Financial Analysis

The Impact of an Online Disease Management Program on Medical Costs Among Health Plan Members

Steven M. Schwartz, PhD; Brian Day, EdD; Kevin Wildenhaus, PhD; Anna Silberman, MPH; Chun Wang, MS; Jordan Silberman, BS

Abstract

Purpose. *This study evaluated the economic impact of an online disease management program within a broader population health management strategy.*

Design. *A retrospective, quasi-experimental, cohort design evaluated program participants and a matched cohort of nonparticipants on 2003–2007 claims data in a mixed model.*

Sample. *The study was conducted through Highmark Inc, Blue Cross Blue Shield, covering 4.8 million members in five regions of Pennsylvania. Overall, 413 online self-management program participants were compared with a matched cohort of 360 nonparticipants.*

Measures. *The costs and claims data were measured per person per calendar year. Total payments were aggregated from inpatient, outpatient, professional services, and pharmacy payments. The costs of the online program were estimated on a per-participant basis. All dollars were adjusted to 2008 values.*

Intervention. *The online intervention, implemented in 2006, was a commercially available, tailored program for chronic condition self management, nested within the Blues on Call℠ condition management strategy.*

Analysis. *General linear modeling (with covariate adjustment) was used. Data trends were also explored using second-order polynomial regressions.*

Results. *Health care costs per person per year were $757 less than predicted for participants relative to matched nonparticipants, yielding a return on investment of $9.89 for every dollar spent on the program.*

Conclusions. *This online intervention showed a favorable and cost-effective impact on health care cost. (Am J Health Promot 2010;25[2]:126–133.)*

Key Words: Disease Management, Self-Management, Costs, Health Care Claims, Prevention Research. Manuscript format: research; Research purpose: intervention testing/program evaluation; Study design: quasi-experimental with a matched comparison group; Outcome measure: financial/economic; Setting: clinical/health care; Health focus: medical self care; Strategy: skill building/behavior change; Target population age: adults, seniors; Target population circumstances: education/income level, geographic location and race/ethnicity

Steven M. Schwartz, PhD, is the Director of Research, Behavior Science, and Data Analytics; Kevin Wildenhaus, PhD, is the Director of Behavior Science and Data Analytics; and Chun Wang, MS, is Data Statistician for Behavior Science and Data Analytics at HealthMedia Inc, Ann Arbor, Michigan. Brian Day, EdD, is the Director of Advanced Analytics; and Anna Silberman, MPH, is Vice President of Preventive Health Services and Clinical Client Relationships at Highmark Inc, Fifth Ave Place, 120 Fifth Ave, Pittsburgh, Pennsylvania. Jordan Silberman, BS, MAPP, is a student with the University of Rochester School of Medicine and Dentistry, Rochester, New York.

Send reprint requests to Steven M. Schwartz, PhD, Director of Research, Behavior Science, and Data Analytics, HealthMedia Inc, University of Michigan, 130 S. First Street, Ann Arbor, MI 48104; sschwartz@healthmedia.com.

This manuscript was submitted December 1, 2009; revisions were requested April 28 and June 3, 2010; the manuscript was accepted for publication June 15, 2010.

0890-1171/10/$5.00 + 0
DOI: 10.4278/ajhp.091201-QUAL-377

INTRODUCTION

The prevalence of chronic conditions, such as heart disease, diabetes, arthritis, and depression, continue to rise with the overall aging of the population. This trend is accompanied by rising health care cost/utilization. For example, in 2001, people living with chronic conditions accounted for 76% of physician visits, 81% of inpatient stays, 91% of prescription medications, and nearly 98% of home health care visits.[1] From 1996–2006, the average number of physician office visits increased 43% for diabetes and 51% for hypertension, whereas physician visits for preventive care increased only 19.2%.[2] The number of Americans experiencing significant functional disability related to chronic disease is projected to increase by 300% over the next 4 decades.[3]

Almost half of the people who are living with a chronic condition have one or more additional conditions with which they must cope.[4] Research has consistently shown that patients with chronic diseases have higher medical costs and put greater demands on the health care system. To illustrate, people living with five or more chronic conditions average 15 medical visits a year (11 more visits than other patients) and fill almost 50 prescriptions in a single year.[5] A 2001 study showed that, as the number of conditions increases, the associated medical costs rise disproportionately. For example, health care spending is more than 2.5 times greater for someone living with one chronic condition when compared with individuals who have no chronic

