building a value model for population health management

Too many wrong steps on the road to population health management could erase margins. Finance leaders need a data-driven “value model” to plan the scale and pace of investments into population health and move confidently into value-based contracting.

Most healthcare leaders understand the importance of managing the health of their patient populations. Building the tools for effective patient population management is key to improving outcomes while “bending the cost curve” in U.S. health care.

At the same time, executives are concerned about the cost of population health initiatives. What level of investment is needed to effect change? What is the right pace for transitioning from fee-for-service (FFS) to value-based payment? Finance leaders, in particular, are concerned about preserving margins during the transition. How can a healthcare organization maintain profitability as spending increases on population health initiatives while FFS revenue decreases?

The only way to answer these questions is to use a data-driven “value model” to predict and manage the total financial impact of the population health initiatives. An ideal value model will accomplish three goals:

> Quantify the output of population health interventions, including shifts in utilization and changes in cost of care
Help identify population health investments that will move the organization forward while retaining margin

Allow finance leaders to support value-based contracting with predictions of costs and the quality of outcomes.

What finance leaders require within their value model is an easy-to-understand framework for making strategic decisions around population health. This framework should provide finance leaders with a means to answer three fundamental questions:

- What population health initiatives should we invest in?
- How much should we invest in these initiatives, programs, and technologies, and how quickly?
- How do we ensure our initiatives achieve targeted outcomes based on new economic drivers such as managing the cost of care and shifts in utilization?

To this end, finance leaders should consider adopting a value model with an assessment framework consisting of three components:

- An economic equation that functions as an ROI calculator for population health initiatives
- A set of statistical cost-of-care tools for analyzing how population health initiatives affect utilization
- A set of predictive-analytics approaches that enable prospective evaluation of provider and health plan costs

Used together, these elements provide a much clearer line of sight for organizations to pursue care delivery innovation and organizational transformation.

Using the Population Health Economic Equation to Calculate ROI

The first component of the population health management value model is an equation that quantifies the economic impact of a population health initiative. This equation provides a “macro” view of how a population health initiative will realize changes in revenue and expenses. It also forms the basis of an ROI calculator for the population health initiative, enabling leadership teams to understand the financial and organizational impacts of care interventions, care management programs, and technology investments.

The equation is expressed through a simple formula:

\[
\text{Net income impact} = \frac{\text{Shared savings revenue} - \text{Change in net FFS revenue}}{\text{Direct program costs}}
\]

\text{Shared savings revenue} is the revenue generated by a population health management program under value-based contracts. This revenue is determined by applying contractual revenue-sharing formulas to per-member-per-month (PMPM) reductions in medical spend achieved through shifts in encounters and utilization activities. Under most value-based contracts, it will be necessary to track both “domestic” utilization (i.e., that within the organized system of care) and “foreign” utilization, (i.e., utilization across various other care settings or places of service, including points outside of the health system’s care network). As an example, reducing hospital length of stay for a high-risk medical condition could result in shifts in utilization within the post-acute or ambulatory care settings. The shared savings revenue calculation (reflecting medical spend and utilization activities) is usually included in the adjudicated claims data files.

\text{Change in net FFS revenue} is primarily payment “lost” as a consequence of either services not performed that would have been performed under an FFS payment model or net shifts in domestic utilization. For example, a population health program that improves care management for patients with high-risk chronic obstructive pulmonary disease (COPD) might reduce average length of stay, thereby reducing overall inpatient revenue. However, these losses can be partially offset by increases in ambulatory utilization and transitions of care programs.
**Program costs** are all the direct expenses created by the population health initiative. Examples include physician salaries, nursing labor costs, care manager investments, technology costs, and other capital investments.

**Net income impact** is essentially shared savings revenue in excess of (or short of) program costs and net FFS reductions.

Calculating ROI based on these inputs is a straightforward process. Net income impact divided by program cost equals program ROI. The ROI calculator provides a high-level tool for planning population health management spending. It also enables the finance department to create scenarios that help guide the pace of transition into the fee-for-value world. The strategic goal is to select population health initiatives, investment levels, and investment timing to optimize net income impact and ROI.

**Using Statistical Utilization Analysis to Quantify Cost Impacts**
The second component of the population health management value model is the statistical cost-of-care analysis. In addition to the macro view of population health economics enabled by the ROI calculator, finance leaders require a deeper analysis of population health costs, outcomes, and utilization impacts. Performing a statistical cost-of-care analysis provides a “micro” view that statistically models the total cost impact of a population health initiative against certain input levers, such as volume/throughput and health plan contracts/mix. It allows finance leaders to understand the performance impact of cost drivers, utilization management, and patient risk cohorts.

