

Using an online, personalized program reduces cardiovascular risk factor profiles in a motivated, adherent population of participants

R. Jay Widmer, MD, PhD,^a Thomas G. Allison, PhD,^a Brendie Keane, RN,^c Anthony Dallas, MD,^c Lilach O. Lerman, MD, PhD,^b and Amir Lerman, MD^a *Rochester, MN; and Nashville, TN*

Background Cardiovascular disease (CVD) is the leading cause of morbidity, mortality, and cost in Western society. Employer-sponsored work health programs (WHPs) and Web-based portals for monitoring and providing guidance based on participants' health risk assessments are emerging, yet online technologies to improve CVD health in the workplace are relatively unproven. We hypothesized that an online WHP, comprehensively addressing multiple facets of CVD, can be successfully implemented and improve the health of participants.

Methods A cohort of employees in Tennessee ($n = 1,602$) was subjected to a health risk assessment at baseline. Those who did not meet all 5 healthy benchmarks ($n = 836$)—body mass index, blood pressure, glucose, total cholesterol, and smoking status—were prospectively assigned to a Web-based personal health assistant and had repeat measurements taken at 90 days.

Results Of those who both completed the personal health assistant program and underwent baseline plus 90-day assessments (508/836, 61%), 75% were female, mean age was 46.5 ± 11.1 years, and the mean number of risk factors at baseline was 1.1 ± 0.9 with a mean 10-year Framingham Risk Score of 2.9%. This cohort demonstrated a significant reduction in total cholesterol ($P < .0001$), low-density lipoprotein cholesterol ($P < .0001$), triglycerides ($P < .0001$), systolic blood pressure ($P = .009$), glucose ($P = .004$), weight ($P = .001$), and body mass index ($P = .001$). Most of the participants improved at least 1 risk factor. Framingham Risk 10-year cardiovascular risk percentages were significantly reduced ($P = .003$).

Conclusions This study in a prospective cohort of community-dwelling employees suggests that an online WHP can provide a viable means to improve surrogates of CVD risk factors. (*Am Heart J* 2014;167:93-100.)

Cardiovascular disease (CVD) is the primary cause for morbidity, mortality, and rising health care associated costs in the United States. Recent estimates attribute >1 in every 3 deaths to CVD^{1,2} and $>90\%$ of CVD morbidity and mortality to preventable risk factors.³ According to 2012 statistics, poor diet, smoking, and lack of physical activity continue to account for an overwhelming majority of CVD and death.⁴ Recently, employers have recognized the significance of health in the workplace in an effort to improve productivity and reduce human and capital costs.

Work health programs (WHPs) have become popular in the past decade showing promising results for reducing health care costs,⁵ improving worker productivity,⁶ and improving surrogate risk factors for CVD⁷ as well as ameliorating lifestyle behaviors known to cause CVD, such as poor diet and lack of physical activity.⁸ However, one of the major challenges is to entice patients to access and engage in these WHPs in concert with the reduction of CVD risk.⁹ Although emergence of the Web-based solutions and social networks in health care shows promise,^{10,11} these interventions are poorly integrated into standard health care with various efficacies.¹² Furthermore, no single WHP, designed in a comprehensive, evidence-based, and Web-based or smartphone-accessible manner, has been able to significantly affect an individual patient's composite primary prevention CVD risk factor profile in a low-risk population. Here, we prospectively follow an adherent cohort of employees as they undergo a health risk assessment at baseline and 90 days after initiating an online, interactive WHP. We hypothesized that participants who qualify for and

From the ^aDivision of Cardiovascular Diseases, Department of Internal Medicine, Mayo Clinic and College of Medicine, Rochester, MN, ^bDivision of Nephrology and Hypertension, Department of Internal Medicine, Mayo Clinic and College of Medicine, Rochester, MN, and ^cCareHere, Inc, Nashville, TN.

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Reprint requests: Amir Lerman, MD, Division of Cardiovascular Diseases, Mayo Clinic, 200 1st St SW, Rochester, MN 55905.

E-mail: lerman.amir@mayo.edu

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Table 1. Baseline parameters upon which patients were included/excluded from participation, based on health risk assessment, in the online PHA and subsequent 90-day follow-up

Health metric	Criterion
BMI (kg/m ²)	>30
Blood pressure (mm Hg)	>140/90
Cholesterol level (mg/dL)	>220
Blood glucose level (mg/dL)	>100
Tobacco use	Presence (current)

complete the health risk assessment at 0 and 90 days along with the online program will have improved cardiovascular risk factors compared to baseline.