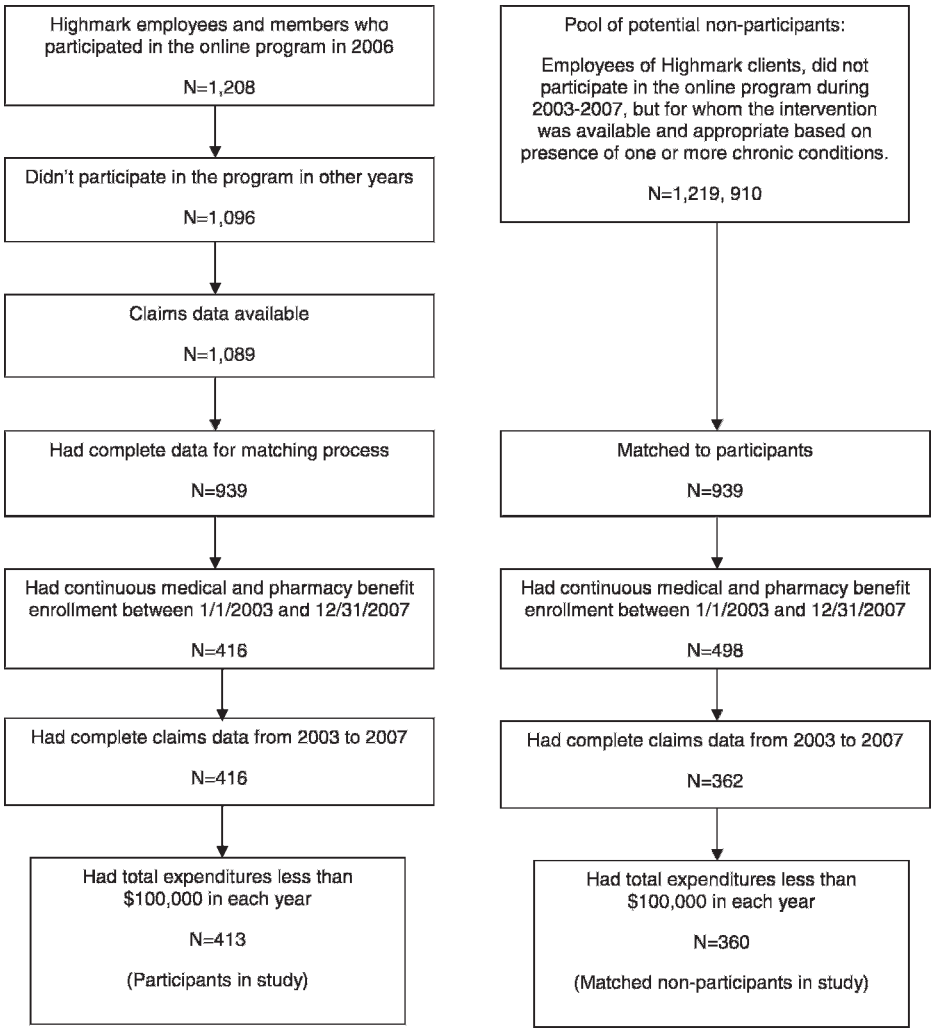
conditions. A person living with three or four chronic conditions will spend seven times more for health care than someone without chronic conditions. Five or more chronic conditions lead to health care spending that is 15 times greater than no chronic conditions.[1]

The costs of chronic conditions reach beyond direct health care expenditures. Chronic conditions seriously impact productivity and performance. For every 1000 working Americans, an estimated 1221 work days are lost each year as a result of asthma, diabetes, and hypertension alone.[6] These three chronic conditions result in an estimated 164 million work days missed by Americans each year, with an annual cost to employers of an estimated $30 billion.[7]

Simply put, the prevalence of chronic conditions is and will continue to grow rapidly. With more chronic disease and fewer primary care physicians per capita,[8] it is becoming increasingly difficult to deliver essential preventive counseling through office visits. A coordinated effort utilizing several public health measures is needed to solve this problem. Consequently, key stakeholders (i.e., patients, providers, employers, caregivers, insurers, and other payers) are now demanding a shift from costly acute care delivered in hospitals to condition management delivered in homes, in communities, at workplaces, and online. This shift involves the use of self-management and preventive care programs that mitigate preventable events. Stakeholders recognize that their approach must extend beyond the physician's office and empower people to take greater responsibility for their health. Such an approach is believed to yield a positive return on investment (ROI) and help patients live healthier, more productive lives.

Some traditional disease management programs have been tested and demonstrate positive outcomes with face-to-face and/or telephonic coaching.[9–11] Despite widespread use of disease management, current outcomes studies have been weakened by factors such as self-selection bias and difficulty estimating ROI.[9,12–16] These challenges could be overcome through randomized, controlled trials, but randomized, controlled trials are expensive, impractical, and perhaps even inappropriate for evaluating disease management interventions in real-world settings.[17–19] Further, most existing care delivery models (i.e., face-to-face, telephonic) cannot scale to meet current and coming need. Moreover, the price of achieving favorable outcomes with traditional disease management services may be cost prohibitive.[19–24]

Figure 1
Selection of Participants and Nonparticipants for Study



Self-management is an approach to chronic care that enhances self-efficacy and teaches problem-solving skills to achieve more effective condition management, role management, and emotional management. Self-management has been most strongly advocated by Kate Lorig,[20–23] drawing heavily upon the self-efficacy theory of Albert Bandura.[24] The self-management framework focuses on the following principles: (1) patients accept responsibility for managing their care, (2) patients optimize daily functioning in ways that realistically consider the limitations imposed by their condition and its treatment, (3) patients effectively and appropriately modulate their affective response to their condition,[23] (4) patients more efficiently manage their care when comorbidities are addressed in a unified manner.

Outcomes research has demonstrated that programming that employs self-management concepts is efficacious in promoting favorable behavior change (e.g., cognitive symptom management, self-reported general health, health distress, fatigue, disability, and

social/role activities)[20–22] and for improving self-confidence to manage chronic condition(s).[24] Self-management can also be a cost-effective method, in that it can reduce preventable health events that drive health care utilization (e.g., inpatient and outpatient visits).[20–22] Online disease management programs may be one essential, but untested, component of this effort.

Few studies have evaluated the potential of electronic modalities to deliver interventions that are cost effective, scalable, and effective in changing behaviors that are at the root of escalating and unsustainable health care costs. The purpose of this study is to evaluate the economic impact of an online disease management program, HealthMedia® Care™ for Your Health, within the context of a broader population health management strategy. The online intervention employed self-management concepts as its foundation within the delivery system of a large, decentralized, regional health plan. The intervention utilizes tailored, personalized content. Key outcomes are health care costs and utilizations.