The statistical cost-of-care analysis has two parts: a utilization analysis and a marginal productivity analysis. These analyses allow finance leaders to quantify the systemwide impact of a population health program, specific care management performance outcomes, and the optimal program investment.

**Utilization analyzer.** This tool models the changes in utilization that occur as population health activities shift patients from high-cost settings to lower-cost care. The key concept here is that under a population health management approach, the focus is on low-cost utilization as a means to avoid high-cost utilization wherever possible, as long as the care can be efficiently managed and clinical outcomes tracked. Simply put, overall utilization improves when expensive inpatient and procedural services are avoided through the delivery of less costly ambulatory care that provides appropriate management of chronic conditions.

The cost-of-care analysis models program impacts by projecting utilization by place of service and medical specialty, as shown in the exhibit on page 4. For example, the COPD program discussed above might include enhanced care management services. Care coordinators would track patient services against care standards, which would likely drive an increase in primary care office visits. The intervention might also emphasize medication management and compliance, resulting in higher pharmacy utilization. Other projected utilization changes might include increased preventive care/wellness services and laboratory services.

At the same time, an important byproduct of an effective COPD care management program would be a decrease in high-cost utilization and diagnostic radiology services. The result of improved care management, care coordination, and medication compliance would be to reduce emergency department visits and shift utilization from the acute care to the ambulatory arena. The net savings, offset by the program investments, would ensure that the ROI calculation for the care management program would be positive.

A leadership team can effectively quantify the specific utilization impact of a population health initiative by using a set of heuristic, statistical tools to identify potential impacts and calculate likely outcomes.
### Population Health Utilization Impact Analysis

<table>
<thead>
<tr>
<th>Low-Cost Types of Utilization</th>
<th>Before initiative</th>
<th>After initiative</th>
<th>Increase/Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Office Visit (PC)</strong></td>
<td>5,800</td>
<td>6,218</td>
<td>+418</td>
</tr>
<tr>
<td><strong>Pharmacy (Rx/1,000)</strong></td>
<td>1,035</td>
<td>1,201</td>
<td>+166</td>
</tr>
<tr>
<td><strong>Skilled Nursing</strong></td>
<td>82</td>
<td>84</td>
<td>+2</td>
</tr>
<tr>
<td><strong>Laboratory</strong></td>
<td>60</td>
<td>78</td>
<td>+18</td>
</tr>
<tr>
<td><strong>Preventive Care/Wellness</strong></td>
<td>110</td>
<td>210</td>
<td>+100</td>
</tr>
<tr>
<td><strong>PMPM</strong></td>
<td>$0.467</td>
<td>$0.555</td>
<td></td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>$13,485,782</td>
<td>$16,027,000</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Higher-Cost Types of Utilization</th>
<th>Before initiative</th>
<th>After initiative</th>
<th>Increase/Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inpatient Acute</strong></td>
<td>186</td>
<td>143</td>
<td>-43</td>
</tr>
<tr>
<td><strong>ED Visits</strong></td>
<td>310</td>
<td>268</td>
<td>-42</td>
</tr>
<tr>
<td><strong>Diagnostic Radiology</strong></td>
<td>181</td>
<td>168</td>
<td>-13</td>
</tr>
<tr>
<td><strong>Specialty Care</strong></td>
<td>694</td>
<td>602</td>
<td>-92</td>
</tr>
<tr>
<td><strong>PMPM</strong></td>
<td>$1.0225</td>
<td>$0.8876</td>
<td></td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td>$30,510,120</td>
<td>$26,394,304</td>
<td></td>
</tr>
</tbody>
</table>

**Total Increase in Lower-Cost Utilization:** ($2,541,218)
**Total Decrease in Higher-Cost Utilization:** $4,115,815
**Net Total Savings:** $1,574,591
**Program Costs:** $500,000
**ROI:** 3.14

This theoretical example shows how to model the total utilization impact of a population health initiative focused on chronic obstructive pulmonary disease (COPD). The analysis quantifies the cost impact as patients shift from high-cost to low-cost types of utilization.

On such an approach is to assess the program or specific interventions in terms of the revenue- and expense-based “value levers” of population health to systematically examine how the program or intervention will affect revenue and expenses.

