Financial Impact of Population Health Management Programs: Reevaluating the Literature

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Abstract

Although many employers offer some components of worksite-based population health management (PHM), most do not yet invest in comprehensive programs. This hesitation to invest in comprehensive programs may be attributed to numerous factors, such as other more pressing business priorities, reluctance to intervene in the personal health choices of employees, or insufficient funds for employee health. Many decision makers also remain skeptical about whether investment in comprehensive programs will produce a financial return on investment (ROI). Most peer-reviewed studies assessing the financial impact of PHM were published before 2000 and include a broad array of program and study designs. Many of these studies have also included indirect productivity savings in their assessment of financial outcomes. In contrast, this review includes only peer-reviewed studies of the direct health care cost impact of comprehensive PHM programs that meet rigorous methodological criteria. A systematic search of health sciences databases identified only 5 studies with program designs and study methods meeting these selection criteria published after 2007. This focused review found that comprehensive PHM programs can yield a positive ROI based on their impact on direct health care costs, but the level of ROI achieved was lower than that reported by literature reviews with less focused and restrictive qualifying criteria. To yield substantial short-term health care cost savings, the longer term financial return that can credibly be associated with a comprehensive, prevention-oriented population health program must be augmented by other financial impact strategies. (Population Health Management 2012;15:xx–xx)

Introduction

Purchasers of worksite-based population health management (PHM) programs are increasingly interested in proof of a return on investment (ROI) and evidence that such programs can reduce or delay the growth of their health care and pharmacy costs. Passage of the 2010 Patient Protection and Affordable Care Act included provisions to promote worksite health programs and align the legislation with “Healthy Workforce 2010” objectives, which were promulgated in 2001 to increase the proportion of worksites in the United States that offer comprehensive health promotion programs to employees. Although the legislation may result in increased adoption of worksite-based PHM programs, it remains to be seen whether these reforms will have an appreciable impact on the level of investment made by employers in comprehensive best-practice programs. A national survey of worksite health promotion program offerings, conducted in 2004, indicated that fewer than 7% of US worksites provided programs that met the criteria for comprehensiveness. The study demonstrated that most large employers offer select components of health promotion programs but only a small minority of companies in the study sample had begun to invest in the type of comprehensive approach likely to be needed to produce a significant financial impact.

Several literature reviews have been conducted to examine the state of the evidence on the cost impact of PHM programs and most are consistent in their conclusion that PHM programs can yield approximately $3 for every $1 invested after approximately 3 to 5 years of intervention. Most of the studies included in these reviews were published before 2000 and used diverse methods that varied in rigor to estimate cost savings. Meta-analyses to date have used relatively broad criteria regarding what constitutes a worksite-based employee health improvement intervention. Studies reviewed and included in the analysis of financial impacts to date have ranged from short- to long-term intervention periods and from narrowly focused risk reduction initiatives to wide-ranging program offerings. We found no meta-analysis...
or literature review articles with inclusion criteria restricted to comprehensive programs that are designed to serve all segments of the health care continuum from the healthy, lowest risk individuals to the highest risk individuals who are in need of complex case management services. We also found no review articles that offer insight into what magnitude of return occurs over shorter and longer time frames. The present study addresses these gaps by offering a current and focused review to determine what level of return can be expected from comprehensive PHM programs based on direct health care cost savings alone, and to determine what financial impact is achievable in the first, second, third, and later years of programming.

Methods

Study inclusion criteria

A computerized search was conducted for primary research articles published in peer-reviewed journals using multiple social sciences databases including CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Database of Systematic Reviews, SAGE Health Sciences, JAMA, MEDLINE, and PubMed. Search terms included combinations of “benefit,” “cost,” “cost-benefit,” “cost-effectiveness,” “disease management,” “employee,” “financial impact,” “health promotion,” “return-on-investment,” “wellness,” “workplace,” and “worksite.” Because this initial search identified over 4000 unique studies, additional filters were applied to narrow the scope of the review. Additional search delimiters included studies published in English and those based on programs implemented in the United States. After applying the additional delimiters, 30 studies qualified for detailed review.

