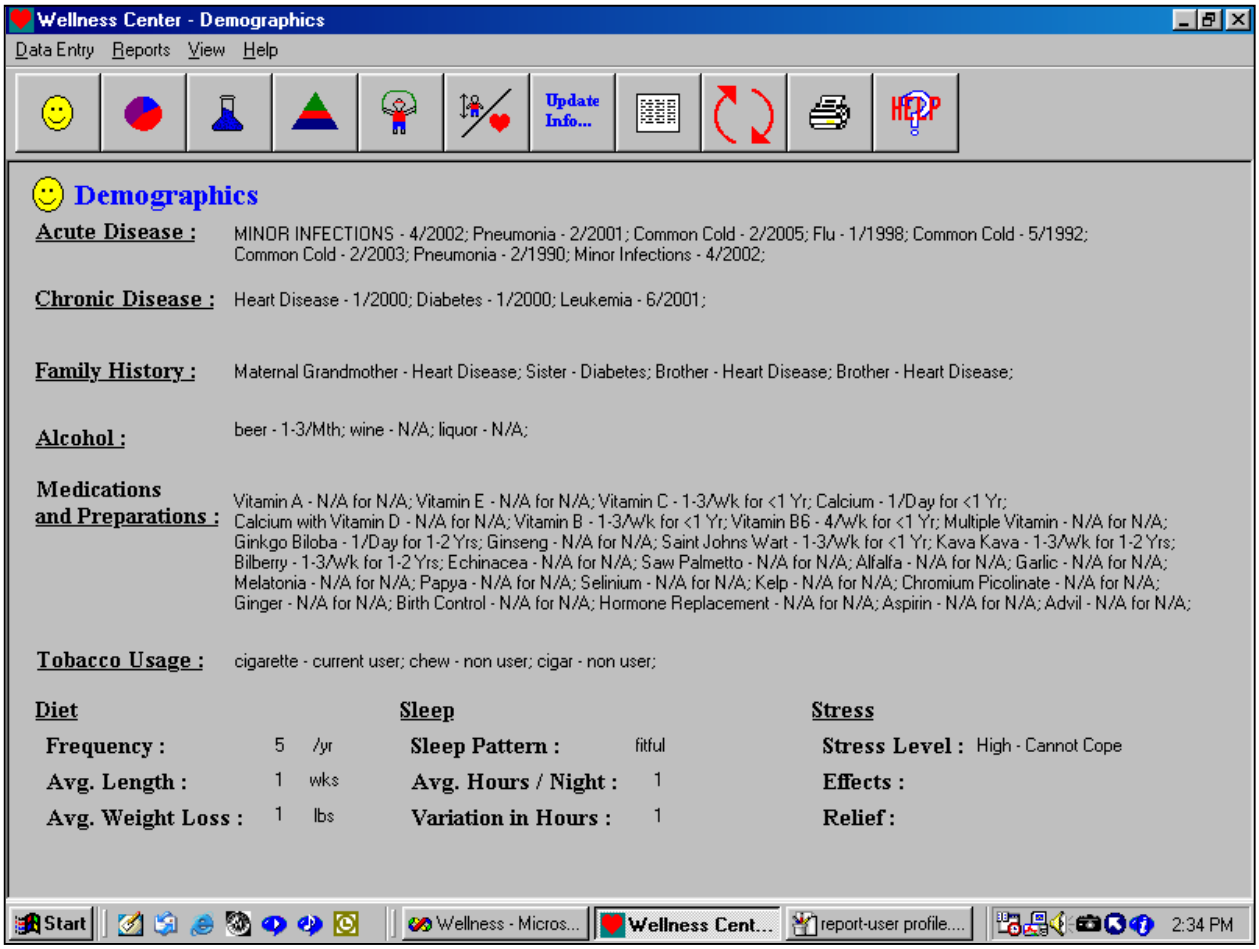


Fig. 40. Demographics Report – On Screen

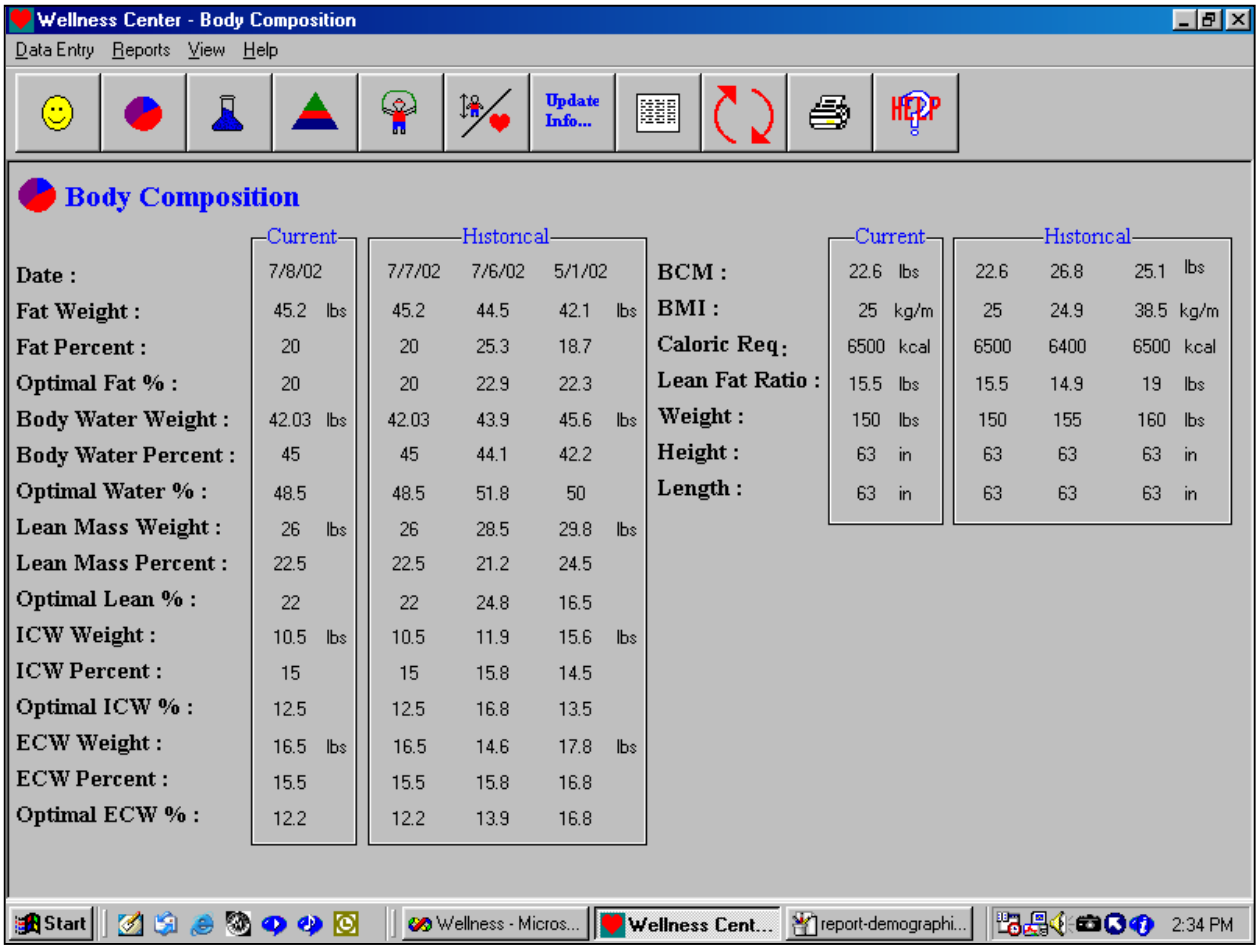


Fig. 41. Body Composition Report – On Screen

