Impact of 2 Employer-Sponsored Population Health Management Programs on Medical Care Cost and Utilization

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Background: Integrated health management programs combining disease prevention and disease management services, although popular with employers, have been insufficiently researched with respect to their effect on costs.

Objective: To estimate the overall impact of a population health management program and its components on cost and utilization.

Study Design, Setting, and Participants: Observational study of 2 employer-sponsored health management programs involving more than 200,000 health plan members.

Methods: We used claims data for the first program year and the 2 preceding years to calculate cost and utilization metrics, and program activity data to determine program uptake. Using an intent-to-treat approach and regression-based risk adjustment, we estimated whether the program was associated with changes in cost and utilization. Data on program fees were unavailable.

Results: Overall, the program was associated with a nonsignificant cost increase of $13.75 per member per month (PMPM). The wellness component alone was associated with a significant increase of $20.14 PMPM. Case and disease management were associated with a significant decrease in hospital admissions of 4 and 1 per 1000 patient-years, respectively.

Conclusions: Our results suggest that the programs did not reduce medical cost in their first year, despite a beneficial effect on hospital admissions. If we had been able to include program fees, it is likely that the overall cost would have increased significantly. Although this study had important limitations, the results suggest that a belief that these programs will save money may be too optimistic and better evaluation is needed.

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For author information and disclosures, see end of text.

As major purchasers of healthcare in the United States, employers are increasingly using population health management programs to constrain the growth of healthcare costs. According to a recent survey, 65% of employers with 500 or more employees and 75% of those with 20,000 or more employees provided 1 or more disease management programs in 2006, up from 58% in 2004.[1] Population health management programs combine interventions that focus on patients with specific chronic conditions (disease management) or very high cost irrespective of the cause (case management) with so-called wellness components that are aimed at using health risk assessments (HRAs) to identify unhealthy behaviors (eg, smoking, lack of exercise) or risk factors (eg, elevated blood pressure) and at helping employees and dependents address these health risks in order to prevent the development of chronic diseases.[2,3]

Although integrated population health management is conceptually appealing, there is limited scientific evidence that it can actually deliver on its promises. This is in part because evaluations are typically conducted by the program vendors themselves using proprietary methods and are not submitted to peer-reviewed journals. Those methods are typically based on observational designs and thus prone to bias.[4] As the industry is increasingly aware that skepticism about the impact of these programs impedes market growth, more rigorous and transparent evaluation standards are beginning to emerge. Most notably, the Disease Management Association of America (DMAA) has published national consensus recommendations for disease management evaluation.[5,6] Although these guidelines represent an important step toward transparency, they have 2 major limitations. First, although use of an equivalent comparison group is encouraged, the guidelines do not explicitly recommend individual-level statistical analysis to account for differences between intervention and comparison groups.[7] Second, they are specifically designed for stand-alone disease management programs, whereas many employers are now implementing and attempting to measure integrated programs across the care continuum.

We used data from the population health management programs of 2 large employers to analyze the impact of the program on overall medical cost and on utilization of inpatient and emergency department (ED) care. We conducted sensitivity analyses to assess the impact of methodologic choices on our findings. To

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our knowledge, we are the first to publish an evaluation of this novel program type.

METHODS

Description of the Intervention

We analyzed the population health management programs of 2 large employers in the consumer goods industry. Both employers had offered a case management program for high-cost patients, a disease management program for employees and dependents with selected chronic conditions, and a medical advice line staffed by nurses for several years; both added a wellness program, consisting of HRA and lifestyle management, in July 2004 and September 2004, respectively. All program components are operated by a variety of external vendors. For disease and case management, the vendors would use proprietary algorithms to screen the claims data of employees and dependents. If their diagnoses and resource use patterns met the vendors' eligibility criteria, members would be offered support through written and/or Web-based materials and call center–based care managers. For the wellness program, all employees and their spouses, but not children, were given the opportunity to take a voluntary HRA survey. Respondents were offered coaching if the survey response revealed relevant risk factors. Participation was voluntary (ie, members could opt out of any offerings).

Although the companies advertised the 2004 program expansion to their employees, no incentives or penalties were introduced to encourage program participation. Likewise, program participation had no effect on a member's health plan benefits (ie, no additional services or modified cost-sharing arrangements were offered in exchange for participation).