Table 1
Baseline Comparison of Participants and Nonparticipants

Variable	2006 Program Participants (n = 413)	2006 Program Nonparticipants (n = 360)	*p*
Female, No. (%)	299 (72.4)	277 (76.9)	0.15
2006 age in years, mean (SD)	47.0 (9.9)	46.9 (9.7)	0.89
18–29, No. (%)	20 (4.8)	18 (5.0)	0.99
30–39, No. (%)	88 (21.3)	75 (20.8)	
40–49, No. (%)	136 (32.9)	119 (33.1)	
50–59, No. (%)	139 (33.7)	121 (33.6)	
60–69, No. (%)	27 (6.5)	25 (6.9)	
>70, No. (%)	3 (0.7)	2 (0.6)	
2005 Charlson score, mean (SD)	0.4 (0.8)	0.4 (0.7)	0.55
0, No. (%)	297 (71.9)	263 (73.1)	0.64
1, No. (%)	80 (19.4)	68 (18.9)	
2, No. (%)	22 (5.3)	22 (6.1)	
3, No. (%)	9 (2.2)	3 (0.8)	
4, No. (%)	5 (1.2)	4 (1.1)	
2005 total medical cost, mean (SD)*	$3508 ($5934)	$3200 ($5807)	0.47
2005 total healthcare cost, mean (SD)†	$4620 ($6794)	$4141 ($6302)	0.31
Health coaching participation: yes, No. (%)	288 (69.7)	117 (32.5)	<0.0001‡

* 2005 total medical cost included inpatient, outpatient, and professional services costs. The dollar amounts were adjusted to 2008 values.

† 2005 total health care cost included inpatient, outpatient, professional services, and pharmacy costs. The dollar amounts were adjusted to 2008 values.

‡ The difference between participants and nonparticipants on telephonic health coaching participation was significant, as tested by χ^2 test ($p < 0.0001$).

METHODS

Design

This study employed a retrospective, quasi-experimental, cohort design that compared claims/utilization data for program participants and a matched cohort of nonparticipants. The overall design was a 2×5 (cohort $\times$ year) mixed model using claims data for the years 2003–2007. The variables of interest are program participation and health care costs. This study was approved by an independent institutional review board.

Sample

Highmark Inc is a Blue Cross Blue Shield health plan with approximately 12,000 employees. The plan's 4.8 million members reside in five diverse areas of Pennsylvania (i.e., Pittsburgh, Camp Hill, Johnstown, Erie, and Williamsport). The study was restricted to 2006 participants and risk-matched nonparticipants, given the small sample sizes of participants in 2004, 2005, and 2007 and in order to establish stable baseline cost trajectory.

The program participants began with 1208 unique Highmark employees and members who completed the self-management program at any time in 2006. Of this sample, 1096 participants did not participate in the program in other years, and 1089 of them had claims data available. Nonparticipants were selected from 1,219,910 Highmark members who had one or more chronic conditions addressed during the study period (2003–2007) but who did not participate in the online self-management program.

To reduce the inherent selection bias in a nonrandomized study, participants and nonparticipants were matched on gender, age (within 2 years), Charlson Comorbidity Index Score (collapsed into three groups: 0, 1, 2+), baseline total medical expenditures in the previous year (sum of inpatient, outpatient, and professional cost within $500), and continuous pharmacy enrollment during the study period using the matching method developed by researchers at the Mayo Clinic Division of Biostatistics.[26] Because pharmacy coverage was not available for all members, a continuous pharmacy enrollment indicator, instead of pharmacy cost, was used as a matching variable. Nine hundred, thirty-nine nonparticipants were able to be matched to 939 participants. Finally, participants and matched nonparticipants were considered eligible for the study if they met the following inclusion criteria: (1) had continuous medical and pharmacy benefit enrollment between January 1, 2003 and December 31, 2007; (2) had complete claims data from 2003–2007; and (3) had total expenditures less than $100,000 in each year (to minimize the impact of extremely high claims). Therefore, 413 participants and 360 nonparticipants met all three inclusion criteria defined above and were included in the respective study cohort (Figure 1).

Participants self-reported their medical history (total 24 chronic conditions) at the HealthMedia® Care™ for Your Health baseline questionnaire. Hyperlipidemia (39.5%), hypertension (36.6%), allergies (24.7%), acid reflux/gastroesophageal reflux disease (23.7%), and back pain (23.5%) were the most common conditions reported

by participants in this study, and, on average, participants had 2.7 chronic conditions. These data were not available for nonparticipants.