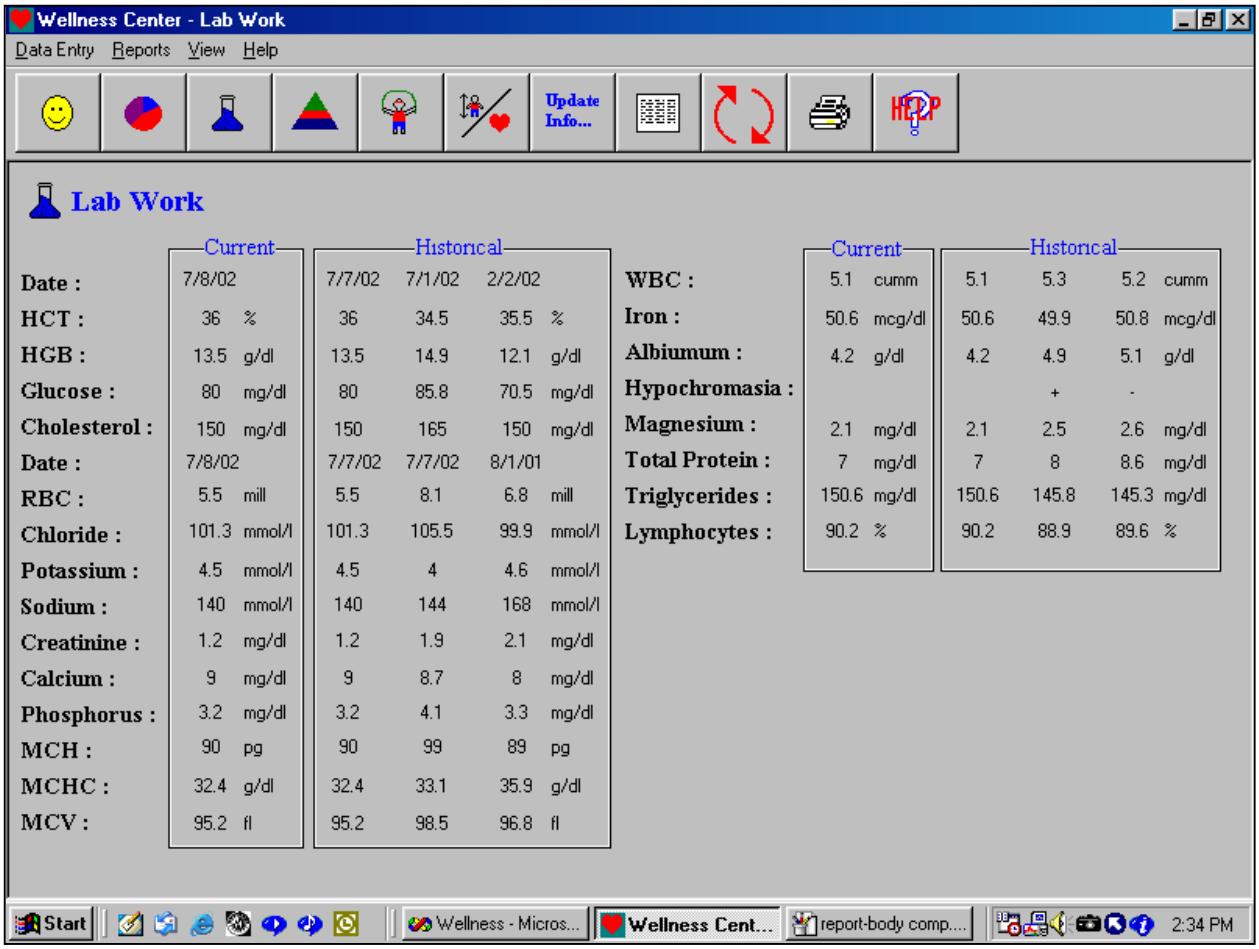


Fig. 42. Lab Work Report – On Screen

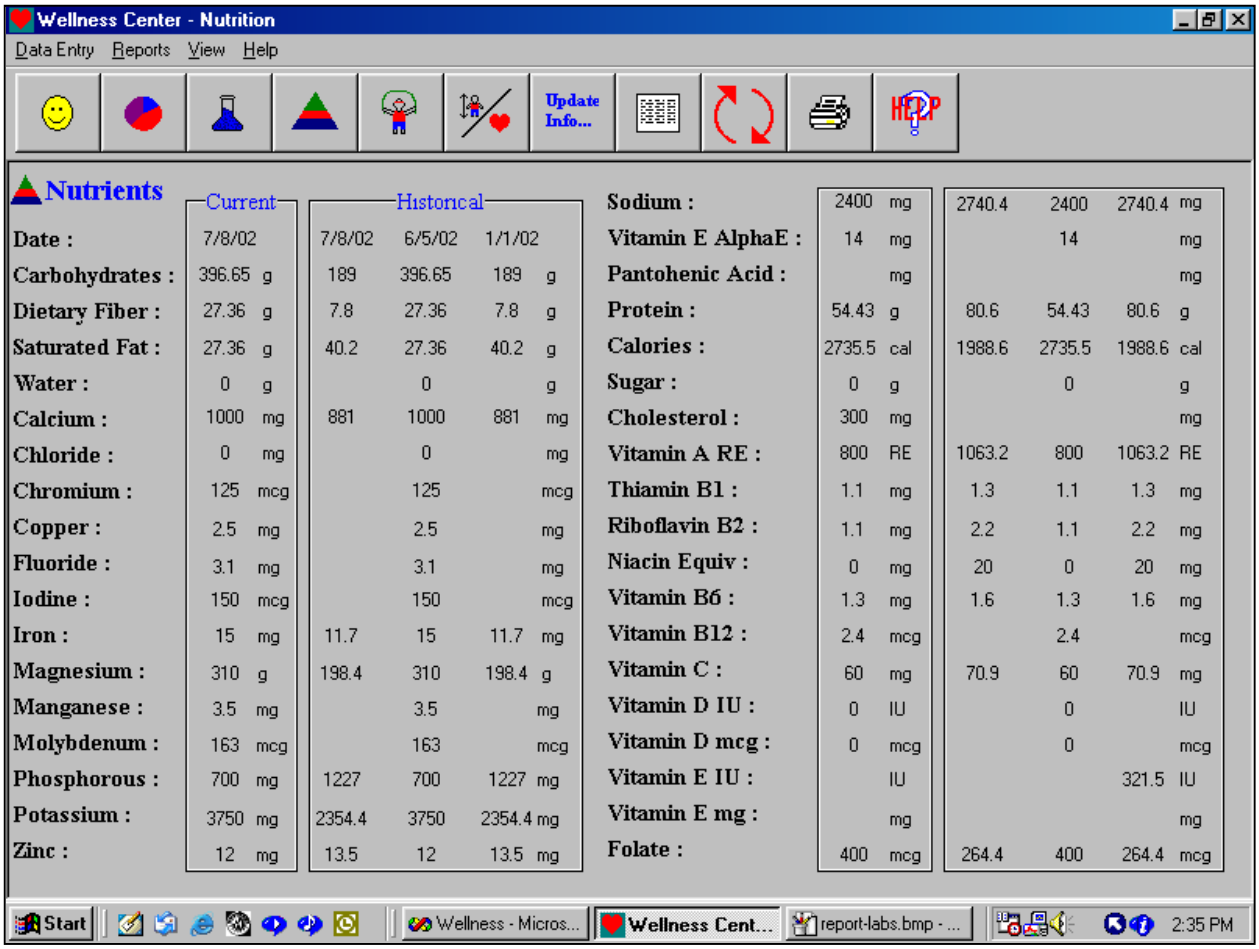


Fig. 43. Nutrition Report – On Screen