Data

We used health plan claims and enrollment data as well as program participation and activity data from 2001 to 2005. No information on program fees was available during this evaluation. Our data covered more than 200,000 employees and dependents in the firms' self-insured health plans. We used the first year of the expanded program as the intervention year (ie, July 1, 2004, through June 30, 2005, for Employer A; and September 1, 2004, through August 31, 2005, for Employer B). The 2 prior years were used as baseline. This study was approved by RAND's institutional review board.

Variables

Our dependent variables of interest were total paid health insurance claims (medical plus prescription drugs) per member per month (PMPM) and information on hospital admissions and ED visits for all causes. Because we did not have access to information on program fees, we could not calculate the return on investment. Age, sex, the presence of comorbidities (asthma, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, depression, diabetes, and cerebrovascular disease) and an overall risk score derived from the predictive modeling systems each company used to predict healthcare spending were used as covariates for risk adjustment. For each of the 4 program components (case management, disease management, nurse advice line, and wellness), our intervention variables were based on separate determinations of whether members were eligible for that component and whether they opted to participate.

Statistical Analysis

Our primary analysis used a difference-in-differences approach that estimated the differential change from the baseline years to the intervention year for the program participants and nonparticipants, adjusted for observable differences in risk. This comparison strategy is based on recent DMAA recommendations to use the trend in members who are not program-eligible, often referred to as the "nonpurchased trend," as a benchmark for the trend in the program members.[4,5] It should be emphasized that "nonpurchased" does not necessarily mean healthy, because health management services usually are procured for specifically defined conditions and not all members with the condition are eligible for the program (only those who meet the program vendors' eligibility criteria). The implicit assumption behind this comparison strategy is that the risk-adjusted trends in the comparison and intervention groups would be similar in the absence of the intervention.

Following the intent-to-treat principle, we labeled all members who had been identified as eligible for 1 of the program components as participants in that component. To even out seasonal variation in care utilization, only members with 12 months of continuous enrollment in 1 of the firms' self-insured plans were included in the analysis. We used ordinary least-squares regressions to estimate the effect of program participation on cost and logistic regression to determine the effect of the program on the probability of hospital admissions and ED visits. Costs were logarithmically transformed to account for their nonnormal distribution. Standard errors were adjusted to account for repeated observations by member. All data extraction was done with SAS 9.1 (SAS Institute Inc, Cary, NC); all statistical analyses were done with Stata 8.0 (StataCorp LP, College Station, TX).

Sensitivity Analyses

We conducted various analyses to assess how sensitive our findings on the program's cost impact were to variations

in the analytic design. First, we used only 1 baseline year instead of the available 2-year period. Second, we included only members who were consecutively enrolled over all 3 years of the analysis. Third, we included members who were enrolled for at least 6 months in both the baseline and the intervention periods, weighting for the number of months each member contributed to the analysis. Fourth, we added interaction terms between program components for members with overlapping participation to test for multiplicative effects.

Lastly, we repeated our primary analysis, replacing the actually paid claims for office visits, ED visits, and hospital admissions with unit cost estimates. For office and ED visits, unit costs were calculated as the average paid claims for those events in the first baseline year. For hospital admissions, unit cost estimates were calculated based on estimates specific to all patient-refined diagnosis-related groups (APR-DRGs). We used the 2005 Nationwide Inpatient Sample (NIS) and corresponding cost-to-charge ratio file to estimate average cost in each APR-DRG. We merged the cost-to-charge ratio file onto the NIS file based on the unique hospital identifier, multiplied the cost for each admission by the cost-to-charge ratio, and calculated samplewide averages of the resulting charges by APR-DRG. Each inpatient stay in our data was assigned to an APR-DRG using 3M Core Grouping Software version 5.3.0 (3M Health Information Systems, Salt Lake City, UT), and the associated charges were replaced by the estimated average charges in the corresponding APR-DRG.

RESULTS

Descriptive Statistics

Table 1 presents a comparison of demographic characteristics of the 158,962 members in the comparison group and the 39,809 members in the intervention group during the baseline period. Statistical tests revealed that the intervention group members were on average older and less likely to be female. They had higher average spending and risk scores. The prevalence of various common conditions, with the exception of stroke, also was higher in the intervention group.

