



Green & Healthy Homes Initiative®

Economic Modeling Handbook

Pay for Success Feasibility Study

August 2016

Founded in 1986, the Green & Healthy Homes Initiative (GHHI), formerly the Coalition to End Childhood Lead Poisoning, is a national 501(c)3 nonprofit organization that provides evidence-based direct services and technical assistance to create healthy, safe and energy efficient homes, improving health, economic and social outcomes for low-income families while reducing public and private healthcare costs.

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SERVICE** 



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Executive Summary

An overview of economic modeling for Pay for Success projects, especially in public health

Economic Feasibility is an assessment of the case for the business model, cost structure, revenue streams, economics on a unit basis, and scalability of a project. The purpose of the economic feasibility analysis is to determine if it is possible to develop a Pay for Success (PFS) transaction using projected underlying economics of the comprehensive asthma management program.

To accomplish this, we undertook a process aimed at determining the net economic value of the prospective project under a range of scenarios. The process was as follows:

- Clearly identify the target population and specific subpopulations within;
- Secure historical data of medical claims for the target population;
- Partner with an actuarial firm, as is industry standard and best practice;
- Conduct a thorough historical analysis determining baselines for key variables including total cost;
- Establish projections for cost savings based on existing literature, research, expert input, and other evidence bases;
- Establish plausible scenarios to scale per-unit dynamics into a full program; and analyze the scenarios for sensitivities.

This process was aimed at determining if there was a program design that could generate a net economic return above program and transaction costs. While our analysis typically stopped at direct cashable savings, other programs would likely have required exploring other sources of value generated by the program. Further, where data was unavailable, we benefited greatly from leveraging our cohort and using a reference class analysis for the entire cohort's subpopulation dynamics.

We approached our determination systemically. We aimed to determine the economic feasibility of each subpopulation and the project in aggregate. The project was deemed feasible if we were able to design a program that generated a net economic benefit above

a reasonable cost of capital. We deemed projects more feasible if they had more evidence of a net economic benefit or if the projections were more favorable, allowing a multitude of net-economic return scenarios. Each subpopulation was deemed feasible for inclusion in the project if it generated a contribution above the program cost of delivering services. Additionally, at least one subpopulation in each project needed to generate a return above and beyond both project costs and allocated transaction costs.

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Document Overview

The purpose, importance, and preview of this document's contents

The purpose of this document is to provide an outline of how we approached economic modeling for a portfolio of 11 Pay for Success projects in public health. The document is intended as a resource for practitioners and an introduction for executives. Ideally, it will provide a guided walkthrough of the major steps and key issues associated with economic modeling in this field.

The importance of the work is multi-faceted:

- It will ensure that there is guidance available for parties as they undertake new and innovative projects in the future;
- It will lower the required expertise to create effective economic models of similar initiative in the future, which will ideally speed the creation of more initiatives that improve public health at large; and
- It will contribute to the discourse on the subject to ensure a critical debate on the usefulness of such modeling and applicability to future projects.

The document will outline our process and the key inputs and assumptions we used to construct a model. It will then turn to the mechanics of composing this model before finally discussing the analysis performed. Ideally, it will serve as an instructional handbook for parties seeking to conduct a similar analysis in the future.

At GHHI, we are always happy to help. Please contact pfs@ghhi.org for more information or for copies of this material.

