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A web-based intervention to support increased physical activity among at-risk adults

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ABSTRACT

Physical inactivity is an important contributor to the development of numerous chronic conditions and alone is an independent risk factor for diabetes, cardiovascular disease, and depression and yet, most Americans consistently fail to achieve the recommended amount of physical activity. As part of Project HealthDesign, we designed and prototyped a personal health record application (PHA) that delivers and supports a highly individualized, behaviorally based lifestyle physical activity intervention for sedentary adults. Through a user centered design approach, we engaged consumers, health care providers, and personal trainers for multiple facilitated group discussions and structured interviews to determine their needs and wants related to an activity PHA. The PHA was developed to include elements of evidence-based approaches which help participants adopt cognitive and behavioral skills such as goal-setting, self-monitoring, accepting social support, cognitive restructuring, contingency management, decisional balance, and relapse prevention. This PHA demonstrated the potential for research-based behavioral interventions to be delivered via a web portal. This finding is important for both consumers and their providers who have the desire to implement physical activity recommendations, but lack the tools to facilitate or undertake such interventions.

1. Project goals and design requirements

In the past two decades, the sedentary lifestyle of Americans has been identified as a major public health crisis and a primary cause of many lifestyle-related health problems such as diabetes, high blood pressure, coronary heart disease, and obesity [1–7]. Compounding the gravity of the health impact of physical inactivity is the fact that it is so prevalent in our nation. The Surgeon General's Report on Physical Activity and Health reported that "more than 60% of adults do not achieve the recommended amount of regular physical activity ... 25% of all adults are not active at all" [1].

The body of research that demonstrates the effectiveness of behavioral lifestyle interventions in helping adults become more active is growing [8–13]. Research in the last few decades has provided insights into components or mediators that predict successful behavior change. Elements of these successful approaches are those which help participants adopt cognitive and behavioral skills such as goal-setting, self-monitoring, accepting social support, cognitive restructuring, contingency management, decisional balance, and relapse prevention [14–20]. Successful interventions [21,22], as the literature demonstrates, must meet individuals 'where they are,' intersecting with their daily lives, their attitudes, and their stage of readiness to change.

The goal of this PHA tool is to deliver and support a highly individualized, behaviorally based lifestyle physical activity intervention for sedentary adults. Critical design requirements of the PHA tool were the ability to provide automated and evidence-based recommendations for physical activity reducing the need for direct involvement and monitoring by health care providers; to track activity performed against activity plan goals; and, to support increased communication between consumers and health care providers focused on physical activity. The interactions facilitated by the PHA tool are shown in Fig. 1 indicating that the PHA was designed to connect consumers, healthcare providers, the medical record, and possibly other supports as desired to be involved in reviewing and commenting on data recorded in the PHA; solid lines in the figure indicate connections between systems and users that are already implemented while dotted lines indicate optional connections that may be selected based on user needs.

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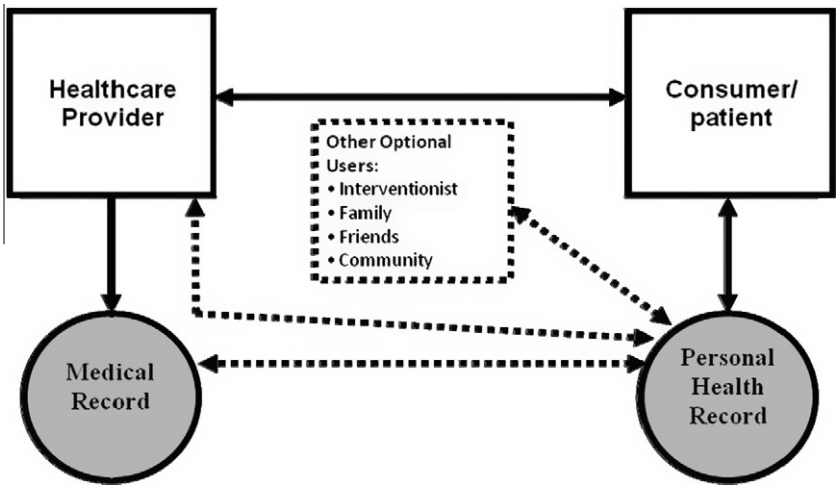

Fig. 1. Conceptual overview of the PHA system.