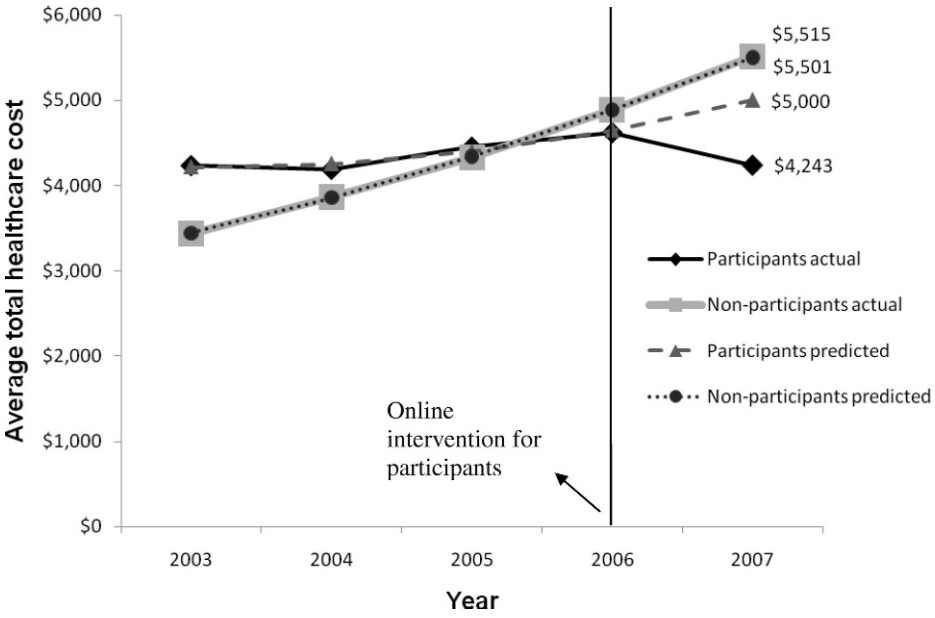
Measures

The costs and claims data presented in this study reflect claims incurred during the 2003–2007 calendar years. Total payments per person per calendar year were aggregated from inpatient, outpatient, professional services, and pharmacy payments. All dollar amounts were Highmark's net payments and were adjusted to 2008 values using the Consumer Price Indices from the U.S. Bureau of Labor Statistics. The medical care index, the inpatient, outpatient, professional services, and pharmacy indices were used to adjust for medical inflation of total payments, inpatient, outpatient, professional services, and pharmacy payments, respectively.[26] Utilization data, such as number of services, hospital admissions, total inpatient days, length of stay, outpatient visits, professional services, and prescriptions are also presented in terms of per person per year.

The costs of the online intervention program were estimated on a per-participant basis by dividing total program costs by total number of participants. Applying this cost to 1208 Highmark participants who participated in the program in 2006, the program expense equates to $76.57 per participant. Other administrative and program costs were considered to be evenly applied to both cohorts.

As a variable used for matching and adjusting, the Charlson Comorbidity Index Score is a scales of 0 to 4 that predicts the mortality for a patient who may have a range of comorbid conditions, such as heart disease, stroke, or cancer. A higher score on the index is associated with higher health care expenditures.[27] As an adjusting variable in the analysis, participation in telephonic health coaching services was categorized as a dichotomous variable (exposure/no exposure), because the level of the services cannot be calculated sufficiently. Participants and nonparticipants who received any health coaching services, including mailings, outbound calls, inbound calls, and interactive voice response calls, during the study period were considered as having participated in the health coaching services. Those who did not receive any services were considered as not participating in the health coaching services.

Figure 2
Actual Versus Predicted Annual Total Health Care Expenditures per Person, 2006 Online Self-Management Program Participants and Matched Nonparticipants



Total health care costs include inpatient, outpatient, professional, and pharmacy costs. All dollars are expressed in 2008 dollars. The values were adjusted for gender, age, Charlson score in 2005, and participation in telephonic health coaching services. The difference between the actual cost and predicted cost for nonparticipants was not significant, as tested by one-sample *t*-test ($p = .49$; one-tailed). The difference between the actual cost and predicted cost for participants was significant, as tested by one-sample *t*-test ($p = .03$; one-tailed).

Intervention

Beginning in August 2002, Highmark implemented a comprehensive Health Promotion and Disease Prevention Program for employees and members that included a suite of online resources, such as a health risk assessment, and online intervention programs focused on healthy lifestyle for weight management, fitness, nutrition improvement, tobacco cessation, and stress management. The online chronic condition intervention being assessed here was part of the Blues on Call℠ condition management program. The Blues on Call℠ program is available for people living with one or more chronic conditions. It provides members with telephone counseling regarding chronic conditions, delivered by registered nurses and registered dietitians. Services include but are not limited to the following: interactive voice response telephonic outreach to members with chronic conditions; letter and phone call reminders for clinical preventive exams; educational resources that include medical management consulting and educational outreach for members and providers; self-management education; and complex case management.

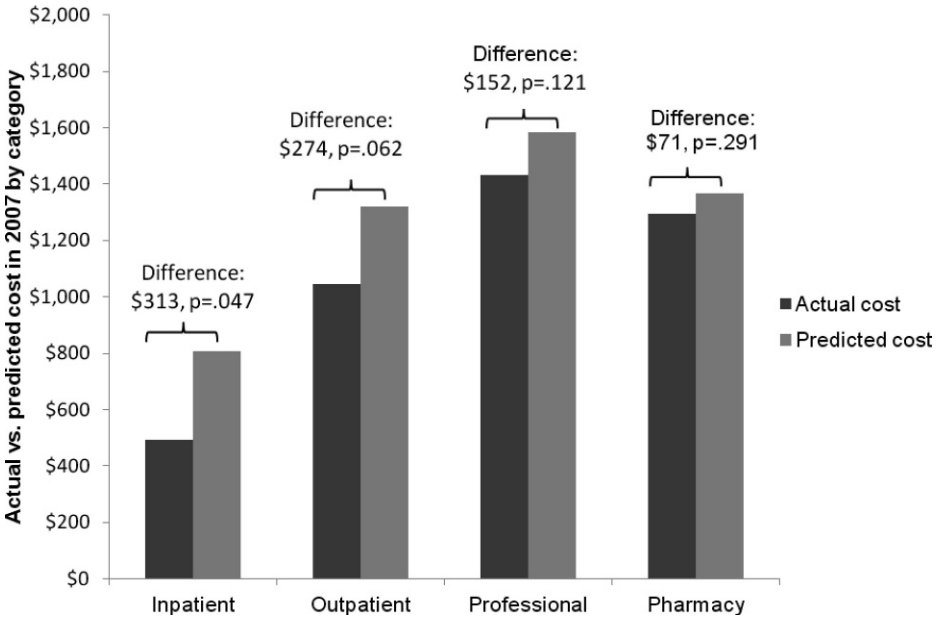
Beginning in September of 2004, members were also offered access to online programs, including an online chronic condition self-management intervention (HealthMedia® Care™ for Your Health) that works in conjunction with Blues on Call℠ health coaches to help members manage chronic conditions, such as coronary artery disease, diabetes, asthma, back pain, and depression. HealthMedia® Care™ for Your Health is commercially available through HealthMedia Inc. The pro-

gram was developed by a team of health care experts and clinical behavioral scientists, and it is based on the principles outlined by Lorig et al.[21,22] It begins with a baseline general health questionnaire, the results of which are used to customize an action plan, three tailored e-mail newsletters, and follow-up evaluations. Follow-up evaluations are administered at days 1, 30, 90, and 180 after program completion. HealthMedia®Care™ for Your Health is a tailored program that teaches people to become more independent, active, and successful managers of their chronic conditions. The following topics are assessed in the baseline and follow-up questionnaires and in the program content: medication compliance; relationships with physicians and pharmacists; symptom management; lifestyle behaviors; emotional modulation; and work productivity.