Process Overview

An overview of the process used to conduct the economic modeling

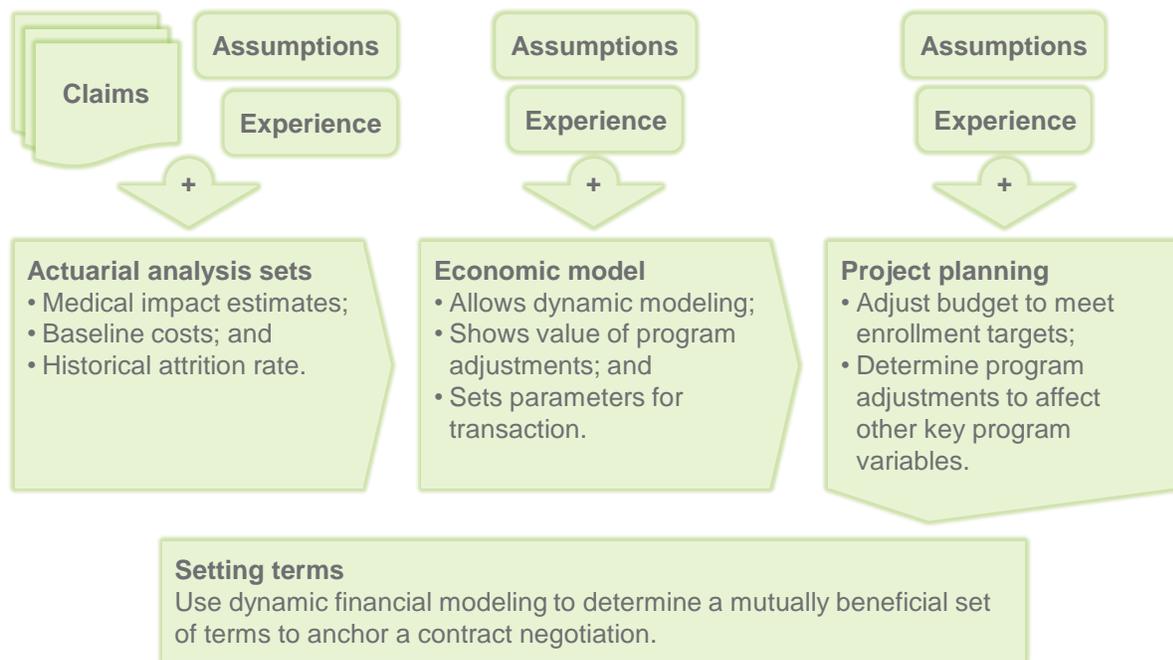
Our process was aimed at determining the parameters of economic viability for a Pay for Success transaction that used the value created by the intervention services. *Please see Exhibit 1.* The economic modeling was a result of three components:

- We used actuaries for projecting changes in medical utilization costs on a per unit basis, treated as value created;
- We leveraged existing programs as a historical baseline for service delivery costs, adjusted for locality and program specifics; and
- We identified reasonable estimates for transaction costs applied to the project.

Exhibit 1



Leveraging historical claims data and an actuarial analysis, we developed an economic model to guide project planning and term setting.



Using these three components, we created a dynamic economic model that allowed us to explore simulated scenarios to identify under what conditions a project would be viable.

We then conducted an iterative process of project planning revisions to allow for the development of terms under which a project could be launched.

Actuarial Projections

We used actuarial projections to calculate medical utilization savings for the projects. To accomplish this, our health partners provided historical¹ claims data on the target population members.² The claims data set was sent to the actuarial firm, Milliman, for analysis to determine the current baseline of medical utilization and cost for the population. Milliman then utilized published studies, decades of experience working with asthma-related programs, interviews with industry experts and an analysis of services on the ground to project the potential future medical savings estimates for members enrolled in the comprehensive asthma intervention program.³ The actuarial assessment also determined the baseline⁴ for key project variables by subpopulation and annual enrollment cohorts including: target subpopulation size, attrition rates from the plan and marginal program impact per person by year of enrollment.

We then took the actuarial analysis and deconstructed it, generating per-unit per-year metrics for different subpopulations, and constructed an economic model that represented the program. This economic model was used to assess plausible scenarios given qualitative input and early-integrated program cost estimates from project partners. If these scenarios were able to cover both program and transaction costs, we made a determination of positive economic feasibility.

¹ We typically aimed for a minimum of three years of data, though leveraged more where available. Due to the implementation of the Affordable Care Act, there was a substantial difference between data prior to three years and post three years' time, limiting the validity of deeper analysis.

² We used claims representing the total cost of care to the organization, with few minor exceptions.

³ Estimates of marginal program impact were based on the historical data provided, assessment by medical professionals of services rendered, and comprehensive research from programs including the Centers for Disease Control, National Institutes of Health and existing programs at the location. The projections were compared to an expected natural reversion to the mean for the population to determine the projected marginal impact of the intervention services.

