CRITICAL NEED IDEA

Critical National Need:
A Risk Based Recommender for Personalized Healthcare

February, 2009

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Risk Based Recommender for Personalized Healthcare

Web 2.0., recommender systems, personalized healthcare, user interface, prospective risk adjustment

Overview

The administration, government and congress seek methods to use efficient knowledge based systems in order to effectively compete in the global marketplace. Balancing affordability of new health technologies against innovation and opportunities for stakeholder value will prove challenging in an era of tightening budgets and increased health services utilization constraints. Technological advances enable a multitude of personalization capabilities not possible earlier. The amount of personalization that can be offered will keep improving with technology and therefore assessment and improvement will be an ongoing process. Personalization is the act of tailoring one's product or service to suit an individual's needs. It is the systematic method of treating customers as individuals.

User specific risk based recommender systems that relate generally to dispensation of healthcare and specifically to the management of an individual user's health risks are not readily found in the literature. Also missing from the literature are reports of user defined methods of combining technology with traditional clinical approaches for primary and secondary chronic disease prevention.

Risk based personalized healthcare and associated health management relies on an efficient method of integrating user specific personal risk analysis as well as the resources utilized by the health care industry, including insurers, medical services providers and manufacturers, care givers and other participants in the user's health care decision making.

Efficiency has become increasingly imperative in the delivery of health care. This necessity has engendered a strong interest in consumer driven health plans, in which the premiums, contributory payment and other costs may be based on an array of factors, including the individual consumer's status of health and assumption and assessment of health risks. Accordingly, it is ever more important to understand and quantify differences in health status when analyzing the cost efficiency of different health plans for the purpose of establishing employee contribution requirements.

In such "user-centric" schemes, it is important for the users to have control of their health care decisions based on informative health guidelines. The general-purpose guidelines, when available, are not always interpreted by the users correctly. There is, therefore, a critical national need for reliable, personalized health guidelines incorporating users' health risks and other relevant information for the user to make informed decisions at the risk stage of chronic disease.

Providers of capitated health plans, on the other hand, can use such a system to contain costs through the use of timely interventions, especially in the case of chronic

disease; their key requirement is a reliable means to identify and categorize user needs based on their individual health risks.

There are many “users” with an interest in such a personalized health management system, including individual consumers, payors, health professionals and manufacturers, suppliers and providers and third party administrators of health products and services. Since it is possible to make personalized health information available to the diverse types of user groups with the help of the new media, therefore the providers of information dissemination networks and media may also be thought of as a “user” group whose needs intersect those of other groups of users of the system.

Computer networks, including the Internet, make the information interactively available, including not only the health guidelines based on personal risk factors and health care management parameters but also peripheral information, such as, the products and services that can assist the user in following the guidelines.

A method and system for personalized healthcare using reliable user defined criteria in a branded healthcare application that links general health guidelines with specific recommendations that are tied to healthcare guidelines would be useful as it would provide a means for a cost efficient outcome including the “packaging” for distribution across industries of personalized healthcare credits linked to general guidelines such as “lose weight” and “exercise” for use in early intervention of chronic disease. Outcomes can be measured by the same method and system.

Personalized healthcare is a critical national need that can be met by developing efficient health delivery and financing infrastructure methods and systems for all stake holders. We believe personalized healthcare in combination with consumer defined criteria will play a key role in integrating “healthcare customers” into the healthcare system at the risk stage in order to curb chronic conditions at a less costly stage for healthcare delivery.

Congress has sought to meet this need and to use networks for healthcare cost solutions including those outlined in the Prospective Risk Adjustment system as mandated by the Balanced Budge Act of 1997. Efficiency and potential cost-effectiveness for management of chronic disease has become increasingly imperative in the dispensation of health care as this and other complex systems unfold in a fragmented healthcare industry causing confusion for healthcare consumers especially at the risk stage of a chronic disease prior to the onset of symptoms or episode.

Enabling users to create a health risk profile - from healthy to very ill - with a reliable risk stratification tool which can enable users to determine concrete methods of follow through on guidelines and health solutions within existing business and information services models and networks, and to personalize health guidelines would be useful for all stakeholders in meeting the need for personalized healthcare beginning at the risk stage. This process helps to facilitate early intervention through expanded information for industry and all stakeholders.

This paper outlines a cost effective prospective healthcare personalization strategy to meet a critical national need for risk based personalized healthcare using information technology networks, including the Internet, in order to make the information interactively available, including not only the health guidelines based on personal risk factors and health care management parameters but also peripheral information, such as, the products and services that can assist the user in following health guidelines.