ANALYSIS

The baseline differences between participants and nonparticipants were evaluated using χ^2test for categorical variables or *t*-test for continuous variables. The costs and utilization differences between participants and nonparticipants were accessed using general linear model with program participation as a between-participants factor; year as a within-participants factor; and gender, age, Charlson score, and participation in telephonic health coaching services (exposure/no exposure) as covariates. All results were also evaluated without controlling for participation in telephonic health coaching services and were compared with the results with this variable as covariates. We predicted the total health care expenditures in the post intervention year (2007) for both participants and nonparticipants by using the trajectory estimate method which predicts a defined-periods cost that was based on a prior period's cost trend. Trajectory estimates for 2006 participants and nonparticipants used second-order polynomial regression of 2003–2006 cost data for best fit, and 2007 costs were predicted. The differences between the predicted costs and actual costs in 2007 were accessed by one-sample *t*-test, and the value for nonparticipants was hypothesized to be nonsignificant in order to support the accuracy of this modeling approach, whereas the value for program participants was determined as the estimated savings per person per year in the one year post the program. The actual costs and utilization data in total and by category were also compared between participants and nonparticipants on the changes from pre- to post-intervention period (2005 vs. 2007). All statistical analyses were performed using SPSS 15.0 (Chicago, Illinois). Any result with a *p* value less than .05 was considered statistically significant.

Figure 3
2006 Estimated Savings Per Person by Cost Category for Program Participants



All dollars are expressed in 2008 dollars. The values were adjusted for gender, age, Charlson score in 2005, and participation in telephonic health coaching services. The differences between the actual cost and predicted cost for program participants were tested by one-sample *t*-tests (one-tailed).

RESULTS

Table 1 presents a comparison of the two cohorts on baseline characteristics. The matching strategy yielded successful matches (i.e., nonsignificant group differences) for gender, age, comorbidity, and baseline expenditures. The only significant difference identified was that online self-management participants were more likely to participate in telephonic health coaching services relative to nonparticipants (69.7% vs. 32.5%, $p < .0001$). Consequently, participation in telephonic health coaching services was used as a covariate in the subsequent analyses. Given the complexities of operationalizing levels of exposure to telephonic health coaching, this covariate was defined in a dichotomous fashion (exposure/no exposure). We also compared the results of including and excluding this variable as covariate to evaluate the impact of this analysis. Gender, age, and Charlson score in 2005 were also used as covariates to better equivalent two groups.

Total Health Care Expenditures

General linear model showed that, after adjusting for gender, age, Charlson score, and participation in telephonic coaching services, the total health care expenditures for people who had participated in the program in 2006 were moderating starting in 2004 (2 years before the intervention) and decreased in 2007 (1 year post the intervention), whereas the costs for the

matched nonparticipants showed a steadily increasing trend from 2003–2007 (Figure 2). To further investigate the relationship between online program participation and total health care expenditure trends, the cost trajectories for both groups were estimated based on a curvilinear fit (second-order polynomial regression, $R^2 > .93$, $p < .0001$) for 2003–2006 data. Total health care expenditures in 2007 were then predicted on the basis of the trend from the data of the prior 4 years. Comparison of actual 2007 costs with predicted costs within each cohort showed that actual costs were significantly lower than predicted for program participants ($4243 vs. $5000, $p < .05$), whereas the difference was not significant for nonparticipants ($5501 vs. $5515, $p = .49$), supporting the accuracy of this modeling approach. These findings are depicted in Figure 2.

Table 2
Annual Health Care Expenditures per Person by Category, 2006 Online Self-Management Program Participants and Matched Nonparticipants

	Year					2005 vs. 2007	
Variable	2003	2004	2005	2006	2007	Difference	Trend
Total healthcare costs							
Participant	$4238	$4193	$4458	$4625	$4243	−$215*	−4.8%*
Nonparticipant	$3439	$3871	$4327	$4891	$5515	$1188	27.5%
Inpatient							
Participant	$723	$643	$634	$687	$495	−$139	−21.9%
Nonparticipant	$583	$669	$900	$669	$932	$32	3.5%
Outpatient							
Participant	$883	$855	$1211	$1155	$1045	−$166	−13.7%
Nonparticipant	$1033	$1094	$1124	$1407	$1354	$230	20.5%
Professional							
Participant	$1572	$1674	$1523	$1610	$1433	−$90*	−5.9%*
Nonparticipant	$994	$1200	$1337	$1624	$1951	$614	45.9%
Pharmacy							
Participant	$1099	$1053	$1150	$1209	$1296	$146	12.7%
Nonparticipant	$897	$976	$1046	$1240	$1324	$278	26.6%

Note: Total health care costs include inpatient, outpatient, professional, and pharmacy costs. All dollars are expressed in 2008 dollars. The values were adjusted for gender, age, Charlson score in 2005, and participation in telephonic health coaching services.

* Participants had significantly lower growth in expenditures than nonparticipants, as tested by general linear models ($p < 0.05$).

ROI

By using the health care expenditure savings of $757 per participant obtained from the trajectory estimate model divided by $76.57 program costs per participant, we yielded an ROI of $9.89 for $1 spent after 1 year utilizing the online self-management program.