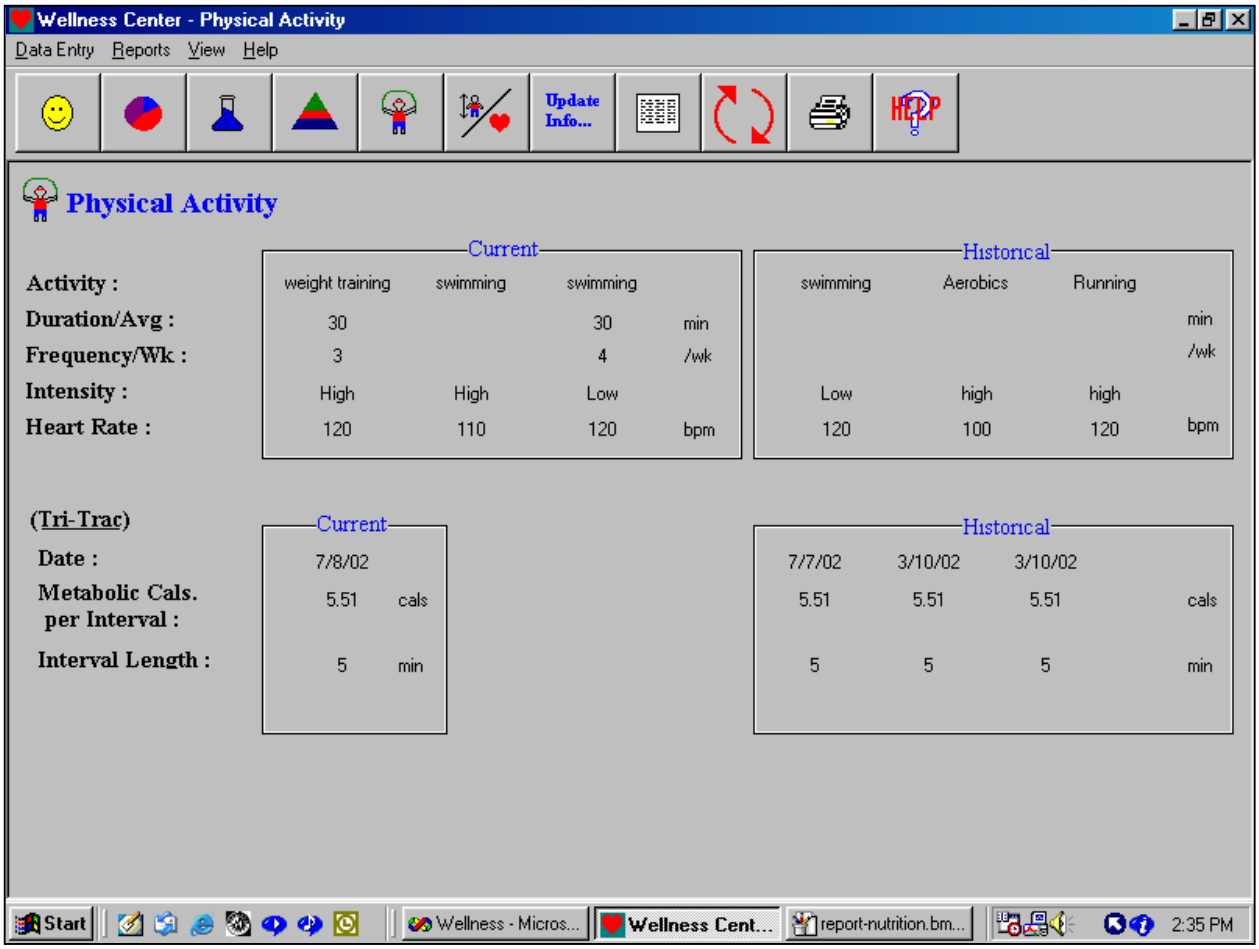


Fig. 44. Physical Activity Report – On Screen

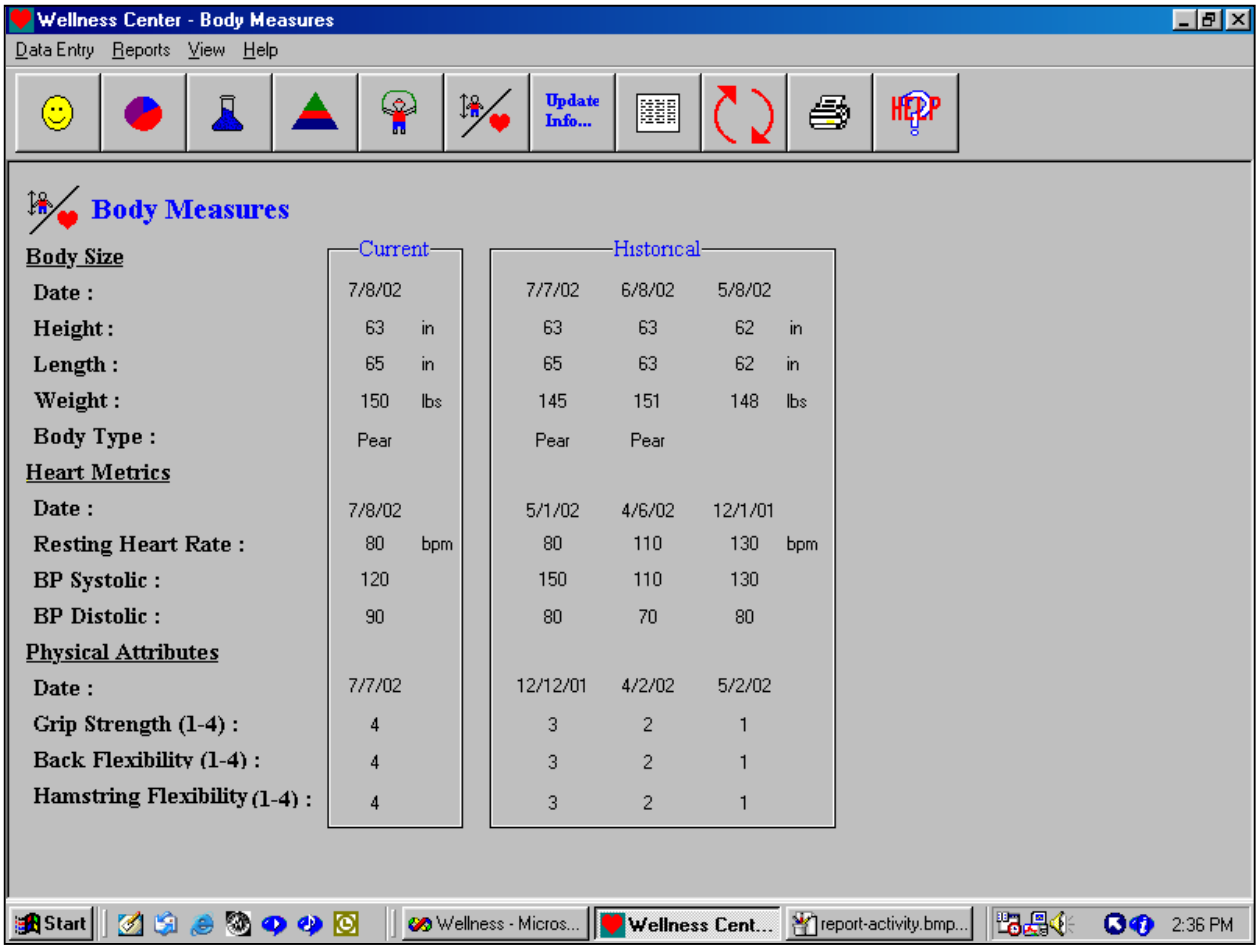


Fig. 45. Body Measures Report – On Screen