Use of a risk based personalized healthcare system using a reliable health profile that is a population based standardized application for primary and secondary prevention of chronic disease beginning at the risk stage would be efficient and cost effective. The direct benefit to health stakeholders is improved ability to assess and track risk and resulting healthcare costs from healthy to seriously ill for chronic conditions and disease and to deliver these tools in systems and networks in place. In healthcare the customer is the end user, the payor and the provider. The federal government is the largest payor.

We propose a primary and secondary chronic disease prevention model using a reliable risk stratification method and system for developing a user profile that incorporates user defined criteria and risk based recommender that can be of value to all healthcare stakeholders. It is a risk based recommender system.

The value of information related to packaged goods and the products and services available in the marketplace should not be minimized, since in many cases availability of the right product or service can make the difference between success and failure in following health recommendations. Appropriate dietary products, such as a sugar substitute for diabetes and gluten-free recipes for celiac disease or behavioral support group in a neighborhood are but simple examples of such market based products and services.

A robust system incorporating access to all relevant information from one source "under one roof" can be useful to the consumers of healthcare, where relevant information for the user's decision making is either stored in a database within the system so as to be searchable or importable on demand. At the present time, there is no available system for health management that incorporates integration of health related information with the market-based data of useful products and services. Contented Hearts, Inc. aim is to meet a critical national need in a cost effective way that makes following guidelines more palatable to users through personalization of health guidelines.

Following review of the Contented Hearts Lifestyle Quiz assessment (**1),** in a telephone conversation, Norbert Goldfield, M.D., an author of the Prospective Risk Adjustment System (**2**), told Contented Hearts, Inc. founder that Contented Hearts was at the "cutting edge of healthcare."

Contented Hearts, Inc., a Michigan based lifescience company, seeks to provide the relevant information at the finger tips of the user based upon interactive dialog and robust filtering mechanisms in a risk based recommender for personalized health management that is user defined. It is necessary for the system to have the components that filter and elicit the relevant information for the diverse groups of users. In particular, for the individual consumer, the filters provide personalized information extracted by the filters. It is imperative also to address potential privacy concerns of the consumers, and except for a few exceptions imposed by the law, have the consumer retain control of personalized data. The challenge is efficient delivery and formation of strategic partnerships with lines of business and networks and systems already in place and infrastructure services that can benefit from new applications.

We propose a method and system to personalize healthcare and health maintenance guidelines targeted to individual users at the risk stage. The system includes databases incorporating general, validated and reliable health information; system

components and criteria for risk factor analysis for an individual user's risk assessment; as well as, a variety of classification and filtering algorithms from user preference models. It includes databases for ongoing analysis and reporting, and allows different users to make different risk-based decisions, set or assume different price structure for desired outcomes or customize the guidelines based on prospective risk analysis.

The system permits creation of groups of users for different risk categories based on personalized guidelines, including prospective risk-adjustment and payment methods that relate a user's risk profile to the amount, type, number and duration of services provided during the treatment of a specific disease process and prospective healthcare use category.

The universe of users of such an integrated, comprehensive system is diverse and includes individuals and groups - such as individual consumers; healthcare payors; health professionals and manufacturers; suppliers, providers and third party administrators of health products and services. The service providers of Internet and computer-based networks and other new media are also expected to be interested parties in this view of health service dispensation.

A key aspect of the proposed system is a "recommender" component, including the mapping of services from categories that meet the personalized guidelines for the individual consumer. This mapping would be stored within the recommender or provided by client software. The method of verification of the private nature of the personalized guidelines sets the recommender system of Contented Hearts from the general purpose recommenders used by vendors of other services.

The Contented Hearts' algorithms of this recommender provide added value by providing healthcare stake holders a customized way to a particular consumer. These recommendations are envisioned as being refined through use of a "ranking" algorithm by using information gathered from the community of users with similar risk factors.

For example Contented Hearts incorporates a proprietary validated population based cardiac risk factor analysis algorithm for user risk clarification and a variety of classifier and filtering algorithms from user preference models. One key purpose of the system is to make the healthcare and maintenance guidelines more readily acceptable to the users, thereby improving the follow through on those guidelines. By making the recommendations integrated within the system it is possible to dynamically fine-tune the recommendations for the end user.