Rating and selection of studies

Abstracts from the initial round of reviews were further analyzed to limit the final selection of studies to those that fulfilled criteria deemed critical for drawing credible, conservative, and relatively confident conclusions about the ROI produced from well-designed PHM programs. Additional criteria used to qualify studies for this second-level review were:

- Studies were published after 2004. The delimiter of excluding articles published before 2005 is derived from our observation that relevant review articles and PHM-related studies prior to this date were an amalgam of worksite wellness or disease prevention-oriented programs. The PHM programs evaluated in more recent studies have expanded to include targeted disease management programs that have been integrated with traditional worksite wellness offerings. Nineteen studies were excluded for this reason, but most of them also failed to meet 1 or more of the additional criteria outlined in the following items.
- Estimates of cost savings were based on changes in direct health care/pharmacy costs as a primary outcome. Six studies were excluded because they combined health care cost savings with other types of savings (eg, disability costs) or estimated cost impact based on changes in other measures. The interventions studied employed a comprehensive PHM approach that included interventions for higher risk as well as lower risk individu-

als. Nine studies were excluded because they were provided only for those with chronic conditions (ie, disease management programs).
- The study methodology employed a well-defined non-participant comparison group in a quasi-experimental or randomized controlled trial (RCT) study design. Two studies were excluded because they did not include comparison groups.
- The analysis used a “differences in differences” approach to assess cost savings by comparing changes in health care cost trends for individual participants versus nonparticipants from preintervention to postintervention periods while controlling for demographic differences between the groups. Four studies were excluded because cost impacts were derived using another methodological approach, such as observing impact on trend over time without adjusting for other contributing factors in a regression model.
- The calculation used to obtain a benefit-to-cost ratio (or ROI) was to divide estimated savings by program costs. One study was excluded because it did not provide sufficient information to calculate ROI.

In addition to the studies eliminated from the review for the reasons stated, one of the extracted studies was excluded from the review, even though it was conducted as part of a comprehensive PHM program, because ROI calculations were limited to a comparison of lifestyle management and disease management coaching. We revisit some of the excluded studies in the discussion section to provide further insight into the limitations of other review articles that have focused on ROI in PHM. The application of these additional literature review criteria resulted in a final sample of only 5 unique studies that met all review criteria.

Results

Paucity of rigorous population health management research

In spite of literature search criteria encompassing all studies published in the past 6 years, only 5 studies met our relatively stringent research methodology requirements, and all were published within the past 3 years. The criterion that eliminated the greatest number of studies from this review was restricting our sample to interventions that used a comprehensive, population-based program design (ie, providing programs for individuals across all levels of risk). The 5 population-based studies that satisfied all inclusion criteria are summarized in Table 1. In the Discussion section, we review 4 other ROI studies that did not satisfy our original criteria but that provide useful additional information about the challenge of identifying rigorous PHM research relevant to current program planners and evaluators.