⁴ The baseline included an assumption, validated in historical data, of rate of regression to the mean for each subpopulation over time.

Service Budgeting

Projected budgets were used to establish the baseline for costs in providing services. Each service provider on a given project was provided with an overview of the GHHI services model operating in Baltimore for more than a decade, as well as comparative analysis of the other sites by cost category. Each of those budgets was then adapted to local circumstances based on assessments of housing stock, cost adjustments for local prices and other factors.

Economic Modeling

We combined the projected cost savings and program costs to determine the net economic value for the program using a dynamic economic model. We used the financial industry's standard discounted cash flow analysis⁵ to assess economic value of the program. We did consider but did not explicitly include the effects of capital efficiency on the project's financial returns, as this would take place during formal negotiations or transaction structuring efforts.

⁵ We used discounted cash flow, internal rate of return and modified internal rate of return methods at differing points, relying on the net present values and internal rates of return for program reporting.

Actuarial Findings

An overview of the actuarial findings and how they were utilized in the economic modeling process

The actuarial findings for the project were based on our actuarial partner Milliman's analysis of claims data received from our health partners, described above. Milliman conducted an analysis using a software suite that analyzed claims data, established subpopulations and segmented costs into categories relevant to reductions in medical utilization. It then researched the existing body of literature⁶ and brought in experts to conduct an assessment of the programs in place at the site, ensuring that all the requirements of a well-functioning program were in place. After the program assessment, Milliman compiled a report with detailed exhibits that explained its analysis.

One substantial benefit of running a cohort was that we were able to rely on the rest of the cohort to fill in any particular data gaps that were apparent in the claims files. One example of this was working with a new health plan without a history to base attrition rates on. We were able to conduct a reference class analysis to broadly set these rates. Further, the actuaries were able to do the same when processing the claims to determine baselines.

Subpopulation Stratification

The project team, led by our health partner, developed a stratification strategy based on medical utilization that was both meaningful medically and would represent major cost-category tiers, each economically differentiated through an existing data element. Most sites determined that they would stratify the population into subpopulations based on a combination of a medical utilization event and accompanying diagnosis. Other criteria for selection were limitations based on geography, age, years under coverage, type of coverage, and others, depending on the specific site's criteria and limitations.

Diagnosis:

- Primary diagnosis of asthma, or
- A non-primary diagnosis of asthma with an accompanying primary diagnosis of a related condition.

⁶ Or reference to appendices listing literature

Trigger events:

- An inpatient admission,
- An emergency visit, or
- An urgent care visit.

Other sites also looked at other measures, the most important of which was to include multiple tiers of high utilizers within a given subpopulation. For example, the average medical costs of any emergency department user with multiple visits was nearly double that of a party with only one visit. This had a proportionate impact on their savings potential.