For instance, tools that allow tracking diet and exercise can benchmark the user's activity against the recommendations, and data entered by the user can be used to update the recommendations as risk factors change. This critical feature of presenting information in a dynamic, integrated fashion makes it possible to provide sustained value to the consumer and to all stakeholders.

It is known that a major factor in successful healthcare management is the patient/client follow-through on guidelines and instructions supplied by a health professional. General guidelines along the lines of "lose weight" or "exercise" are often ambiguous and difficult to achieve.

Contented Hearts offers a method and system to personalize user health guidelines, in combination with the personal risk factors, thereby clarifying the risk factors for the individual user; this system is integrated with user preference for the

guidelines, along with the other aids that may help the user in the follow-through of the guidelines and recommendations. A corollary is reduced healthcare costs.

Significance

Cardiovascular disease is a leading health problem in this country. The cost associated with cardiovascular disease in 1991 was estimated by the American Heart Association at $101.3 billion. This figure includes the cost of physician and nursing services, hospital and nursing home services, the cost of medications and lost productivity resulting from disability. **2** Cardiovascular disease is linked to certain risk factors and behaviors, including high blood pressure, elevated total serum cholesterol, cigarette smoking and physical inactivity.**3**

Behavioral Risk Factor Surveillance System (BRFSS) results collected by the Center for Disease Control indicate an increase in behavioral risk factors in the United States. Nearly 60 percent of the US population does not exercise, 30 percent is overweight, 21 percent has high blood pressure and 18 percent has high cholesterol.**4** The BRFSS is a random-digit-dialed monthly telephone survey of persons age 18 and over in nearly all 50 states and the District of Columbia.

Contented Hearts offers the capability of maintaining and presenting dynamically updated, personalized guidelines for the users. A number of modern media, including the Internet and other internet-based networks have the capability to provide such user-mediated, dynamic personalization of the data and guidelines periodically or on demand. Contented Hearts integrates user preferences with the risk-based recommendations and is calculated to encourage follow-through since it makes the recommendations more palatable to the user.

User personalization of prospective risk may relate to the amount, type, number and ration of services - including exercise - and healthcare delivery use category, e.g. healthy, seriously ill, etc., in connection with the treatment of a specific disease process. Such details allow users to personalize risk categories at various risk stages of a chronic disease process. This feature compliments features of the Prospective Risk Adjustment system.

The risk-based recommender system can include the database of user health-risk models and encoded health guidelines. These recommendations are further interpreted in order to restrict the space of possible services to those in conformance with guidelines.

The mapping of products and services into categories that meet the guidelines is a key aspect of this system. This mapping may be stored within the recommender system or provided by, or imported from, external client software.

Thus, the risk based recommender has three distinct kinds of information integrated to provide tailored guidance to a user: The first kind of information is the association of each risk factor with the corresponding medical recommendations; this provides, for example, a tailored set of behavioral and dietary guidelines to a user based on their individual risk factors. These recommendations may be automatically generated and filtered to present the individualized information.

The second kind of information relates to the products and services, presented in view of the particular medical recommendations. While the primary goal may be to provide readily usable information to the consumer, additionally it may be of interest to

the vendors of the products and services, since it can add a valuable channel for marketing the products and services.

Third, the system encompasses information of interest to a community of users with shared risk factors, disease status, preferences and goals etc. In particular, the recommendations can be refined using information gathered from a community of users with the same risk factors. For instance, by using consumer-provided ratings of the products and services, it may combine such information into a recommender system with enhanced value to the consumer. Similarly advantages may flow from using virtual communities of consumers with similar concerns. Aside from providing the ratings, the virtual communities can assist in support and follow-through of the recommendations, and in making informed decisions.

The system is based on the concept that a dynamic integration of such diverse kinds of information is critical to the sustained value of the system to the consumer. For instance, tools that allow tracking diet and exercise can benchmark the user's activity against the recommendations, and data entered by the user can be used to update the recommendations as risk factors change or different products and services are utilized.

An important component of the system is the set of filters for comprehensive analysis of risk factors vis-à-vis other user data. Collaborative filters help find relevant content on the Internet, which unlike usual keyword search engines for the internet, actually gauges an individuals interest in content - in this case risk assessment. Risk based lifestyle recommendations with guidelines including diet and exercise use a form of content filtering. Further, content such as labels on cans of food times for health can aid in reducing chronic conditions such as diabetes, high blood pressure and high cholesterol may be displayed for the user.