Program comprehensiveness

All of the studies included in this review collected population-based health assessment data using a combination of measurement tools including surveys, biometric screening, and/or health care claims data. These assessments were used both to provide baseline data on risk levels in the population as well as to determine eligibility for and recruitment into interventions, including targeted disease management...
<table>
<thead>
<tr>
<th>First author and year</th>
<th>Study Population</th>
<th>Study Design</th>
<th>Program Focus</th>
<th>Number of Study Years</th>
<th>Results</th>
</tr>
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<tbody>
<tr>
<td>Grossmeier, 2010&lt;sup&gt;9&lt;/sup&gt;</td>
<td>5408 employees</td>
<td>Quasi-experimental design comparing medical expenditures pre/post intervention for participants and nonparticipants.</td>
<td>Disease management, lifestyle management, health awareness programs, on-site programs, on-site fitness centers.</td>
<td>4 years; 2 intervention years and 2 preintervention years.</td>
<td>Cost savings sufficient to yield break-even ROI after 2 program years.</td>
</tr>
<tr>
<td>Mattke, 2009&lt;sup&gt;10&lt;/sup&gt;</td>
<td>198,771 employees and adult dependants</td>
<td>Quasi-experimental design comparing medical expenditures pre/post intervention for participants and nonparticipants.</td>
<td>Case management, disease management, lifestyle management, health awareness programs.</td>
<td>3 years; 1 intervention year and 2 preintervention years.</td>
<td>Cost increase of $13.75 PMPM; no reduction in medical costs in the first year.</td>
</tr>
<tr>
<td>Milani, 2009&lt;sup&gt;11&lt;/sup&gt;</td>
<td>339 employees and spouses</td>
<td>Randomized experimental design comparing medical expenditures pre/post intervention for participants and nonparticipants.</td>
<td>Case management, disease management, lifestyle management, health awareness programs, on-site programs, fitness center memberships.</td>
<td>2 years; 1 intervention year and 1 preintervention year.</td>
<td>$6.00:$1 ROI after 1 year.</td>
</tr>
<tr>
<td>Naydeck, 2008&lt;sup&gt;12&lt;/sup&gt;</td>
<td>3784 employees</td>
<td>Quasi-experimental design comparing medical expenditures pre/post intervention for participants and nonparticipants as well as a third external group of nonparticipants. Relyed on case-matched comparison groups using sex, age, baseline costs, and morbidity scores.</td>
<td>Disease management, lifestyle management, health awareness programs, on-site programs, on-site fitness centers.</td>
<td>5 years; 4 intervention years and 1 preintervention year.</td>
<td>$1.65:$1 ROI after 4 years.</td>
</tr>
<tr>
<td>Nyman, 2009&lt;sup&gt;13&lt;/sup&gt;</td>
<td>21,124 employees</td>
<td>Quasi-experimental design comparing medical expenditures pre/post intervention for participant and nonparticipant program groups. Included random effects regression.</td>
<td>Disease management, lifestyle management, health awareness programs.</td>
<td>3 years; 1 intervention year and 2 preintervention years</td>
<td>Savings were observed for disease management but were not great enough to yield positive ROI. No savings for lifestyle management.</td>
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PMPM, per member per month; ROI, return on investment.
coaching, targeted lifestyle management coaching, and population-wide health awareness programs. In addition, 3 of the programs provided on-site activities and 2 provided case management interventions.

**How soon for cost savings from population health management programs?**

Intervention periods for the 5 qualifying studies ranged from post-assessment after 1 year of program intervention to post-assessment after 4 years of intervention. Because purchasers of PHM programs typically are interested in knowing how soon their investment will yield a return, this review provides categorical information about the most rigorous studies, the number of intervention years that were evaluated, and the calculated levels of cost savings that each program yielded. One study, by Grossmeier and colleagues, assessed the impact of a comprehensive PHM program after 2 intervention years and showed a 1:1 ROI at the end of the intervention.

Only 1 of the studies reviewed demonstrated cost savings after 1 year of intervention; the level of savings achieved was sufficient to yield a return of $6 for each dollar invested. The other 2 studies that were based on a 1-year intervention period demonstrated a greater cost increase for participants than for nonparticipants. The 2 remaining studies demonstrated sufficient savings to yield a break-even ROI after 2 years of intervention and an average ROI of 1.65:1 after 4 years of intervention, respectively.

**Discussion**

A time-honored assumption in research is that using rigorous methods makes it more difficult to demonstrate program outcomes. This review supports that assumption. Comparing these 5 studies illustrates that the ROI from PHM programs, while substantial, is somewhat lower than the ROI proffered by other thoughtfully conducted published reviews. Nevertheless, our more restrictive literature review criteria afforded us the opportunity to compare similarly comprehensive population health programs that were evaluated with traditional, homogenous, and reliable research methods. Four of the 5 studies we examined used a quasi-experimental, pre/post design, with a comparison group and only 1 used the gold standard of an RCT study design.