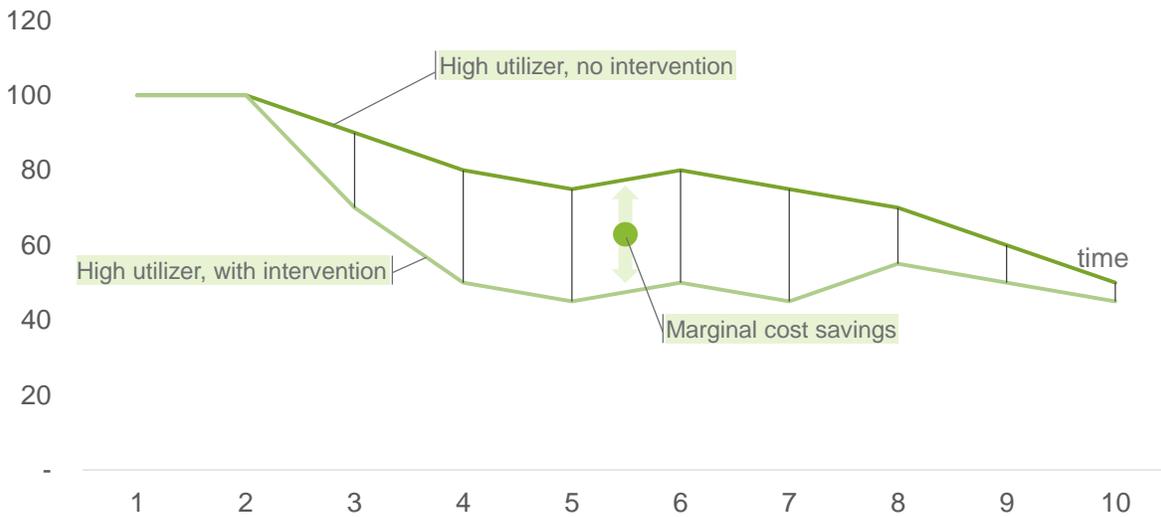
Exhibit 2



The actuarial analysis assumes that high utilizers would regress to a more normal population over time and calculates the effect from that baseline.

Medical utilization

Value of services required over time



Note(s): * Example for one cost category of multiple analyzed.

Source(s): GHHI depiction of information from discussions with actuarial service provider

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Marginal Effect Size

The marginal effect size was determined by creating projections of the course of medical utilization spending over the foreseeable project term for a population not receiving additional services, and comparing that to the expected utilization by a group that did receive the services. *Please see Exhibit 2.* This comparison generated a marginal impact on cost due to a reduction in medical utilization needs.

Attrition Rates

The actuaries were able to look at the subpopulations' trends over time to determine the net-effective⁷ attrition rate for populations over the term of the project. GHHI also conducted a reference class analysis using the composite of the five projects in this cohort by subpopulation for an additional reference point.

The actuarial assessment relied on a single attrition rate for project participants. We leveraged reference classes for individual subpopulations, the historical attrition rates at each of the sites for their subpopulations at the site, as well as differentials between reference classes and subpopulations, in an attempt to use the underlying data to triangulate the most likely outcome scenario.

⁷ The net-effective attrition rate represents the aggregate rate at which persons cease to be covered by the entity whose data we were working with, typically a health plan. The rate is inclusive of and agnostic to any reason someone would no longer be covered by the entity. It may include loss of eligibility, changing to another source of health insurance and other reasons.

Service Delivery Budget

An overview of composing the service delivery budget

The cost of the program was based on budgetary projections from the specific site partners in combination with input from other service providers. Those estimates were based on historical data from their site, historical data as reference points from other sites nationally and extensive forward-looking estimates or projections of costs for the programs. Each site's budget is different and has been adapted from their existing service provision due to:

- Local housing stock and propensity to need differing services by severity,
- Local price adjustments for goods or services, and
- The specificity of the intervention to asthma prevention.

The process for determining the budget was extensive. It required establishing a baseline program design with initial estimates for costs, setting strategic budget targets related to program enrollments, conducting final iterative revisions to determine if meeting targets was possible and reassessing the project scope if necessary.

The baseline for program expense was established by using historical performance data and filling any gaps with information from across the cohort as well as from ongoing GHHI operations as a direct service provider in Baltimore.

After the actuarial analysis and initial economic modeling was completed, we were able to determine what the expected value of cost-savings for each of the subpopulations would be. This allowed us to determine budgetary thresholds for inclusion of each of the subpopulations. For example, the required budget target was frequently too low to reliably deliver comprehensive services to the urgent care populations.

The final iterative revisions determined if there was a way to effectively deliver the comprehensive services at the target budget level. Frequently we relied on a reference class analysis of program cost categories from our cohort to identify outliers. This benchmarking allowed us to ensure that program costs were reasonable.

Transaction Costs

An overview of the transaction costs for our Pay for Success projects

While a Pay for Success project has many benefits, the transaction does have costs associated with it. GHHI initially priced what those costs would be, *please see Exhibit 3*. We believe that many of those costs could be brought down with economies of scale leveraged across our cohort and with potentially leveraging other institutions that are capable of playing or assuming substantial parts of other roles.