Almost 55,000 members were identified or volunteered for a component of the population health management program in the intervention period. By far the most commonly used program was the wellness program with more than 43,000 members, followed by disease management with 18,497 members. The nurse advice line and the case management program accounted for 1774 and 2020 members, respectively. Of the members that the vendors had identified as eligible for case and disease management, 59% and 44%, respectively, agreed to participate (ie, did not opt out of the program). A total of 14,032 members participated in more than 1 program and the most common overlap was between wellness and disease management, with 8953 members. Table 2 shows the health management programs in which members participated.

Bivariate Analysis

Table 3 summarizes the relative changes in overall medical cost, ED visits, and hospital utilization for program participants

Table 1. Demographic Characteristics of the Intervention and Comparison Groups: Baseline Year[a]

Characteristic	Comparison Group (n = 158,962)	Intervention Group (n = 39,809)	*P*
Female sex, %	48	43	<.001
Average age, y	32	42	<.001
Average risk score	0.93	1.59	<.001
Average PMPM healthcare spending, $	120	271	<.001
Members identified as having a common chronic condition, %			
Asthma	2.07	3.45	
CAD	1.66	3.68	<.001
CHF	0.60	0.80	<.001
COPD	0.98	1.23	<.001
Diabetes	2.18	5.75	<.001
Depression	1.65	2.92	<.001
Stroke	0.10	0.13	NS

CAD indicates coronary artery disease; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; NS, not significant; PMPM, per member per month..
[a]Tests for statistical differences were based on the *t* test for continuous variables and on the χ^2 test for binary variables.

and nonparticipants. On average, cost increased $9.83 PMPM faster for participants than for nonparticipants. Although the faster increase was observed for all program components, it was most prominent for case management ($137.34 PMPM) and smallest for the wellness component ($5.26 PMPM). Effects on utilization were mixed, with the most relevant effect being a reduction of hospital admissions in the disease management component.

Statistical Analysis

As Table 4 shows, the risk-adjusted estimates of program impact suggest that the integrated program, as well as all individual intervention components except case management, is associated with higher PMPM cost. However, the change is only statistically significant for the wellness program, which showed a $20.14 PMPM cost increase. There was a small but statistically significant decrease in the probability of all-cause hospital admissions of 4 events per 1000 patient-years for case management members, and 1 event per 1000 patient-years for disease management members. The probability of an ED visit increased significantly for disease management participants (7 per 1000 patient-years) and users of the nurse advice line (67 per 1000 patient-years).

Sensitivity Analyses

The variations run on our sample selection and analytic design typically resulted in small changes to the estimates and would not have affected the interpretation of the results substantially (Table 5). The most consistent finding was that using 12 months of baseline data instead of 24 months led to a more favorable assessment of the program effect. Adding interaction terms between program components changed the relative assessment of the wellness program. Whereas the wellness program was associated with a significant $20.14 increase in PMPM cost in the model without interaction terms, it dropped to $8.37 PMPM and lost its statistical significance in the model with the interaction term. However, this model also showed that members who used both disease management and wellness programs experienced a statistically significant cost increase of $19.09 PMPM. Of note, basing the evaluation on unit cost estimates rather than actual cost did not alter the results substantially.

Table 2. Program Uptake and Participation (N = 203,968)

Program Component	Percentage	Average Age, y	Percent Female
Wellness			
HRA eligibility	56.20	41.3	45.28
Identification for LM	21.33	39.9	43.04
Participation	21.15	39.9	43.02
Percent participants out of those identified	99.14		
Advice line			
Identification	0.87	29.0	54.96
Participation	0.71	28.9	54.61
Percent participants out of those identified	81.96		
Disease management			
Identification	9.07	44.9	40.24
Participation	3.95	44.3	39.40
Percent participants out of those identified	43.59		
Case management			
Identification	0.99	37.9	47.28
Participation	0.58	36.9	43.56
Percent participants out of those identified	58.76		
Any program			
Identification	26.87	40.7	43.33
Participation	23.31	40.0	43.30
Percent participants in any program out of those identified	86.73		

HRA indicates health risk assessment; LM, lifestyle management.