It is likely that each of the study samples substantially influenced the final ROI estimates. The study by Milani and Lavie, for example, recruited individuals from a single employer and relied on 2 geographically distinct worksites to serve as the intervention and control locations. Of those recruited to participate in the study, a portion from each location was randomly selected to comprise the study population. Participation in the study required individuals to complete several assessment questionnaires before and after the program. The final recruited study population was a much smaller sample (n = 339) than the other reviewed studies. Though it was not mentioned in the article, study requirements may have limited the study participants to only those extremely motivated to change their lifestyle. Of the 4 remaining quasi-experimental studies, 1 used a case-matched comparison group to better control for baseline differences between study groups. This rigorously controlled study demonstrated a break-even ROI after 4 years.

This review focused only on savings generated from changes in health care cost trends and did not include savings from reductions in absenteeism. Other published reviews have found significant cost savings associated with positive changes in productivity-related outcomes. A 2010 meta-analysis by Baicker, Cutler, and Song was restricted to studies that met a level of methodological rigor similar to this review, but it included studies of programs that were not as comprehensive as those in this review or that were published more than 10 years ago. The authors reported an average ROI of 3.27:1 based on direct health care costs alone, with an average intervention period of 3 years. A separate meta-analysis in the same study based only on reduced absenteeism costs found an average ROI of 2.73:1 after an intervention period of only 2 years. These results suggest that a significant ROI can be achieved in a shorter time period if cost savings associated with productivity impacts are included in the ROI calculation.

Another characteristic of the studies included in this review is that the programs evaluated were more comprehensive and thus may have had a higher cost than those included in previous reviews. More comprehensive programs may take a longer period of time to yield a positive return because they require a greater investment than the less comprehensive programs represented in the previous literature reviews. This greater investment may reap a greater ROI, but that return may take longer to materialize.

Because our stringent review criteria yielded only 5 studies for full review, we re-rated our initial 30 studies according to modified criteria. We retained criteria related to methodological rigor but extended the publication date back to 1995 and relaxed our standard related to comprehensive programming to include studies of programs that offered extensive lifestyle management and wellness programming but did not specifically offer targeted intervention programs for those at highest health risk (ie, disease management programs). These 2 changes yielded 3 more studies. One more study was identified by further relaxing our criteria to include studies that did not use a well-defined nonparticipant comparison group.

None of the studies derived from our modified criteria tested interventions with a time frame shorter than 2 years. One of the studies with a comprehensive program design and 2-year intervention time frame, similar to the Grossmeier study referenced in the Results section, found no ROI related to health care costs. However, this study by Aldana and colleagues reported a $15.60:1 ROI related to absenteeism. Two of the studies had 3-year intervention periods. Ozminowski and colleagues reported an ROI of 4.56:1 and Stave and colleagues reported a 6.13:1 ROI. Though the Stave et al study provides thorough detail concerning “per participant” cost reductions, they provide sparse program cost data to support their ROI calculation but state that “the estimated cost per participant is around $100.00.” The result must be further qualified because the researchers combined health care costs with workers’ compensation, short-term disability, and long-term disability costs. Additional information in the Discussion section makes it possible to deduce that health care cost impacts comprised about 19% of the savings. Further calculations yield the conclusion that an ROI of 1.20:1 was achieved after 3 program years based on health care cost savings alone. Another study with the least robust
methods, by Davis and colleagues, showed a 2.43:1 ROI after a 4-year intervention.\(^{18}\) In this study, only 25\% of eligible employees were enrolled in the program and, without a nonparticipant comparison group, the authors appropriately qualify their reported ROI by indicating, "we cannot say for certain that these decreases were attributable to wellness program participation."\(^{18}\)