Exhibit 3



Transaction costs can vary widely depending on program design, though can sometimes be supported by foundations.



Contract and legal fees

Setting up the project including legal due-diligence.



Evaluation fees

Performing the ultimate evaluation of medical outcomes and communicating the results.



Intermediation fees

Providing services that include two components:

- Project management; and
- Financial intermediation.

Transaction cost type	High	Expected	Low
Origination	125,000	50,000	50,000
Evaluation	500,000	200,000	100,000
Program management*	750,000	200,000	100,000
Transaction management*	750,000	200,000	100,000
Total	2,125,000	650,000	350,000

Note(s): * A social impact investor could play the role of transaction manager and supervise a built-in project management capability for the project; however, an investor may want to see the foundation is invested in the project before they would be willing to agree.

Source(s): GHHI analysis of publicly available information.

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We believe that transaction costs of originating these agreements will vary widely based on key factors:

- The number of parties involved in the transaction and the number of agreements they are each required to enter into;

- The availability of templates and legal precedent they can rely on to form the basis of their legal agreements; and
- The ability of the parties to leverage economies of scale by advancing any number of additional projects simultaneously.

Evaluation fees would also vary widely due to a number of factors. The bare minimum evaluation would be a specification of a comparison group for which the same actuarial analysis could be conducted on a recurring basis to determine if the appropriate marginal effect size is attained. More advanced and elaborate designs are also possible and would be substantially more capital intensive. In many cases, we would expect that if those substantively more expensive options were undertaken, they would need to be, at least, partially subsidized by a party seeking to accomplish a broader research agenda. Without that assistance, they would be economically burdensome on the project.

GHHI has worked with our site partners to ensure that strong project management capabilities have been built into each of the site's program designs, which could dramatically reduce the reliance on outside project management needs, lowering the transaction costs substantially. This would be difficult, however, in cases where investors wanted an independent party to play a larger role for the purposes of risk mitigation.

Transaction management is the act of setting up and managing the special purpose vehicle or other entity that will fill the purpose of fiscal agency throughout the project. These fees will vary widely as well, depending on the party playing the role. While a traditional financial institution could play this role, a local foundation, community development financial institution, or similar entity could play the role requiring substantially less capital to do so.

We are actively working to reduce transactions costs for all of our sites, as they have been identified as one of the key economic inefficiencies of a Pay for Success project.

Model Composition

An overview of composing an economic model from the assorted components

We took the projections of medical utilization savings, program costs and transaction costs and integrated them into a dynamic economic modeling tool by leveraging the following simplifying assumptions:

- Enrollments would be consistent on a monthly basis for 36 months;
- Attrition is a constant monthly effect over that time using statistical averages of the likely number of persons enrolled; and
- Program benefits accrue on a monthly basis at the rates projected by the actuarial analysis.⁸

The model first determines program enrollment using the above stated assumptions, the actuarial estimates of the target population, and the associated attrition⁹ rates. We used incoming enrollments to trigger service costs and ongoing enrollments to calculate expected reductions in medical utilization. The result was a calculation of the direct program contribution for each subpopulation. We then added in the expected transaction costs, to determine the net economic value generated by the program in order to determine the economic viability of a PFS project.¹⁰

The project was modeled taking place over a 10-year term, *please see Exhibit 4 below*. While enrollments take place starting with the initiation of the project, there is a delay in the delivery of services to parties. One key consideration is that any person enrolled on the final day of the third year will receive their services over the course of the fourth year. Savings will be captured primarily in year five and beyond.

⁸ Their pay-out is a function of financial modeling to take place in transaction structuring and was not a focus of our analysis concerning the underlying economics.