2. Prototype description

2.1. System architecture and database

The PHA is a web-based application developed utilizing the Microsoft.Net 2.0 framework, using the open source web portal frame work DotNetNuke. Microsoft technology including ASP.Net, VB.Net, IIS, Web Services and Microsoft SQL Server 2000 database provided broad applicability across common information system environments. The project team developed a custom DotNetNuke module consisting of multiple layers (user interface, business tier, and data access) to interact with the Project HealthDesign common component platform discussed by Sujansky et al. in this issue. Although this is a prototype PHA, the project team has designed and implemented a functional system with a back end SQL Server 2000 database and a user interface for both patients and healthcare providers. As shown in Fig. 2, the basic elements of the system included external web services (common platform), core system logic and business services (PHA application web server and database), and a user level (web site and device services for uploading activity data).

To facilitate testing of a several options for the input of physical activity data, the project team developed an integrated activity tracking system for users. This included both manual and automated data input on the website to facilitate user preferences for using different options to track and report their activity. First, the project team developed an automated method of recording and uploading activity data using a sophisticated physical activity monitor called the Kenz LifeCorder Plus™; the device is able to record and store all physical activity engaged in by a user for more than 2 weeks at a time. This device was used to prototype the ability of the system to incorporate data from external monitors that provided automated tracking and uploading of data. A web services component was developed and integrated into the PHA website enabling automatic upload of data when the attached computer is connected to the internet. When the device is plugged into a USB port of any Internet-capable computer, the device automatically connects to the PHA and uploads data to the account registered with the device.

In addition to the automated data entry elements of the PHA the project team also developed a manual interface. This interface allowed consumers using the PHA to enter activity they had engaged in over the past 24 h; the interface included the ability to choose the type, intensity, and total time that the user engaged in the physical activity. Following data entry, users and healthcare providers (that users have granted permissions to) could view these data in the tracking/reporting component of the PHA, an interface that allowed users to view tables, graphs, and reports of their physical activity and progress in meeting stated activity goals. Overall, the team's approach was to make the PHA component which interfaces with the Project HealthDesign common component platform as a complete and independent module so that it can be used in future applications as well as be extended to include additional services. For instance, while additional functions such as providing users with supportive messages, connecting them with social sup-

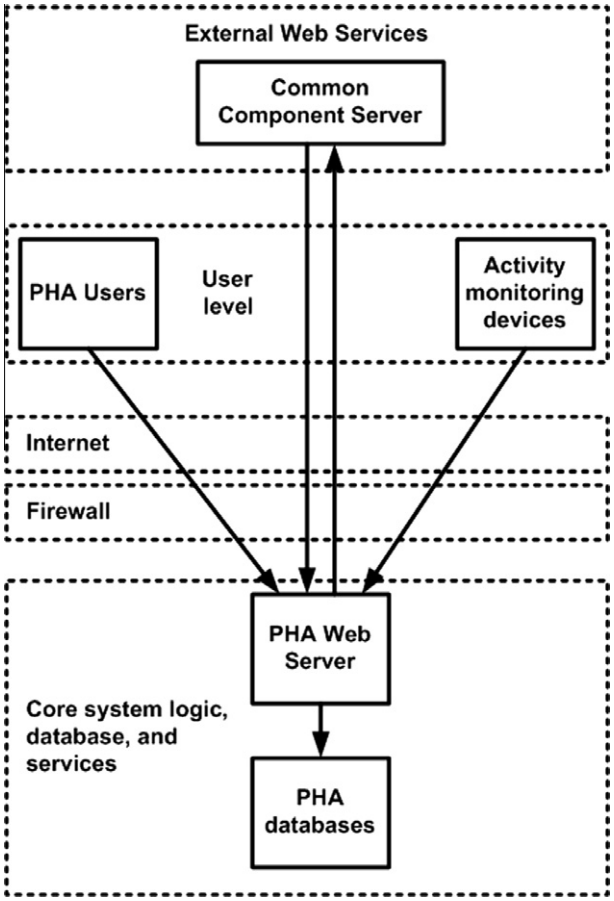

Fig. 2. System diagram.