Table 3. Effect of Program Components on Cost and Utilization: Bivariate Comparisons[a]

Program Component	Within-Program Changes Over Time			Difference-in-Differences (Program/Category vs No Program)
	Pre	Post	Absolute Change	
No program				
Total cost, $	121.54	122.88	1.34	—
Hospital admissions	46	43	–3	—
ED visits	140	139	–1	—
Any program				
Total cost, $	254.63	265.80	11.17	9.83
Hospital admissions	66	62	–4	–1
ED visits	157	166	10	11
Advice line				
Total cost, $	161.00	191.64	30.64	29.30
Hospital admissions	67	78	11	14
ED visits	198	324	126	127
Disease management				
Total cost, $	476.70	513.17	36.47	35.13
Hospital admissions	116	99	–17	–14
ED visits	253	272	19	20
Case management				
Total cost, $	1052.12	1190.80	138.68	137.34
Hospital admissions	241	245	3	6
ED visits	348	336	–12	–11
Wellness				
Total cost, $	125.91	132.51	6.60	5.26
Hospital admissions	35	35	0	3
ED visits	110	118	7	8
Disease management and wellness				
Total cost, $	271.67	299.93	28.26	17.09
Hospital admissions	75	78	3	7
ED visits	159	183	24	14

ED indicates emergency department.
[a]Hospital admissions and ED visits are expressed as events per 1000 patient-years; total cost is expressed as cost per member per month.

DISCUSSION

Population health management programs have become very popular, particularly in the employer community, but so far little objective information on their impact is publicly available. To our knowledge, ours is the first independent evaluation of an example of an integrated program that offers support for members with manifest conditions as well as for those with risk factors and unhealthy lifestyles. Our results suggest that, at least in the first year of the expansion from a disease and case management program to an integrated population health management model, participants and nonparticipants had similar increases in medical cost, adjusting for observable differences in case mix. In other words, we could not detect a positive impact on medical cost and utilization. To the contrary, some of our findings point toward faster cost increases for program participants than for nonparticipants, even though these estimates were not statistically significant. As we did not have access to information about program fees paid to the vendors, we could only speculate as to whether adding those fees to the cost for the program members would have made the increase statistically significant. Consistently, we did not find

Table 4. Effect of Program Component on Cost and Utilization: Statistical Analysis[a]

Program Component	Estimated Change in PMPM Spending, $	Estimated Change in Hospital Admissions per 1000 Patient-Years	Estimated Change in ED Visits per 1000 Patient-Years
Any program	13.75	0	2
Case management	–1.35	–4[b]	4
Wellness	20.14[b]	2[b]	–3
Disease management	8.63	–1[b]	7[b]
Advice line	21.71	6	67[b]

ED indicates emergency department; PMPM, per member per month.
[a]All estimates were adjusted for age, sex, presence of chronic conditions, and risk score.
[b]$P < .05$.

Table 5. Sensitivity Analyses: Impact of Variation in Analytic Design on Estimates of Program Effects (PMPM Cost)

	Estimate, $ (Difference From Base Approach Estimate)					
Program Component	Base Approach	12-Month Baseline	Quasi-Cohort Analysis	True Cohort Analysis	Unit Cost Estimation	Synergy Effects
Case management	–1.35	–15.30 (–13.95)	–5.84 (–4.49)	–11.01 (–9.66)	3.07 (4.42)	10.17 (11.52)
Wellness	20.14[b]	12.91 (–7.23)	23.17[b] (3.03)	23.72[b] (3.58)	15.09[b] (–5.05)	8.37 (–11.77)
Disease management	8.63	–1.89 (–10.52)	8.73 (0.10)	5.54 (–3.08)	5.95 (–2.67)	17.35 (8.72)
Advice line	21.71	15.58 (–6.13)	30.08 (8.37)	38.55[b] (16.84)	21.74 (0.02)	95.14[b] (73.43)
Disease management and wellness	NA	NA	NA	NA	NA	19.09[b]

NA indicates not applicable; PMPM, per member per month.
[a]The base approach included 2 years of baseline data and 1 year of intervention data, but only data for the years in which a member was consecutively enrolled for 12 months. The 12-month baseline approach used only 1 year of baseline data. The quasi-cohort analysis included all member who contributed at least 6 months of data to the baseline and the intervention period. The true cohort analysis included only members who were consecutively enrolled over the 3-year period. The synergy effects analysis accounted for the effect of members participating in more than 1 program component by introducing interaction terms between program participation variables in the statistical model. See the text for details.
[b]Significantly different compared with nonprogram members at $P < .05$.

that the program significantly reduced the probability of high-cost events (eg, ED visits, hospital admissions), which is the mechanism through which such programs reduce cost.