Costs by Service Category

To better understand the source of savings, expenditures were analyzed by category (i.e., inpatient, outpatient, professional services, pharmacy) using the same predictive modeling approach employed above for total costs. We estimated savings of $313 for inpatient cost, $274 for outpatient cost, $152 for professional services, and $71 from pharmacy costs (Figure 3). Note that, because of the use of separate predictive models for each category, the sum of these categorical savings does not equal the $757 savings reported for total health care expenditures.

We also compared data from 2005 (1 year prior to the intervention) to 2007 (1 year post intervention) to investigate the rates at which expenditures changed for participants after the intervention to the rates of change experienced over the same period for nonparticipants. Analyses showed that participants had lower cost increase than nonparticipants in total health care cost and all of the categories. Significant differences were found on total health care cost and professional services ($p < .05$, Table 2).

Health Care Utilization

Table 3 presents the number of health care services utilized by the two groups from 2003 through 2007. Participants consistently had lower utilization increases relative to nonparticipants from the pre- to post-intervention period (2005 vs. 2007) in all categories except outpatient services. Significant differences in changes in service utilization were found for total number of services, professional services, and pharmacy services ($p < .05$). Participants also had fewer annualized total inpatient days and shorter length of stay per person per year and showed a declining trend from 2005 to 2007.

Without Control on Health Coaching Services

To assess whether including participation in telephonic health coaching services as a covariate in the analysis impacted the results, we reviewed all the data without adjusting on this variable. All the trends were consistent as the data showed above when adjusting on participation in health coaching services. Without control on health coaching services, the savings in total health care cost in 2007 for participants was slightly higher: $982 savings when comparing predicted cost with actual cost. Participants also had lower cost and utilization increases relative to nonparticipants from pre- to post-intervention period, but the only significant difference was found for the professional cost category (data was not shown here).

DISCUSSION

This study evaluated the impact of a scalable, convenient, online intervention designed to enhance the patient's ability to self manage chronic conditions, focusing on the development of self-management skills and the mitigation of costs (both direct and indirect). The results showed, relative to predicted costs (that were based on 4 years of established cost trends), that partic-

Table 3
Annual Number of Health Care Services per Person per Year by Category, 2006 Online Self-Management Program Participants and Matched Nonparticipants

Variable	Year					2005 vs. 2007	
	2003	2004	2005	2006	2007	Difference	Trend
Total number of services							
Participant	45	45	48	58	55	7*	15.5%*
Nonparticipant	39	45	50	59	67	17	33.8%
Inpatient (hospital admissions)							
Participant	0.08	0.08	0.08	0.10	0.07	−0.01	−13.3%
Nonparticipant	0.08	0.09	0.10	0.10	0.13	0.03	27.0%
Total inpatient days							
Participant	0.30	0.21	0.27	0.26	0.17	−0.10	−36.5%
Nonparticipant	0.36	0.33	0.42	0.40	0.62	0.20	46.7%
Length of stay							
Participant	0.21	0.16	0.23	0.25	0.15	−0.08	−34.2%
Nonparticipant	0.23	0.24	0.39	0.25	0.42	0.03	7.4%
Outpatient visits							
Participant	9	5	6	11	11	5	73.3%
Nonparticipant	9	9	10	12	14	4	40.8%
Professional visits							
Participant	21	23	23	28	26	3*	12.8%*
Nonparticipant	17	21	24	29	34	10	40.8%
Pharmacy (prescriptions)							
Participant	16	17	18	18	18	0.4*	2.0%*
Nonparticipant	14	15	16	18	19	3	19.1%

Note: Total number of services includes inpatient, outpatient, professional, and pharmacy services. The values were adjusted for gender, age, Charlson score in 2005, and participation in telephonic health coaching services.

* Participants had significantly lower increases in service use than nonparticipants, as tested by general linear models ($p < 0.05$).

ipants' costs were, on average, $757 less than expected on the basis of a predictive model, even when accounting for age, gender, morbidity values, baseline costs differences, and participation in telephonic coaching services. The results also showed the increase in outpatient services from pre- to post-intervention period was higher among program participants compared with nonparticipants, but the outpatient cost and total health care cost were lower. This could be explained, as the program probably encourages people to seek regular outpatient care to manage their condition; this reduces the need for more aggressive medication and hospitalization. The same result has been found in other studies.[28,29]

There are limitations to the study design. First, this study was a retrospective analysis and was subject to selection bias even with a matched sample and statistical adjustments for other identified group differences. Second, other potential confounds, such as incentives provided for participation within a specific Highmark customer, may also affect the participation and outcomes. The incentive data was not available to be analyzed in this study. Third, the level of received telephonic coaching services could not be sufficiently calculated for either cohort; therefore, the participation in telephonic coaching (exposure/no exposure) was controlled statistically. Our analysis also indicated all the results held the same trend even without control for this variable. Fourth, the sample size was relatively small, although clearly of sufficient power to detect between- and within-group differences. Nevertheless, when coupled with self-selection, one should avoid the tendency to over-generalize, and replication of findings would surely strengthen any conclusions. Fifth, the change in self-management skills for participants in the program could not be tested because of low response rates at the follow-up questionnaires. The relationship between actual risk modification and health care expenditures was not tested directly either. Further, the savings and ROI calculation were based on health care cost savings in 1 year after the intervention. The study was not designed to measure costs in successive years, and that savings would increase if these trends are maintained. Finally, costs in this study were operationalized as Highmark net payments (Highmark paid to providers) and not on total medical costs incurred, and the analysis constituted a cost offset approach.