Methods

Employee recruitment and study parameters

In 2011, a Tennessee employer in coordination with CareHere, LLC (Nashville, TN) created and implemented an incentive plan to motivate employees to improve their health. CareHere, LLC onsite clinic vendor managed the program and tracked results manually and by using the Online CareHere Connect Personal Health Assistant (PHA) designed and produced by Healarium, Inc (Dallas, TX). All employees enrolled in the employer-sponsored health insurance program were asked, without coercion as a normal part of their insurance process, to accomplish the following steps: (1) Complete a 28 panel biometric screening and provide answers to a set of questions regarding personal health behaviors. (2) Follow up with a health care provider within 90 days of biometric screening to review results and see if all health benchmarks set by the employer were met. Patients were given the option to “opt out” of the program upon the initial intake into the program. Those who decided against entry were placed into the “excluded” group regardless of baseline benchmark status. Baseline and 90-day assessments included standard laboratory blood tests, participants' primary care physician, for fasting lipid panels and serum glucose values. Blood pressure, height, weight, and the health behavior questionnaires (mentioned above) were assessed at baseline and 90 days in a standard fashion by the patients' primary health care providers. Participants were eligible for enrollment into the WHP and cohort if they met at least 1 of the 5 inclusion criteria (Table 1). Those who did meet any of the inclusion criteria were entered into a “health maintenance plan,” offered a reduced rate on employee-sponsored health insurance, were not required to take any further action, and were excluded from the study analysis.

Participants who did not meet one or more benchmarks were asked to complete the following steps: (1) Participate in a CareHere Connect online wellness program or complete another plan of care established by healthcare provider. (2) Return to health care provider 3 months following initial biometric screening for a follow-up appointment to discuss compliance with online wellness program or plan of care. Patients who participated in the online wellness program were considered compliant by a health care provider remained in a preferred low deductible benefit plan. Patients who did not

comply with the online wellness program and were determined noncompliant were placed in a high deductible benefit plan. Patients who had experienced extenuating circumstances making it impossible to follow any of the program requirements received waivers of compliance and were placed in the low deductible benefits plan.

Follow-up assessment at 90 days consisted of a replication of the baseline parameters in a similar fashion. Deidentified data was transmitted through Healarium, Inc, to investigators at Mayo Clinic for a comprehensive deidentified data analysis at the completion of the program. A total of 508 patients were eligible for inclusion; however, because of incomplete data collection secondary to incomplete laboratory testing and patient information, Framingham scores were only able to be calculated on 152 of the 508 patients. For statistical analysis, a set of cardiovascular benchmarks—a list expanded from the inclusion criteria—was used including low-density lipoprotein (LDL) cholesterol <130 mg/dL, high-density lipoprotein (HDL) >40 mg/dL, triglycerides <150 mg/dL, glucose <100 mg/dL, and systolic blood pressure <120 mm Hg. Patients who returned at 90 days and completed the online program were considered “completers” and eligible for inclusion into the study. Those who never logged in and did not complete the online assessment were considered “pending,” and those who logged on but did not finish either the online program or the follow-up visit were considered “noncompleters.” These patients were not used in the final data analysis (Figure 1). Framingham Risk Score (FRS) was calculated at baseline and 90 days based on combined patient metrics (age, blood pressure, presence or absence of blood pressure treatment, total cholesterol, HDL cholesterol, and smoking status in those who had a complete set of measurements based on current ATPIII guidelines).¹³

The PHA

The PHA is an integrated and personalized interface that tracks, logs, educates, and forms actionable tasks for the user seeking to improve their current state of health in online and smartphone-based platforms (Figure 2). It provides user-friendly and interactive access to health status information, tasks, targets, plans, awards, and a social reinforcement network that encourages the adoption and maintenance of a healthier lifestyle for improved wellness. Tasks keep patients on track towards achieving health plan recommendations. They also help in reporting how well the patient has been doing with the plan. Reminders to complete tasks may be received via email or SMS text messaging.

The PHA explains a patient's risk factors (such as the risk of having cardiovascular disease or the risk of having diabetes) using dashboard-like graphics that are clear and easy to understand and that are accompanied by simple explanations (Figure 2). Patients can also learn what specific indices or measurements (such as blood pressure and weight) affect their risk factors, what each piece of data means, what needs to be improved, and how it can be done. Graphics that show a patient's history and trends help visually demonstrate changes over time and show the direction in which the patient is heading.

The PHA provides patients with easy-to-understand views that show them how they are progressing toward achieving each target. A plan is a set of recommendations that guide day-to-day activities, helping patients adopt a healthier lifestyle. Patients

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