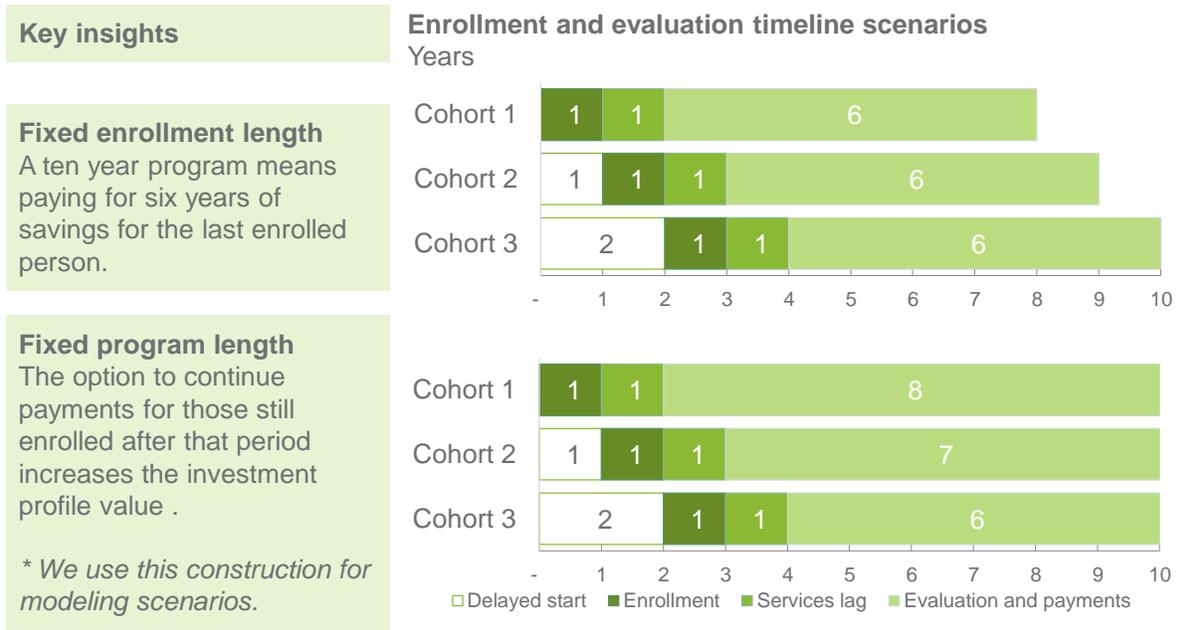
⁹ Attrition as used was a net-effective projection of enrollment with the MCO. We used multiple assumptions for attrition ranging from the stated rate in actuarial assessment, using the actuarial assessment weighted for the enrollment percentages, as well as adjusting weighted rates for the expected program impact on housing stabilization, Medicaid re-enrollment improvements, as well as reductions in mortality. We were unable to project the potential impact of loss eligibility due to improvements in socio-economic status as a result of improvements in employment stability or other factors.

¹⁰ We acknowledge that a further analysis of the capital efficiency of the project would be necessary for any investor and we did conduct this analysis, but did not include it in the economic feasibility determination.

Exhibit 4



Different program structures will impact how long each party is evaluated and what payments are made to investors.



Note(s): An individual may be enrolled on 31 December of year 3, with services being delivered in year 4, leaving only 6 years of evaluation for that party. A "5-year" project, due to the cohort structure actually takes place over 9 calendar years. Capital allocations reflect this.

Source(s): GHHI

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Economic Analysis

An overview of the economic analysis process used to determine feasibility

Our economic analysis was conducted to determine if there is a viable underlying net economic value for the program based on enrolling the different subpopulations. The process for this analysis was as follows:

- We first analyzed the subpopulations on a per-unit basis to determine if they were feasible for inclusion in a program and under what terms.
- Given the per-unit analysis, we turned to determining enrollments based on subpopulation inclusion and reasonable capture rates.
- We then moved to compose scenarios for an economically viable transaction that also met the requirements of the service partners.
- Finally, we stress tested these models through sensitivity analysis.