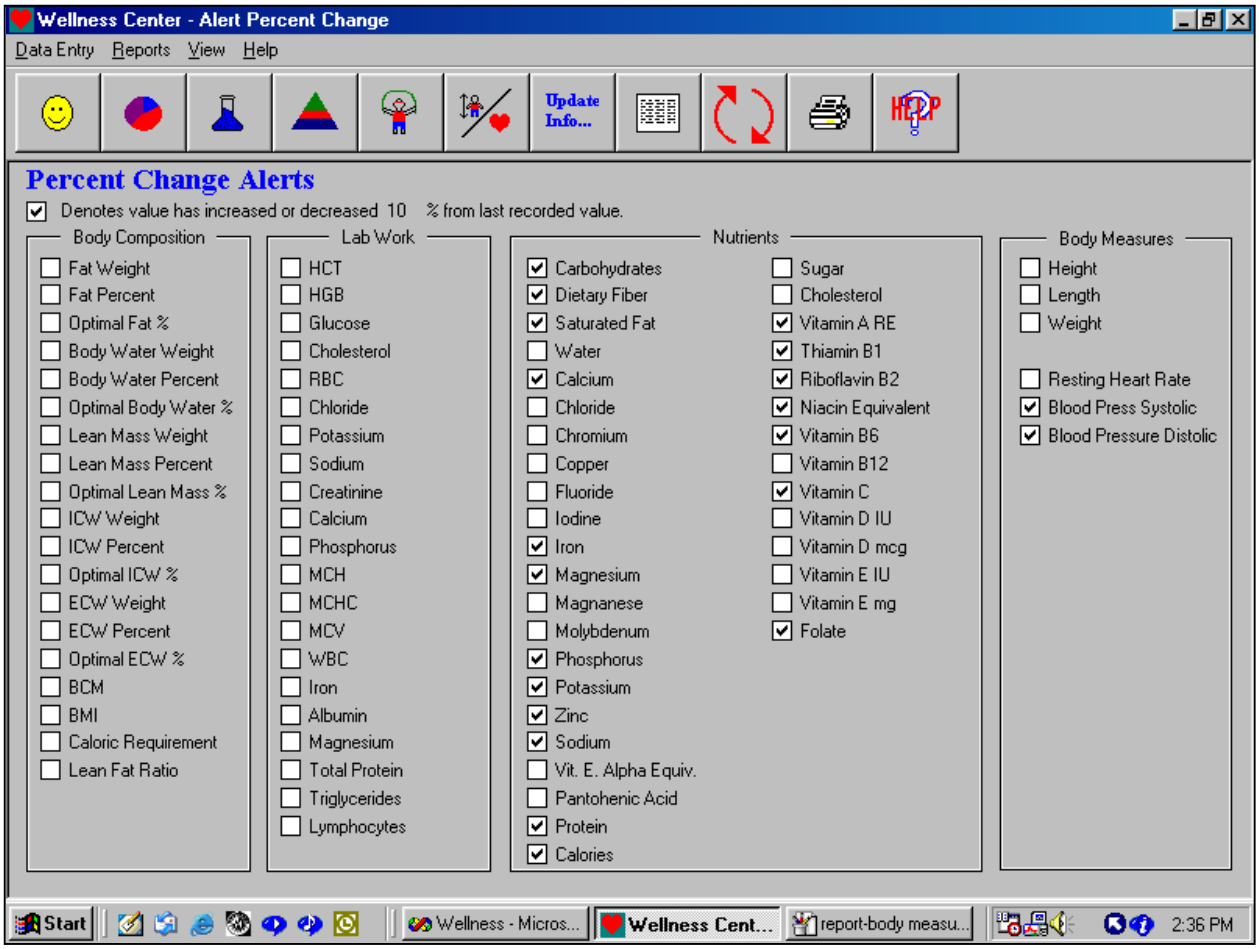
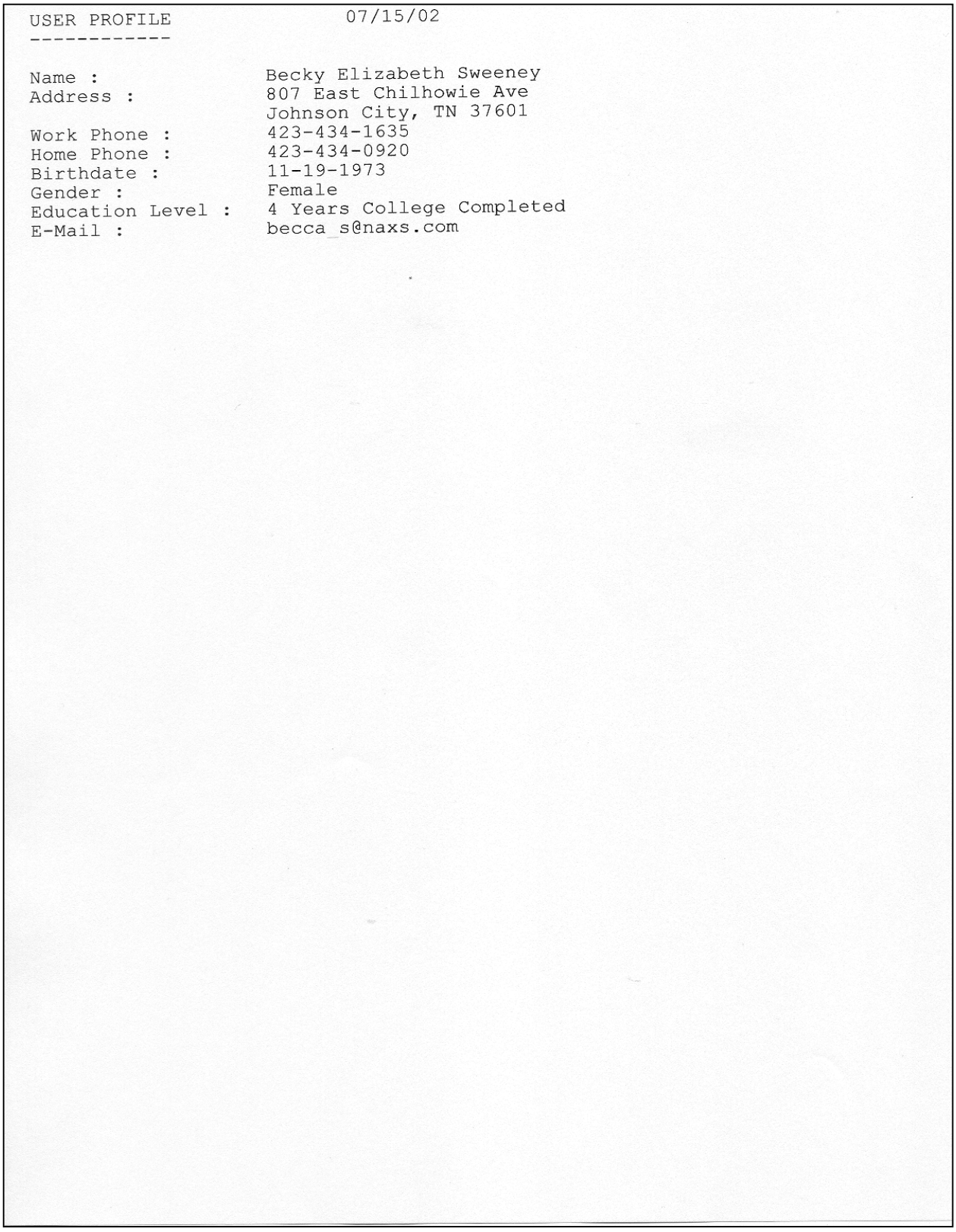


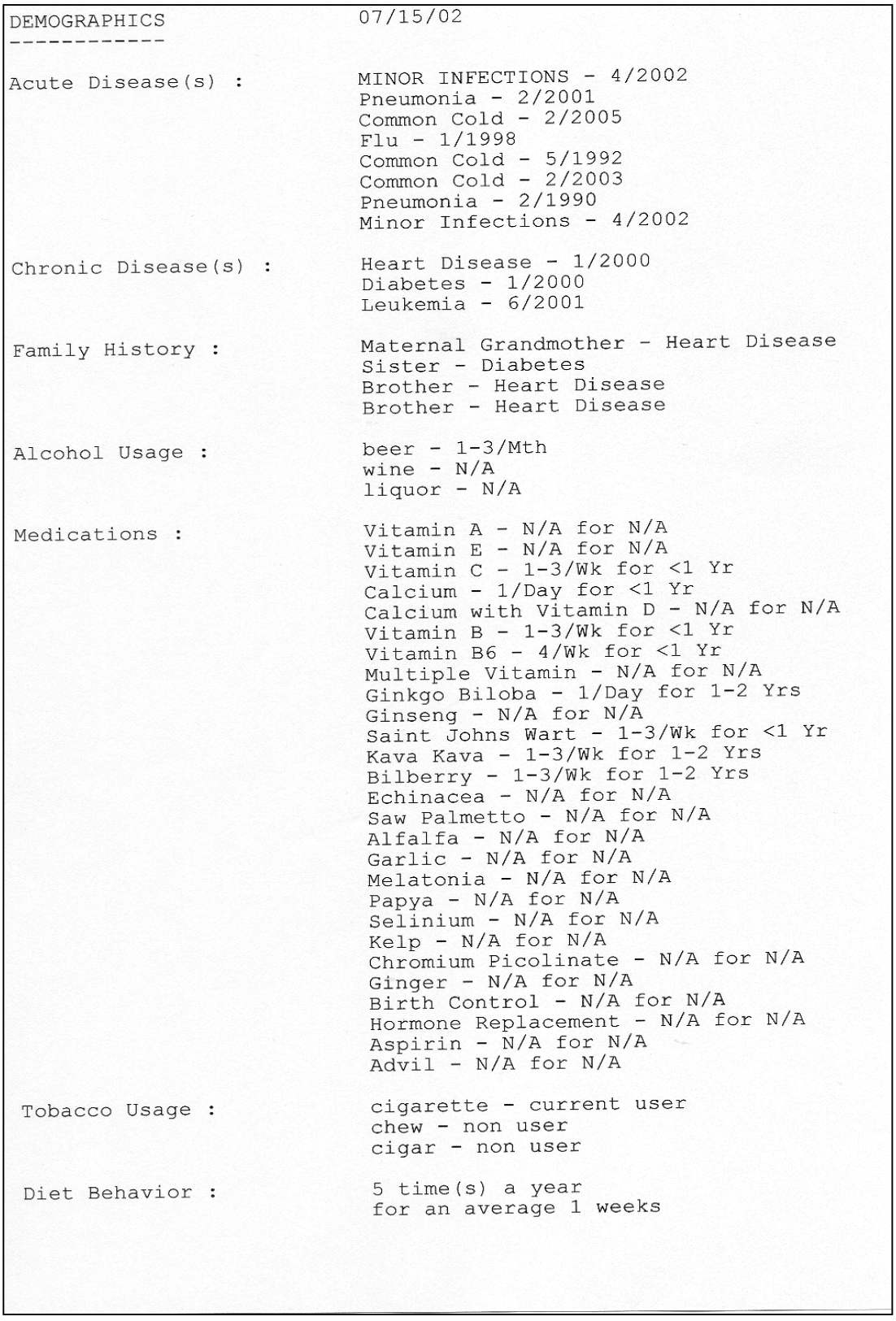
Fig. 46. Percent Change Alarms Report – On Screen