The current disease management model must be improved and expanded. Innovative methods for empowering patients to take greater responsibility for their health are currently available, and evidence is beginning to support the clinical and cost effectiveness of these methods. New approaches to delivering health promotion must be efficacious, economical, scalable, and sustainable. Data presented herein suggest that online delivery of health promotion interventions that are standardized, personalized, and based on proven behavioral principals and techniques can meet these challenges. These interventions can be deployed at a population level, are relatively low cost and convenient, and work both independently and as adjuvant resources that scale higher-touch interventions. Technologies such as this must continue to be developed, tested, and—where effective—exploited if we are to address the mounting health care challenges related to chronic disease management and cost containment.

There is more work to be done. Future research must explore how best to combine and deliver high-tech interventions with high-touch ones. This should include the creation of optimized risk stratification models. Financial outcomes must include indirect cost savings from improved productivity in order to evaluate the full economic benefit of participating in

such programs. Prospective approaches will need to be considered in order to draw firmer causal conclusions on whether and how program participation leads to actual risk modification and to decreased health care expenditures. Finally, new strategies for participation that go beyond monetary incentive must be developed and tested in real-world settings to increase the benefit of the program.

SO WHAT? Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Researchers have shown that chronic illness management programming facilitates positive behavior change and decreases health care utilization when self-management is central to the intervention's framework.[20–22] Yet, few studies have evaluated the potential of delivering self-management–based interventions via electronic modalities. Because of the great scalability of such modalities, the intervention's reach can be extended to the entire population along the care continuum, not just the high-risk segment.[31]

What does this article add?

Although not a complete answer, this study is one of the first to illustrate that the application of general self-management principles can produce a measurable ROI. The intervention was evaluated in a real-world setting, which allows the outcomes to be understood in the context of real-world conditions.

What are the implications for health promotion practice or research?

This study brings the potential of efficient and effective population chronic illness management to both employers and health plans.

Acknowledgment

We thank Danielle L. Giuseffi, MPH, Health Research Associate in Behavior Science and Data Analytics Group from HealthMedia Inc for her valuable assistance in drafting this manuscript and revisions.