The revenue-based value levers focus on four areas: volume and throughput, health plan contracts and mix, patient and service mix, and revenue cycle. Each area revolves around a series of key questions. For example, when examining the volume/throughput impact of a population health initiative, leadership teams may ask questions such as the following:

- Will this program convert inpatient volume to outpatient volume or vice versa?
- Will it convert observation patients to admissions or vice versa?
- How will this program impact average length of stay for admitted patients?
- Will this program unlock latent patient demand for services?
- Will this program increase throughput or create bottlenecks?

Expense-based value levers also focus on four areas: labor, compensation/benefits, supplies and pharmaceuticals, and integration optimization. Key questions include the following:
Does this program create opportunities to align staff scheduling with predictive demand?
Does it create opportunities to align physician compensation with value-based care?
Does it create opportunities to standardize supplies, order sets, or formularies?
Does it create opportunities to centralize or co-locate administrative functions?

By asking these questions, leadership teams not only identify ways a population health program is likely to affect revenue and expenses, but also discover tactics for optimizing that financial impact.

Once likely sources of financial impact have been identified, the next step is to use statistical tools and advanced analytics to quantify that impact. Finance leaders should focus on identifying the factors that are statistically significant drivers of quality improvements and cost reductions. They then should use benchmark data to pinpoint the utilization effects of modifying these factors.

Data modeling also can be used to drive program management. For example, analytical techniques can be applied to clinical, financial, and claims data to stratify patients by risk cohort, thereby enabling management teams to identify patients at high risk, low risk, rising risk, or declining risk for a poor outcome. Program leaders then can create interventions designed to manage costs and utilization activities for high-risk patients or proactively “intercept” rising-risk patients.

**Marginal productivity analysis.** A key element of an effective cost-of-care analysis is determining marginal productivity. The key question here is, At what point will additional investments stop yielding cost-of-care improvements?

The blue line is the total cost-of-care savings yielded from a value-based contract. If the value-based contract were full risk or capitated, this line would represent what the provider organization would receive from savings. Because most contracts are upside-only contracts, the savings are shared between the plan and provider organization; thus, actual savings to the provider organizations is shown by the orange line, or the marginal revenue savings. The red line represents the cost to provide the care management service or program. It is assumed that this expense is fixed, but every time an expense is added (i.e., in this instance, a new physician to the program or a new care manager), the relational net impact is slightly less. There is a point of diminishing return where the marginal savings or cost-of-care savings intersect the marginal cost per input line, and below this point, the organization loses more money than it will make. The value model identifies where this point is and forces organizations to think about how to lower the marginal cost line to realize additional savings.
For example, let’s say our COPD program also includes hospitalists who focus on optimizing inpatient care, as shown in the exhibit on page 5. Direct program costs, which include salaries for these employed physicians who manage the program, are included in the formula. The exhibit shows that care management services provided by the program’s first hospitalist generates roughly $450,000 in revenue from shared savings (or cost-of-care savings). Employing additional hospitalists (up to 20 in the exhibit) produces additional revenue with each additional hospitalist added, but at a successively lower rate of return for each because the added revenue is offset by the additional marginal cost of employing each hospitalist (i.e., $200,000 per hospitalist).

For example, the exhibit shows that the COPD program generates about $500,000 annually in shared savings without even one hospitalist, and that additional shared savings are added with each added hospitalist ($450,000 from adding just one, as mentioned previously). Thus, adding a third hospitalist brings an additional $400,000 in shared savings at a cost of $200,000 (roughly Point A). There is still opportunity at that point for additional shared savings from additional hospitalists, but the amount of shared savings achievable drops below $200,000, the cost of employing a hospitalist, at about 10 employed hospitalists. Thus, the cost of employing the 11th hospitalist would exceed the benefits in additional shared savings.

To summarize, to plan and manage this program effectively, leadership must calculate the program’s marginal productivity curve, which reflects direct program costs versus output or impact (e.g., in this case, the creation of additional shared savings). Output or impact is quantified by calculating changes in utilization or the decrease in medical spend. The goal is to identify the point of diminishing return, where the cost of an additional input (e.g., another physician) does not generate equal or greater shared savings revenue.

A marginal productivity analysis uses cost as the dependent variable. In addition to focusing on program-specific cost impacts, the analysis can be tied to aggregate PMPM costs by care setting or place of service. Marginal productivity can even be analyzed in terms of patient-level PMPM costs. As a practical tool, such an analysis can help finance leaders ascertain the optimal investment in a population health management program.