USER PROFILE 07/15/02

Name :	Becky Elizabeth Sweeney
Address :	807 East Chilhowie Ave Johnson City, TN 37601
Work Phone :	423-434-1635
Home Phone :	423-434-0920
Birthdate :	11-19-1973
Gender :	Female
Education Level :	4 Years College Completed
E-Mail :	becca_s@naxs.com

Fig. 47. User Profile Report – Printed Report



DEMOGRAPHICS 07/15/02

Acute Disease(s) :
MINOR INFECTIONS - 4/2002
Pneumonia - 2/2001
Common Cold - 2/2005
Flu - 1/1998
Common Cold - 5/1992
Common Cold - 2/2003
Pneumonia - 2/1990
Minor Infections - 4/2002

Chronic Disease(s) :
Heart Disease - 1/2000
Diabetes - 1/2000
Leukemia - 6/2001

Family History :
Maternal Grandmother - Heart Disease
Sister - Diabetes
Brother - Heart Disease
Brother - Heart Disease

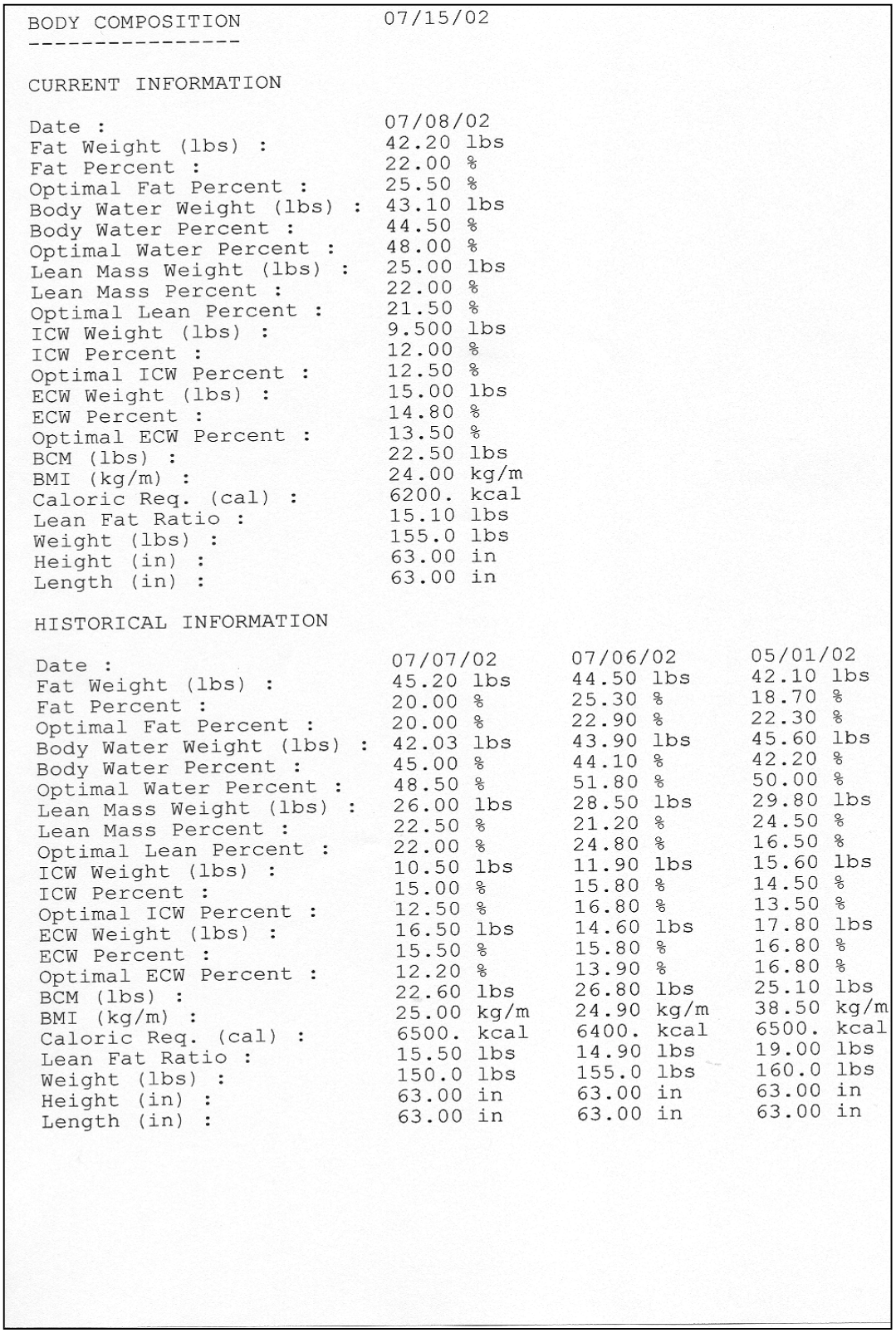
Alcohol Usage :
beer - 1-3/Mth
wine - N/A
liquor - N/A

Medications :
Vitamin A - N/A for N/A
Vitamin E - N/A for N/A
Vitamin C - 1-3/Wk for <1 Yr
Calcium - 1/Day for <1 Yr
Calcium with Vitamin D - N/A for N/A
Vitamin B - 1-3/Wk for <1 Yr
Vitamin B6 - 4/Wk for <1 Yr
Multiple Vitamin - N/A for N/A
Ginkgo Biloba - 1/Day for 1-2 Yrs
Ginseng - N/A for N/A
Saint Johns Wart - 1-3/Wk for <1 Yr
Kava Kava - 1-3/Wk for 1-2 Yrs
Bilberry - 1-3/Wk for 1-2 Yrs
Echinacea - N/A for N/A
Saw Palmetto - N/A for N/A
Alfalfa - N/A for N/A
Garlic - N/A for N/A
Melatonia - N/A for N/A
Papya - N/A for N/A
Selinium - N/A for N/A
Kelp - N/A for N/A
Chromium Picolinate - N/A for N/A
Ginger - N/A for N/A
Birth Control - N/A for N/A
Hormone Replacement - N/A for N/A
Aspirin - N/A for N/A
Advil - N/A for N/A

Tobacco Usage :
cigarette - current user
chew - non user
cigar - non user

Diet Behavior :
5 time(s) a year
for an average 1 weeks

Fig. 48. Demographics Report – Printed Report



BODY COMPOSITION 07/15/02

CURRENT INFORMATION

Date :	07/08/02
Fat Weight (lbs) :	42.20 lbs
Fat Percent :	22.00 %
Optimal Fat Percent :	25.50 %
Body Water Weight (lbs) :	43.10 lbs
Body Water Percent :	44.50 %
Optimal Water Percent :	48.00 %
Lean Mass Weight (lbs) :	25.00 lbs
Lean Mass Percent :	22.00 %
Optimal Lean Percent :	21.50 %
ICW Weight (lbs) :	9.500 lbs
ICW Percent :	12.00 %
Optimal ICW Percent :	12.50 %
ECW Weight (lbs) :	15.00 lbs
ECW Percent :	14.80 %
Optimal ECW Percent :	13.50 %
BCM (lbs) :	22.50 lbs
BMI (kg/m) :	24.00 kg/m
Caloric Req. (cal) :	6200. kcal
Lean Fat Ratio :	15.10 lbs
Weight (lbs) :	155.0 lbs
Height (in) :	63.00 in
Length (in) :	63.00 in