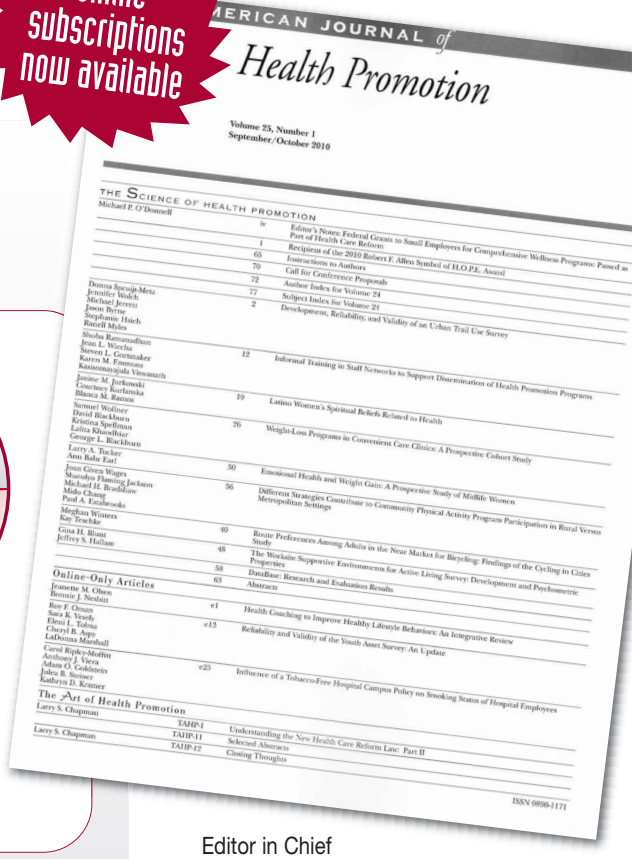
References

1. Agency for Healthcare Research and Quality. Medical Expenditure Panel Survey (MEPS): Justification for budget estimates for appropriations committees, fiscal year 2001. Available at: http://www.ahrq.gov/about/cj2001/meps01a.htm. Accessed September 1, 2009.
2. Cherry DK, Hing E, Woodwell DA, Rechtsteiner EA. National ambulatory medical care survey: 2006 summary—national health statistics reports, no 3. Hyattsville, MD: National Center for Health Statistics; 2008. Available at: http://www.cdc.gov/nchs/data/nhsr/nhsr003.pdf. Accessed September 1, 2009.
3. Boult C, Altmann M, Gilbertson D, Yu C, Kane RL. Disability in the 21st century: future effects of controlling fatal and nonfatal disease. *Am J Public Health.* 1966;86:1388–1393.
4. Wu S-Y, Green A. *Projection of Chronic Illness Prevalence and Cost Inflation.* Washington, DC: RAND Corp; October 2000.
5. Mollica RL, Gillespie J. Care coordination for people with chronic conditions. Partnership for Solutions; 2003. Available at: http://www.partnershipforsolutions.org/DMS/files/Care_coordination.pdf. Accessed September 1, 2009.
6. Goetzel RZ, Long SR, Ozminkowski RJ, et al. Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting US employers. *J Occ Env Med.* 2004;46:398–412.
7. Davis KG, Collins SR, Doty MM, et al. *Health and Productivity Among U.S. Workers.* New York, NY: The Commonwealth Fund; 2005.
8. Kuehn BM. Reports warn of primary care shortages. *JAMA.* 2008;300:1872–1875.
9. Mattke S, Seid M, Ma S. Evidence for the effect of disease management: is $1 billion a year a good investment? *Am J Manag Care.* 2007;13:670–676.
10. Chan V, Cooke CE. Pharmacotherapy after myocardial infarction: disease management versus usual care. *Am J Manag Care.* 2008;14:352–358.
11. Galbreath AD, Smith B, Wood PR, et al. Assessing the value of disease management: impact of 2 disease management strategies in an underserved asthma population. *Ann Allergy Asthma Immunol.* 2008;101:599–607.
12. Kominski GF, Morisky DE, Afifi AA, Kotlerman JB. The effect of disease management on utilization of services by race/ethnicity: evidence from the Florida Medicaid program. *Am JManag Care.* 2008;14:168–172.
13. Buntin MB, Jain AK, Mattke S, Lurie N. Who gets disease management? *J Gen Intern Med.* 2009;24(5):649–655.
14. Linden A, Adams JL, Roberts N. Strengthening the case for disease management effectiveness: unhiding the hidden bias. *J Eval Clin Pract.* 2006;12:140–147.
15. Goetzel RZ, Ozminkowski RJ, Villagra VG, Duffy J. Return on investment in disease management: a review. *Health Care Financing Review.* 2005;26:1–19.
16. Lau G. Study questions effectiveness of disease management. *Investor's Business Daily.* October 3, 2005.
17. WHO European Working Group on Health Promotion Evaluation. Health promotion evaluation: recommendations to policy-makers. Available at: http://www.infosihat.gov.my/artikelHP/bahanrujukan/HEandPenilaian/HP%20Evaluation.pdf. Accessed September 1, 2009.
18. Schwartz CE, Chesney MA, Irvine J, Keefe FJ. The control group dilemma in clinical research: applications for psychosocial and behavioral medicine trials. *Psychomatic Med.* 1997;59:362–371.
19. Schwartz SM, Trask PC, Shanmugham K, Townsend CO. Conducting psychological research in medical settings: challenges, limitations, and recommendations for effectiveness research. *Prof Psychol Res Pr.* 2004;35:500–508.
20. Lorig KR, Sobel DS, Stewart AL, et al. Evidence suggesting that a chronic disease self-management program can improve health status while reducing utilization and costs: a randomized trial. *Med Care.* 1999;37:5–14.
21. Lorig KR, Ritter P, Stewart AL, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. *Med Care.* 2001;39:1217–1223.
22. Lorig KR, Sobel DS, Ritter RL, et al. Effect of a self-management program on patients with chronic disease. *Eff Clin Pract.* 2001;4:256–262.
23. Stanford Patient Education Center. Chronic disease self-management program. Available at: http://patienteducation.stanford.edu. Accessed June 5, 2009.
24. Bandura A. Self-Efficacy*: The Exercise of Control.* New York, NY: WH Freeman; 1997.
25. Bergstralh EJ, Kosanke JL. Computerized matching of controls: section of biostatistics, technical report 56—Mayo Foundation as provided in %MATCH (an SAS macro to match cases with controls), 1995. Available at: http://mayoresearch.mayo.edu/mayo/research/biostat/sasmacros.cfm. Accessed September 1, 2009.
26. US Department of Labor, Bureau of Statistics. *All Urban Consumer Not Seasonally Adjusted: US City Average.* Available at: http://data.bls.gov/PDQ/outside.jsp?survey=cu. Accessed September 1, 2009.
27. Charlson ME, Pompei P, Ales KL, McKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chron Dis.* 1987;40:373–383.
28. Fireman B, Bartlett J, Selby J. Can disease management reduce health care costs by improving quality? *Health Affairs.* 2004;23:63–75.
29. Maciejewski ML, Maynard C. Diabetes-related utilization and costs for inpatient and outpatient services in the Veterans Administration. *Diabetes Care.* 2004;27:b69–b73.
30. RAND Corp. Improving chronic illness care evaluation (ICICE). Available at: http://www.rand.org/health/projects/icice/. Accessed September 1, 2009.

AMERICAN JOURNAL of
Health Promotion

The Wisdom of Practice and the Rigor of Research

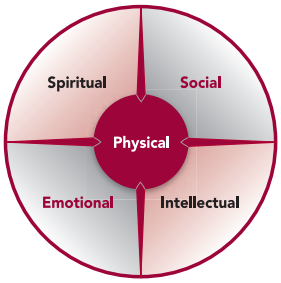
Online subscriptions now available



Definition of Health Promotion

"Health Promotion is the art and science of helping people discover the synergies between their core passions and optimal health, enhancing their motivation to strive for optimal health, and supporting them in changing their lifestyle to move toward a state of optimal health. Optimal health is a dynamic balance of physical, emotional, social, spiritual, and intellectual health. Lifestyle change can be facilitated through a combination of learning experiences that enhance awareness, increase motivation, and build skills and, most important, through the creation of opportunities that open access to environments that make positive health practices the easiest choice."

(O'Donnell, *American Journal of Health Promotion,* 2009, 24,1,iv)



DIMENSIONS OF OPTIMAL HEALTH

" The *American Journal of Health Promotion* provides a forum for that rare commodity — ***practical and intellectual exchange between researchers and practitioners***. "

Kenneth E. Warner, PhD
Dean and Avedis Donabedian Distinguished University Professor of Public Health
School of Public Health, University of Michigan

" The contents of the *American Journal of Health Promotion* are ***timely, relevant,*** and most important, ***written and reviewed by the most respected researchers in our field***. "

David R. Anderson, PhD, LP
Senior Vice President & Chief Health Officer, StayWell Health Management

Subscribe today...

ANNUAL SUBSCRIPTION RATES: (Available 1/1/11. Good through 12/31/11)

	INDIVIDUAL	INSTITUTION		
	Print + Online	Print	Online	Print + Online
U.S.	$139	$184	$359	$359
Canada and Mexico	$148	$193	$359	$368
Other Countries	$157	$202	$359	$377

Call 800-783-9913 (U.S. only) or 818-760-8520

Check out our new online format:

http://www.HealthPromotionJournal.com/online.htm