The question now becomes whether it is surprising that integrated population health management had no measurable impact on cost in the first year; we think the answer is no. Such programs try to improve health-related behavior, reduce risk factors, and encourage the use of preventive services. Although these goals would imply increased use of medical services in the short term, the assumption is that the resulting improvements in health and disease control can help avoid high-cost events (eg, ED visits, hospital admissions) in the future enough to offset the higher short-term cost and the cost of the program. As working-age populations tend to have a relatively low baseline rate of hospital admissions, however, it is challenging to achieve enough of a reduction to generate the necessary savings in the short run.[8]

Past research is consistent with this intuition. Although integrated population health management programs as a whole have not been sufficiently evaluated, more information is available on the impact of their components, in particular on the impact of disease management and worksite wellness programs. A recent RAND review of the disease management literature showed solid evidence for a positive impact on quality of care and disease control, but very little support for the hypothesis that disease management can decrease cost.[9] Most notably, there was very limited evidence for the effect of large-scale, population-based programs that are administered by health plans or third-party vendors, which are the type of programs typically used as part of the health management interventions. Better support exists for worksite wellness programs, as reviews by Pelletier concluded that these programs reduce risk factors, improve clinical outcomes, and decrease cost, even though the underlying research varies in its methodologic rigor.[10,11]

Positive effects typically take time to materialize though, as suggested by a recent study that showed a wellness program yielded net savings only after 4 years.[12]

An important result of this study is that the estimates of program impact were quite robust against changes in the definition of the sample and the analytic design. Our findings suggest that using a longer baseline period (24 months instead of 12 months) led to a more conservative assessment of the program's effect, lending support to a recently published DMAA recommendation to use at least 24 months of baseline data.[6] The use of unit cost rather than actual charges, which has been advocated as being less sensitive to unrelated changes in prices for medical services, did not affect our results substantially.[13] However, it has to be kept in mind that most of our unit cost estimates were derived as sample averages at baseline; true unit cost derived from an external sample might have had a different effect. The use of interaction terms to account for program overlap did influence the relative effect of the disease management and wellness components.

Take-Away Points

Purchasers are increasingly relying on population health management programs to contain costs; however, whether these programs can reduce costs has been insufficiently researched.

- Using data from 2 large employers, our evaluation shows that integrated health management programs that combine disease prevention and disease management services do not seem to reduce healthcare spending in their first year.
- No information on program fees was available. It is likely that overall cost would have increased significantly if we had been able to include them.
- Purchasers of disease prevention and disease management programs should be skeptical of vendors that claim substantial savings in the short run.

Limitations

Clearly, our comparison strategy is not optimally protected against bias. Although the difference-in-differences approach can account for baseline differences, it rests on the implicit assumption that the trend in the program and nonprogram groups would have been the same in the absence of the intervention. As program participants were on average sicker than nonparticipants, it is reasonable to assume that cost in the program group would increase faster, which would bias our results against finding a positive program effect. We tried to minimize this bias by adjusting for observable variables, but unobservable differences may have influenced the results, as our statistical model has only limited explanatory power.

Our data also did not provide for a clean baseline period without any program exposure. Therefore, we may have misestimated the effect of the components that started prior to 2004 (case management, disease management, and nurse advice line).

Implications

Although our study had important design limitations, its results suggest that a belief that these programs will save money in the short run may be too optimistic and better evaluation is needed. However, the finding that broadening a case and disease management program to include wellness programs does not have a measurable impact on healthcare cost in the first year does not disprove that this approach to improving health works in the long run. As such programs differ substantially in scope, content, and execution, one should be careful about generalizing the findings from one evaluation to other programs.[14] But until more definite evidence is available, purchasers of such programs, private and public, should view vendor claims about the prospect of short-term savings with caution and insist on a valid and transparent evaluation strategy.

Our findings also show that estimates from a multivariate statistical model differ substantially from those based on an unadjusted comparison of means, which is the most commonly used evaluation approach in the industry. This is particularly true when it comes to the effect of individual components of an integrated program. Because the statistical model does differ substantially and, by including more information, is better able to adjust for differences in risk and the effect of multiple program participation, these findings support an evaluation strategy based on statistical modeling instead of the current industry-standard unadjusted comparison of means.[15]

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