Subpopulation Findings

Each subpopulation was analyzed for their economic value on a per unit basis. Analysis showed that each subpopulation fell in one of the following three groups, *please see exhibit 5 for illustration*:

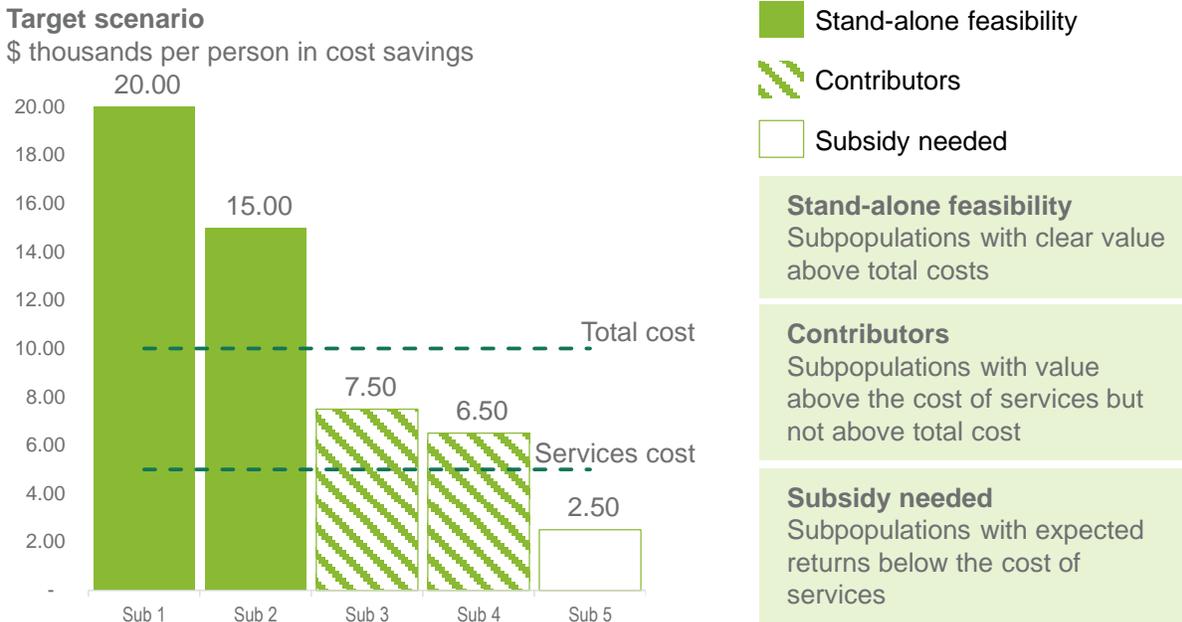
- A net benefit to the program above allocated fixed expenses, making it worthy of stand-alone investment;
- A contribution margin above variable costs, making that group economically viable for inclusion in a larger project; or
- Cost savings less than the variable cost of services, making that group applicable for some manner of subsidization.

The presence of any one subpopulation warranting a stand-alone investment would have made the project economically viable, though perhaps not desirable given the potentially small size of such a program.

Exhibit 5



While the program is a test of real economics, we are limiting risk by focusing enrollment efforts on high-return subpopulations.



Source(s): GHHI analysis

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Transaction Composition

The purpose of transaction composition was to determine if there was overlap between a net-economic benefit for the program and the capacity limits of the program’s service providers. Our process was as followed:

- Survey of service providers for capacity limits, both upper and lower bound, when a project was too small to warrant the effort and the upper limit of what they could scale to in a reasonable timeframe;
- Identify reasonable capture rates¹¹ for subpopulations, *please see Exhibit 6*; and
- Create scenarios for each including an additional subpopulation at a time, in order of economic¹² value.

¹¹ Capture rates measured the likelihood that a targeted person would enroll in the program once targeted.

¹² In our project, medial need was both a 1.0 correlation coefficient proxy for and took precedence over economic viability. In non-medial projects we would recommend using economic benefit as the primary decision-making criteria. We were fortunate that they were interchangeable on our projects.

The scenarios we considered were:

- **Conservative:** These scenarios looked at the downside risk for many project variables which could include: missing enrollment targets in key subpopulations or overall; higher than expected attrition rates; budgetary overruns; and the possibility that changes in the Medicaid landscape could preclude the payer from participating beyond a certain year.
- **Target:** This scenario represented the expected and desired outcome for key variables in the project, relying on historical data and reference classes to establish expectations of the most likely outcome if the program meets operational goals.
- **Outperformance:** This scenario looks at the equally plausible case of exceeding performance expectations on a variety of key program variables.