Contented Hearts system persistently stores, for a single subject or a group of subjects, the results from each determination over time of the percentage of absolute risk of heaving a heart attack (or having heart disease).

A significant feature of Contented Hearts for use in prospective risk adjustment is creation of a disease risk profile for the consumer. The system offers a basis for user profile formed by allowing the risk analysis of a clinical episode at the risk stage for heart disease. For example, assignment of Risk Adjustment Category (“RAC”) which quantitatively represents severity of disease, for instance, a seven-digit number, where the first digit may indicate the individual’s general health status among the following possibilities: 1) Healthy; 2) Moderate, Acute; 3) Single chronic; 4) Multiple Chronic; 5) Three or more Dominant Chronics; 6) Metastasic Malignancies; 7) Catastrophic Illnesses and Conditions.

The Contented Hearts risk assessment is based on a population based algorithm that predicts for the user the risk of developing heart attack/heart disease based on the percentage of similarly situated population at risk of developing heart disease within ten years. The risk assessment incorporates the following risk factors: age, gender, chronic stress, high blood pressure, elevated cholesterol, smoking, excess weight, family history, lack of exercise, diabetes and enlarged heart.

A major advantage of making the exhaustive information, including sequential test results over time, available to the consumer for retrieval and display is to quantitatively demonstrate to the consumer the lowered risks associated with continuing healthy lifestyle choices and behavior changes. The system uses the general health report

profile for users of health risk status for chronic condition or disease process and links general strategies with specific recommendations for personalization of health guidelines including services and products for individuals and groups. A healthcare credit system can be added to this component. Thus anticipating and meeting need for tailoring guidelines by stakeholders.

The prospective, personalized risk-adjustment for the consumer further allows the payment options to conform to an individuals healthcare use category based on the analysis of known risk factors and efforts at risk reduction at every stage of risk. In this framework, relating user characteristics to the amount, type and number of risk factors can be tied to the prospective amount, type and duration of services provided during the treatment of a specific disease process, e.g., heart disease, diabetes, hypertension, high, cholesterol, etc., and based on the ongoing profiling by multivariate risk analysis with the system.

The system and method of the Risk Based Recommender of Contented Hearts may link the general strategies outlined above with the specific recommendations for products or services from the market that includes retail pharmacy and grocery operation, and e-commerce, based on opt-in marketing strategies.

Contented Hearts' risk based personalized healthcare recommender offers a consumer driven solution to a critical national need for personalized healthcare. CONTENTED HEARTS® provides value to its customers by creating a branded healthcare personalization program and health application that can provide customers tools to develop related healthcare assessment, monitoring, tracking and credit point program for sale to industries other than healthcare.

Contented Hearts will benefit healthcare consumers and practitioners who often find it difficult and time consuming to assess and track health risk factors. A major factor is patient follow through on guidelines. Problem with general guidelines: "lose weight," "exercise." Personalized healthcare will result in earlier intervention leading to lower chronic healthcare costs for payors.

Company operations will be based in Michigan, creating additional jobs and income for the state with add on features. The strategy is to offer Contented Hearts risk based recommender as a Web-based tool that will bring those asymptomatic individuals at risk for a chronic disease into the healthcare system at the risk stage. A distinguishing factor is the simplicity of the tool and method of delivery making it more likely to be used in various clinical and non-clinical settings and across industries.

The Contented Hearts development structure will center on the Web application design and distribution of its health risk management products beginning with the risk based recommender in a recurring revenue producing model. This involves a strong technology team working in cooperation with a scientific team. The Guide to Contented Hearts: Cardiac Risk Management can be added electronically. Scientists will work on an ad hoc basis when their skills are required for product development and data management. Contented Hearts has developed associations with scientists and bio informatics specialists who are the leaders in their field; along with technology experts with a depth of experience in data architecture for large healthcare organizations.

A business development team will be involved with networks in healthcare and cardiology and Internet application management. The central location will be in Michigan as noted in western Michigan and on the eastern part of the state. The

organizational structure may evolve to include regional locations on the east and west coasts in order to meet customer demands for service. Data management will originate from a central location in Michigan.

Personnel Planning for Contented Hearts will be under the direction of the CEO. An advisory board will be sought to assist in locating officers and directors.

By focusing innovation on a costly chronic disease that is tied to lifestyle, Contented Hearts can be a market leader for risk based recommender systems. Once the personalized health model is complete for cardiac risk analysis and accompanying recommender as outlined, it can be developed for other related diseases such as diabetes, hypertension and high cholesterol.

References:

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