Such an analysis also can help in setting the right pace for program development. For instance, once shared savings revenue generated by hospitalists crosses the marginal cost line, COPD program leaders could consider strategies for reducing costs through use of nurse practitioners or technology, thus producing additional net savings opportunities.

The initial example of a marginal productivity analysis here involving COPD was presented to provide a perspective into the inherent nature of this type of analysis. Clearly, such an analysis can be used in many ways and for many purposes, as also have been suggested. The goal here, however, is not to provide a guide for performing each type of analysis, which is clearly beyond the scope of this discussion. Rather, it is to underscore the need for finance leaders to become conversant with such analytical techniques and begin to apply them routinely in developing and refining an effective population health management strategy.

**Using Predictive Analytics to Support Value-Based Contracting**

The tools described previously allow healthcare leaders to plan and manage margin-positive population health initiatives. The statistical cost-of-care model identifies the total utilization impact of a population health program, allowing finance leaders to calculate the program’s shared savings revenue and FFS impact, which are elements of the macroeconomic equation for population health. The marginal productivity analysis provides the tools for maximizing shared savings in relation to program costs, further honing performance under the macroeconomic equation. Together, these tools and analyses help
answer leadership questions about where to invest in population health management, how much to invest, and how quickly to invest.

As organizations become adept at using these tools, finance leaders can begin to apply them prospectively to health plan contracting. Specifically, the analyses can be used to quantify current outcomes of care management activities and predict future outcomes by statistically identifying certain contribution-dependent variables such as medical disease conditions, patient encounter patterns, and physician clinical management activities. Finance leaders can use the results of such analyses as the basis for performing prospective risk modeling, which will enable them to strategically enter risk-based payer contracts.

The predictive modeler. For example, say a hospital creates a population health management program focused on coronary artery disease (CAD). Analytical tools used to plan program economics also can be used to identify the factors that have a statistically significant impact on CAD patient costs and outcomes. In the near term, understanding these factors allows program leaders to design clinical programs and interventions that effectively improve quality and drive utilization savings. For example, nurse navigators may provide care based on care protocols, defined care pathways, medication management plans, and clinical guidelines, which would allow the program to track specific clinical outcomes and continuously evaluate performance.

In the long term, finance leaders can use data on these factors to predict which care protocols and population cohorts will drive the greatest opportunity for improved clinical outcomes and reductions in cost of care. The organization can then use this information to negotiate payer contracts that accurately reflect its true level of risk and the statistical output performance of the CAD population, with achievable outcome targets and appropriate shared savings incentives. This information also can help the organization begin to understand which independent variables, such as social determinants of health and behavioral health factors, are influencing actual care delivery outcomes.

Data Sources

Obtaining the data to power the population health value model is a challenging but manageable task. It involves a four-step process.

First, the organization should work with its health plan partners to obtain claims data for both attributed and potentially attributed populations. These data should include raw claim files and accurate PMPM data reportable by time, ideally by month but at least by quarter. Health-plan-provided data also should include eligibility files and demographic information with key factors such as age, gender, and geographic codes.

Second, the organization should work with clinical leaders to obtain data on care management program activities and outcomes, including data on investments such as labor, technology, and any infrastructure spending. This step also will involve identifying appropriate clinical and quality measures. For example, a CAD population health program might track measures such as lipid panel results, statin and beta blocker utilization, and dietary counseling. All clinical data should be identifiable by time period, ideally by month.

Third, financial system data should be pulled in to provide patient-level, line-item records on claims, utilization, place of service, and eligibility, including date and allowable (payment) fields.

Once all these data are captured, the final step is to match member data from the different sources. Assembling member data is key to modeling interventions and tracking impacts. It also enables the construction of matched patient cohorts for comparison against nonattributed populations.

The Real Value of the Value Model

The transition to effective management of population health presents many challenges. As
healthcare leaders think about how to apply the value model described above, they also should consider factors such as external competition, internal corporate culture, IT infrastructure, analytics capabilities, and current levels of clinical integration.

The biggest challenge in preparing for population health management is planning and managing an orderly transition to value-based payment. With net margins at 2 or 3 percent for most health systems, healthcare leaders have little room for mistakes in program selection and investment as they build their population health management capabilities. The value model is a powerful tool for planning and navigating a pragmatic approach to building population health capabilities and leveraging those capabilities to achieve high performance in the world of value-based contracting.

About the author

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