HISTORICAL INFORMATION

Date :	07/07/02	07/06/02	05/01/02
Fat Weight (lbs) :	45.20 lbs	44.50 lbs	42.10 lbs
Fat Percent :	20.00 %	25.30 %	18.70 %
Optimal Fat Percent :	20.00 %	22.90 %	22.30 %
Body Water Weight (lbs) :	42.03 lbs	43.90 lbs	45.60 lbs
Body Water Percent :	45.00 %	44.10 %	42.20 %
Optimal Water Percent :	48.50 %	51.80 %	50.00 %
Lean Mass Weight (lbs) :	26.00 lbs	28.50 lbs	29.80 lbs
Lean Mass Percent :	22.50 %	21.20 %	24.50 %
Optimal Lean Percent :	22.00 %	24.80 %	16.50 %
ICW Weight (lbs) :	10.50 lbs	11.90 lbs	15.60 lbs
ICW Percent :	15.00 %	15.80 %	14.50 %
Optimal ICW Percent :	12.50 %	16.80 %	13.50 %
ECW Weight (lbs) :	16.50 lbs	14.60 lbs	17.80 lbs
ECW Percent :	15.50 %	15.80 %	16.80 %
Optimal ECW Percent :	12.20 %	13.90 %	16.80 %
BCM (lbs) :	22.60 lbs	26.80 lbs	25.10 lbs
BMI (kg/m) :	25.00 kg/m	24.90 kg/m	38.50 kg/m
Caloric Req. (cal) :	6500. kcal	6400. kcal	6500. kcal
Lean Fat Ratio :	15.50 lbs	14.90 lbs	19.00 lbs
Weight (lbs) :	150.0 lbs	155.0 lbs	160.0 lbs
Height (in) :	63.00 in	63.00 in	63.00 in
Length (in) :	63.00 in	63.00 in	63.00 in

Fig. 49. Body Composition Report – Printed Report

LAB WORK

07/15/02

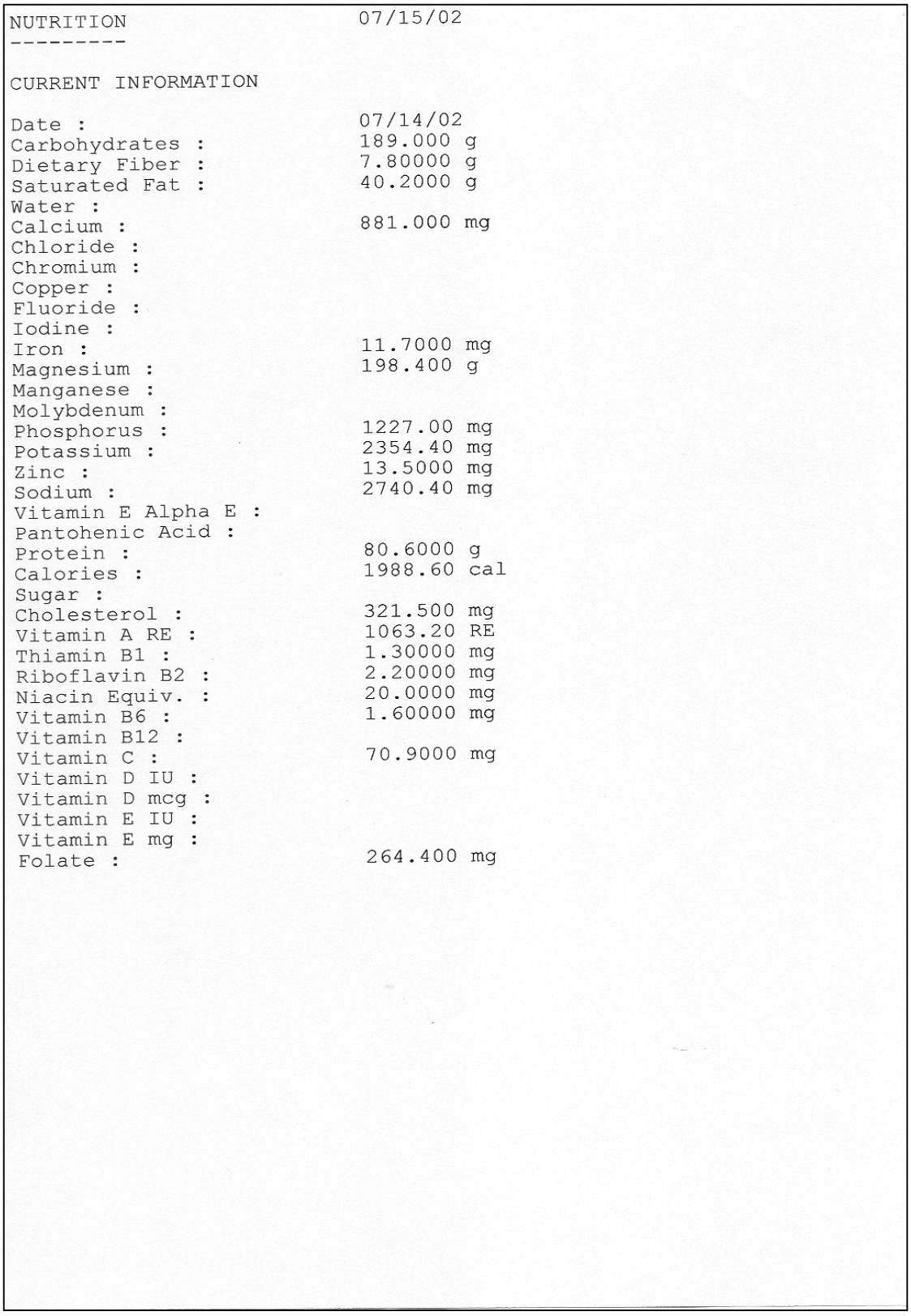
CURRENT INFORMATION

Date :	07/12/02
HCT :	35.00 %
HGB :	12.50 g/dl
Glucose :	75.00 mg/dl
Cholesterol :	149.5 mg/dl
Date :	07/13/02
RBC :	4.500 mill
Chloride :	102.5 mmol/l
Potassium :	4.200 mmol/l
Sodium :	139.0 mmol/l
Creatinine :	1.100 mg/dl
Calcium :	8.000 mg/dl
Phosphorus :	3.100 mg/dl
MCH :	85.80 pg
MCHC :	31.50 g/dl
MCV :	94.60 fl
WBC :	5.000 cumm
Iron :	56.30 mcg/dl
Albiumum :	2.100 g/dl
Hypochromasia :	-
Magnesium :	1.100 mg/dl
Total Protein :	6.800 mg/dl
Triglycerides :	149.3 mg/dl
Lymphocytes :	89.50 in

HISTORICAL INFORMATION

Date :	07/07/02	07/01/02	02/02/02
HCT :	36.00 %	34.50 %	35.50 %
HGB :	13.50 g/dl	14.90 g/dl	12.10 g/dl
Glucose :	80.00 mg/dl	85.80 mg/dl	70.50 mg/dl
Cholesterol :	150.0 mg/dl	165.0 mg/dl	150.0 mg/dl
Date :	07/07/02	06/01/02	08/01/01
RBC :	5.500 mill	8.100 mill	6.800 mill
Chloride :	101.3 mmol/l	105.5 mmol/l	99.90 mmol/l
Potassium :	4.500 mmol/l	4.000 mmol/l	4.600 mmol/l
Sodium :	140.0 mmol/l	144.0 mmol/l	168.0 mmol/l
Creatinine :	1.200 mg/dl	1.900 mg/dl	2.100 mg/dl
Calcium :	9.000 mg/dl	8.700 mg/dl	8.000 mg/dl
Phosphorus :	3.200 mg/dl	4.100 mg/dl	3.300 mg/dl
MCH :	90.00 pg	99.00 pg	89.00 pg
MCHC :	32.40 g/dl	33.10 g/dl	35.90 g/dl
MCV :	95.20 fl	98.50 fl	96.80 fl
WBC :	5.100 cumm	5.300 cumm	5.200 cumm
Iron :	50.60 mcg/dl	49.90 mcg/dl	50.80 mcg/dl
Albiumum :	4.200 g/dl	4.900 g/dl	5.100 g/dl
Hypochromasia :		+	-
Magnesium :	2.100 mg/dl	2.500 mg/dl	2.600 mg/dl
Total Protein :	7.000 mg/dl	8.000 mg/dl	8.600 mg/dl
Triglycerides :	150.6 mg/dl	145.8 mg/dl	145.3 mg/dl
Lymphocytes :	90.20 in	88.90 in	89.60 in