Though 9 studies do not provide sufficient data to garner definitive conclusions, they do provide support for the relationship between the size of the ROI and the length of the intervention period. A modest interpretation, when considering the 9 studies together, is that it is unlikely\(^{13,14}\) but possible\(^{11}\) that an ROI can accrue after 1 year of intervention; a nominal ROI can occur after 2 years,\(^{10,15}\) but the more substantial returns are more likely after 3 or more years.\(^{16,17}\)

Consistent with our assumption that the most rigorous studies would produce the more modest ROIs, of the 5 studies that satisfied our original criteria and reported an ROI, the average ROI is 1.73:1; the average ROI from the additional 4 studies is 2.05:1. When considering all 9 of these relatively rigorous studies, the average ROI is 1.87:1 and the average intervention interval is 2.2 years. This finding is positive but clearly less than the 3.27:1 ROI over 3 years reported in the Baicker and colleagues review that employed somewhat less stringent selection criteria.\(^{5}\)

What we found to be consistent in both the 5 studies featured in this review and the additional 4 studies summarized in the Discussion section is that comprehensive PHM programs are capable of yielding a positive return over time based on participation-linked health care cost impact. Moreover, this finding was based on recent, rigorously conducted studies of the financial impact of comprehensive PHM programs.

**Study limitations**

The criterion that eliminated many studies from this review was use of a comprehensive PHM program. It is possible that some excluded studies employed a comprehensive program but that the published description of the program did not fully convey the program’s comprehensive nature. Though an important contribution of this study relates to the inclusion of only direct health care cost savings to help inform purchasers and policy makers who are focused primarily on this portion of the total ROI, it is likely that program designers also planned these programs to yield a substantial impact on employee productivity and associated costs and that these savings opportunities are also important to employer purchasers. If so, our sole focus on health care cost impact significantly understimates the total relevant financial impact of the PHM program. Supporting this assertion, previous literature reviews found that most of short-term financial impact resulted from indirect productivity impacts in the form of reduced time away from work or increased on-the-job productivity.\(^{4,7,19}\) It is important for employers to understand that although it may take more than a year to realize a significant impact on direct health care costs, short-term savings in indirect productivity costs appear to be more than sufficient to justify stakeholder support for the program. Additionally, employers may complement the longer term health care cost impact strategy of a comprehensive prevention-oriented population health strategy with short-term health care cost savings strategies such as health plan design changes and health care consumerism.\(^{20–22}\)

**Recommendations for future research**

Additional research is needed on comprehensive PHM programs in which ROI evaluation is begun earlier in the program, and annual and cumulative ROI are calculated on an ongoing basis. To add to the body of evidence included in this review, studies should rely on similarly rigorous methods and comprehensive program scope. Sufficient information should be provided to help end users of published research understand the program components and delivery costs included in and excluded from the ROI calculation. Most important, rigorously conducted studies that fail to produce cost savings should be considered to contribute the same level of knowledge as those studies that demonstrate significant cost savings, and should be treated accordingly in publication decisions. A 2009 commentary on diffusion of innovation in public health reported that an estimated 17\% of original research is not submitted for publication because investigators assumed negative results would not be published.\(^{23}\)

**Conclusion**

The aim of this review was to assess the cost impact of comprehensive PHM programs that are based on rigorously executed, recently published, peer-reviewed studies. This focused review found that comprehensive PHM programs yield a positive ROI based on the impact on direct health care costs, but the level of ROI achieved was lower than that reported by literature reviews using less rigorous inclusion criteria. This review does not question the consistent finding that an ROI of $3:$1 is achievable after 3 to 5 years of program implementation. However, it suggests that feasible levels of ROI from a comprehensive PHM strategy may be substantially lower than this in the first and second years of program implementation, especially if ROI is based solely on direct health care cost savings.

**Author Disclosure Statement**

Drs. Grossmeier, Terry, and Anderson, and Mr Wright are employed by an organization that provides comprehensive population health management programs to employers and health plans on a for-profit basis.

**References**


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