Fig. 50. Lab Work Report – Printed Report

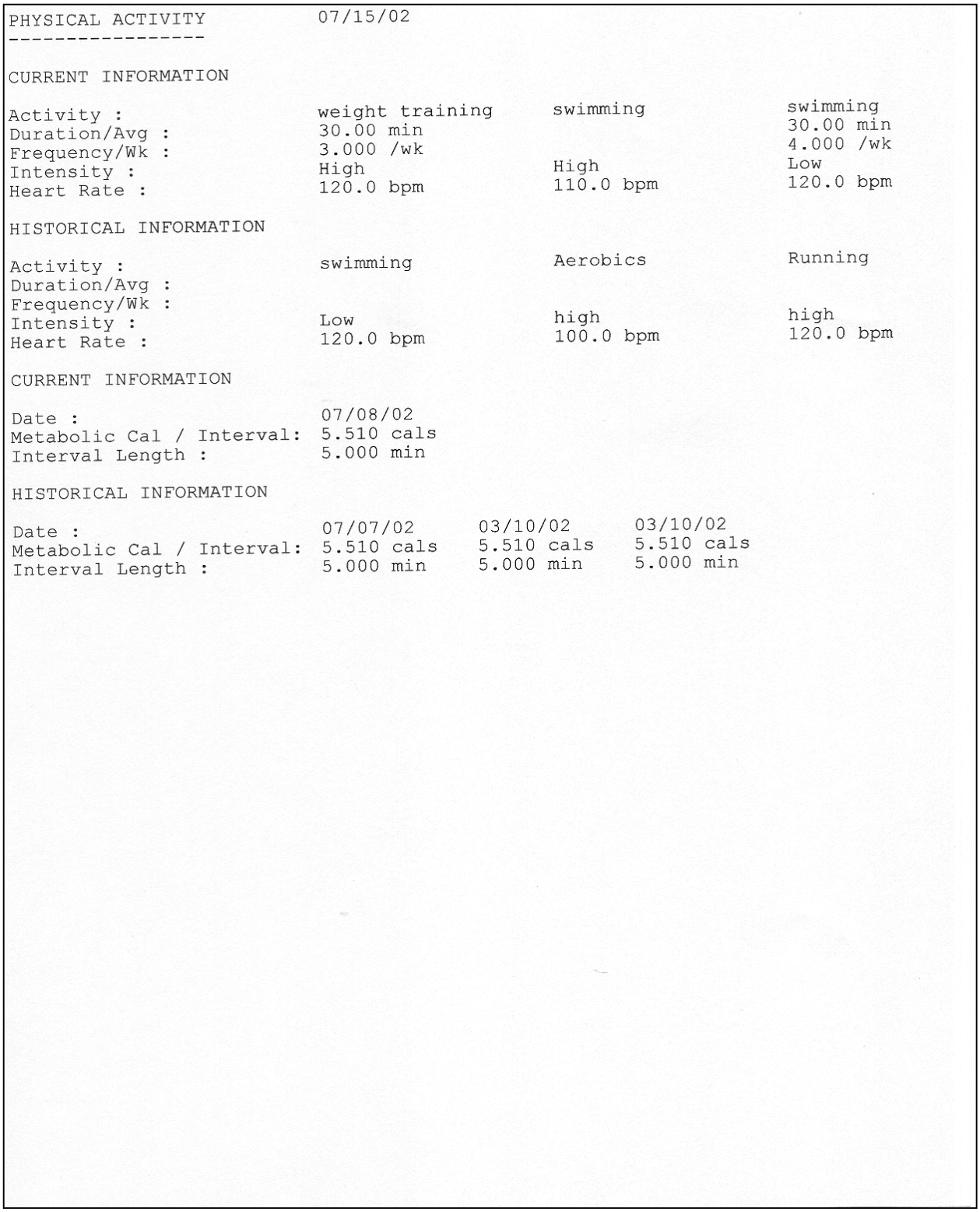


NUTRITION 07/15/02

CURRENT INFORMATION

Date :	07/14/02
Carbohydrates :	189.000 g
Dietary Fiber :	7.80000 g
Saturated Fat :	40.2000 g
Water :	
Calcium :	881.000 mg
Chloride :	
Chromium :	
Copper :	
Fluoride :	
Iodine :	
Iron :	11.7000 mg
Magnesium :	198.400 g
Manganese :	
Molybdenum :	
Phosphorus :	1227.00 mg
Potassium :	2354.40 mg
Zinc :	13.5000 mg
Sodium :	2740.40 mg
Vitamin E Alpha E :	
Pantohenic Acid :	
Protein :	80.6000 g
Calories :	1988.60 cal
Sugar :	
Cholesterol :	321.500 mg
Vitamin A RE :	1063.20 RE
Thiamin B1 :	1.30000 mg
Riboflavin B2 :	2.20000 mg
Niacin Equiv. :	20.0000 mg
Vitamin B6 :	1.60000 mg
Vitamin B12 :	
Vitamin C :	70.9000 mg
Vitamin D IU :	
Vitamin D mcg :	
Vitamin E IU :	
Vitamin E mg :	
Folate :	264.400 mg

Fig. 51. Nutrition Report – Printed Report



PHYSICAL ACTIVITY 07/15/02

CURRENT INFORMATION

Activity :	weight training	swimming	swimming
Duration/Avg :	30.00 min		30.00 min
Frequency/Wk :	3.000 /wk		4.000 /wk
Intensity :	High	High	Low
Heart Rate :	120.0 bpm	110.0 bpm	120.0 bpm

HISTORICAL INFORMATION

Activity :	swimming	Aerobics	Running
Duration/Avg :			
Frequency/Wk :			
Intensity :	Low	high	high
Heart Rate :	120.0 bpm	100.0 bpm	120.0 bpm

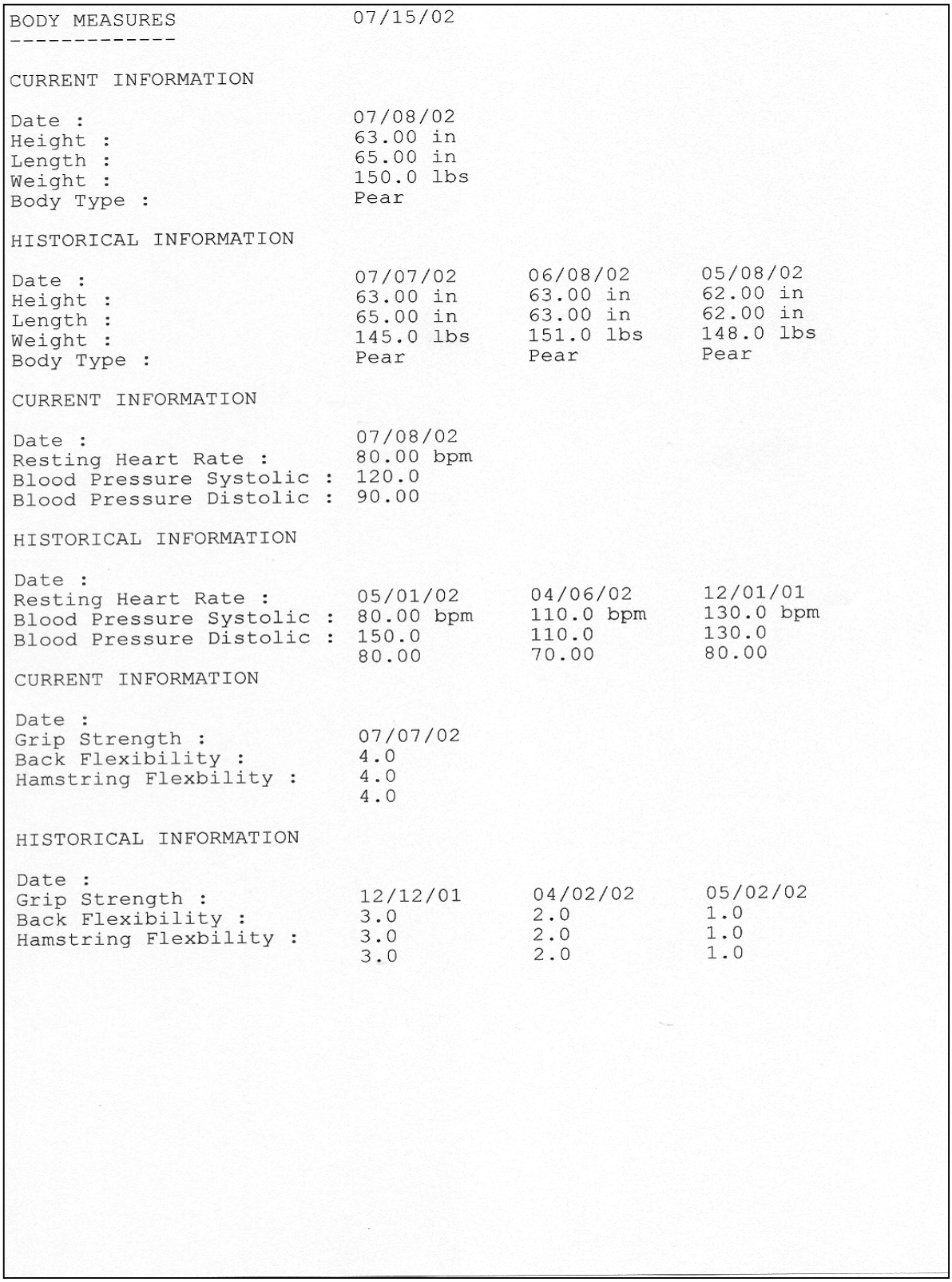
CURRENT INFORMATION

Date :	07/08/02
Metabolic Cal / Interval:	5.510 cals
Interval Length :	5.000 min

HISTORICAL INFORMATION

Date :	07/07/02	03/10/02	03/10/02
Metabolic Cal / Interval:	5.510 cals	5.510 cals	5.510 cals
Interval Length :	5.000 min	5.000 min	5.000 min

Fig. 52. Physical Activity Report – Printed Report



BODY MEASURES 07/15/02

CURRENT INFORMATION

Date :	07/08/02
Height :	63.00 in
Length :	65.00 in
Weight :	150.0 lbs
Body Type :	Pear

HISTORICAL INFORMATION

Date :	07/07/02	06/08/02	05/08/02
Height :	63.00 in	63.00 in	62.00 in
Length :	65.00 in	63.00 in	62.00 in
Weight :	145.0 lbs	151.0 lbs	148.0 lbs
Body Type :	Pear	Pear	Pear

CURRENT INFORMATION

Date :	07/08/02
Resting Heart Rate :	80.00 bpm
Blood Pressure Systolic :	120.0
Blood Pressure Distolic :	90.00

HISTORICAL INFORMATION

Date :	05/01/02	04/06/02	12/01/01
Resting Heart Rate :	80.00 bpm	110.0 bpm	130.0 bpm
Blood Pressure Systolic :	150.0	110.0	130.0
Blood Pressure Distolic :	80.00	70.00	80.00

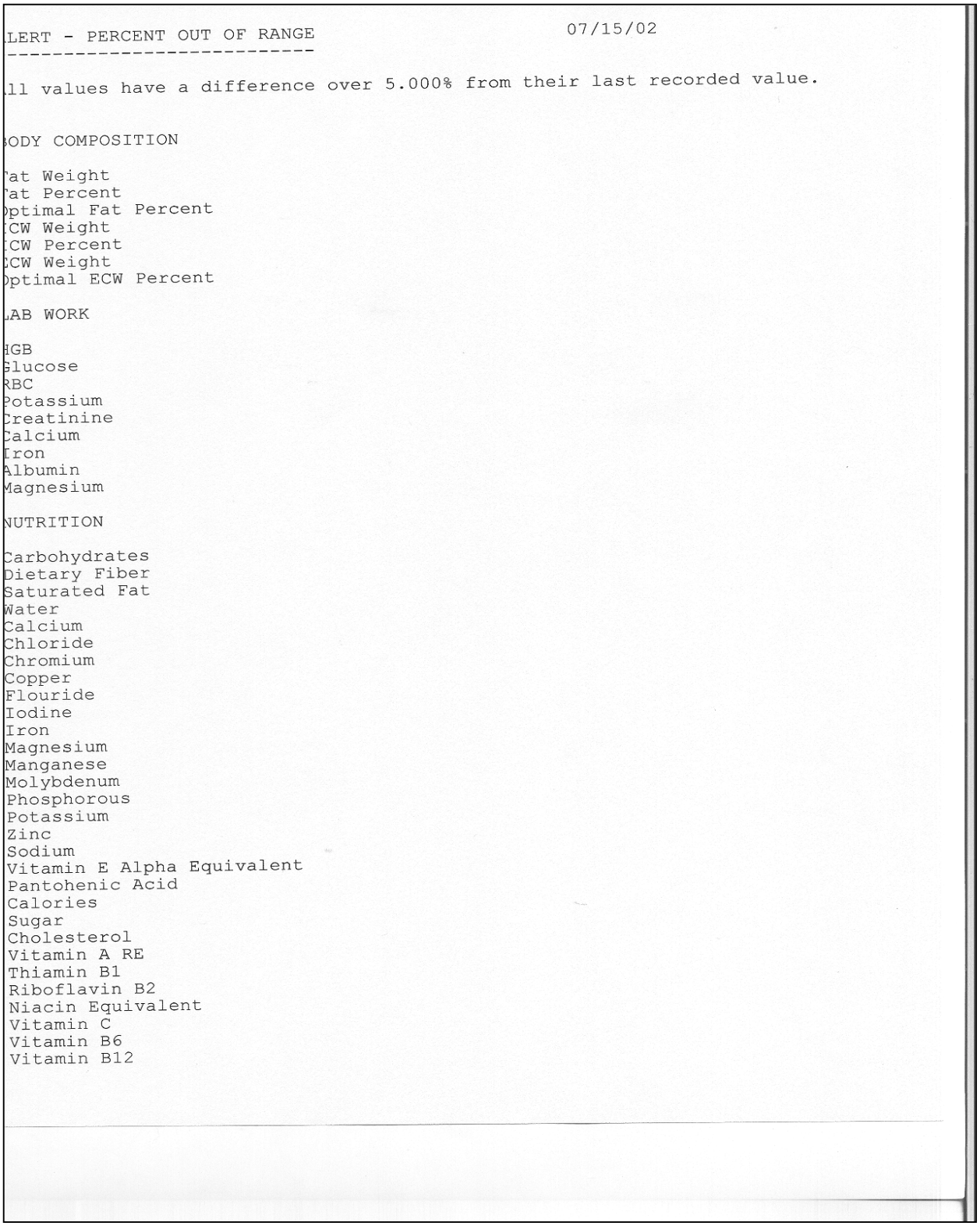
CURRENT INFORMATION

Date :	07/07/02
Grip Strength :	4.0
Back Flexibility :	4.0
Hamstring Flexbility :	4.0

HISTORICAL INFORMATION

Date :	12/12/01	04/02/02	05/02/02
Grip Strength :	3.0	2.0	1.0
Back Flexibility :	3.0	2.0	1.0
Hamstring Flexbility :	3.0	2.0	1.0

Fig. 53. Body Measures Report – Printed Report



LERT - PERCENT OUT OF RANGE 07/15/02

ll values have a difference over 5.000% from their last recorded value.

ODY COMPOSITION

at Weight
at Percent
ptimal Fat Percent
CW Weight
CW Percent
CW Weight
ptimal ECW Percent

AB WORK

GB
lucose
BC
otassium
reatinine
alcium
ron
lbumin
agnesium

UTRITION

arbohydrates
ietary Fiber
aturated Fat
ater
alcium
hloride
hromium
opper
louride
odine
ron
agnesium
anganese
olybdenum
hosphorous
otassium
inc
odium
itamin E Alpha Equivalent
antohenic Acid
alories
ugar
holesterol
itamin A RE
hiamin B1
iboflavin B2
iacin Equivalent
itamin C
itamin B6
itamin B12

Fig. 54. Percent Change Alarms Report – Printed Report

VITA

REBECCA. E. SWEENEY

Personal Data: Date of Birth: November 19, 1973
Place of Birth: Johnson City, Tennessee
Marital Status: Single

Education: Elizabethton High School, Elizabethton, Tennessee
East Tennessee State University, Johnson City, Tennessee;
Mathematics, B.S., 1996
East Tennessee State University, Johnson City, Tennessee;
Computer Science, M.S., 2002

Professional Experience: Graduate Assistant, East Tennessee State University;
Johnson City, Tennessee, 1996 – 1998
Engineer, American Water Heater Company;
Johnson City, Tennessee, 1998-2002