Exhibit 7



Using scenario analysis demonstrates just how viable a project may be under varying program circumstances.

Conservative	Target	Over-perform	Scenario names
\$ 5.0 M	\$ 7.5 M	\$ 10.0 M	Program cost savings
\$ 2.5 M	\$ 3.0 M	\$ 2.5 M	Intervention costs
\$ 2.5 M	\$ 3.5 M	\$ 7.5 M	Program contribution
\$ 1.0 M	\$ 0.8 M	\$ 0.8 M	Transaction costs
\$ 1.5 M	\$ 2.3 M	\$ 6.8 M	Net benefits
5.0 %	10.0 %	20.0 %	Annual program Internal rate of return

250	300	300	Total persons per year
25	50	75	Highest utilizers
75	100	150	High utilizers
100	100	75	Medium utilizers
50	50	0	Low utilizers

Key assumptions			
**8	10	10	Years of evaluation (payments)
12.5 %	10.0 %	7.5 %	Net effective annual attrition rate
\$(6,000)	\$(5,500)	\$(5,000)	Average cost per home budget

Note(s) Scenarios do not represent actual data or analysis and are for illustration purposes only.

Source(s): GHHI analysis for illustration purposes only.

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Sensitivity Analysis

After constructing scenarios, we conducted sensitivity analysis to show the likely program outcomes that result from variations among key project variables. The purpose of this exercise was to show the relative impact of different variables as well as the expected outcomes associated with the statistically likely ranges we observed in historical data, *please see Exhibit 8.*

Exhibit 8



The health plan’s attrition rate is a key project variable.



Importance
 The attrition rate affects how many years of cost savings will be captured for each person on average, based on their likelihood of leaving the program.

Note(s): - Assuming the target scenario assumptions.

Source(s): GHHI, exhibit for illustrative purposes only.

Analysis and Discussion of Alternatives

An analysis and discussion of post-feasibility alternatives to Pay for Success

As part of conducting the feasibility assessment, the GHHI team actively looked at industry standards for conducting analysis as well as looked at bringing in expertise from the areas of behavioral economics and the decision sciences to improve our efforts. The following is an analysis and discussion of alternatives we evaluated during our project.

Alternative options to be discussed:

- To model or not to model
 - Helps with understanding dynamics
 - Identifies key variables for project planning
- Actuarial projections v. other sources
- Economic v. Financial modeling considerations
- Static v. dynamic modeling
- Finite v. probabilistic modeling

The Value of Economic Modeling

All models are some form of projected values that, in the best of cases, are appropriately adjusted with the best available information to show realistic expectations of an outcome. We determined we needed an economic model for two reasons: 1) the exercise helped us understand the underlying economics in the system, and 2) additional understanding helped identify key variables for the project so we could create a better project.

In our particular circumstance, the modeling exercise impressed upon us the importance of the enrollment capture rate and the attrition rate of the program. Both of these key variables had the possibility of derailing entire projects with just a few percentage point changes. We then used this insight to do additional project planning, in some cases adding a process or planning for additional personnel to ensure success at key junction points. Without out this, it was substantially less likely that our economic modeling would be accurate as the variability of those points would not be as actively controlled.

Industry Norms (Actuarial Projections vs. Other Sources)

We also debated the use of actuarial projections specific to project partners, general application of actuarial analysis, as well as using other methods for establishing the baseline projections of cost and marginal impacts resulting in savings. We finally settled on an actuarial analysis specific to each project because it increased the rigor of analysis and coincided with the industry standards for public health, by using the very same actuarial standards used for determining the rates to be paid in managed care situations.

Economic vs. Financial Modeling Considerations

We also conducted a financial modeling exercise, though differentiated it from the analysis of the underlying economic value. We settled on this option because there is such variety in the way that the final transactions can be structured, that as long as there is viable underlying economics, a viable financial transaction can be created from it. We also determined it would be counterproductive to put forth a possible financial transaction before parties were socialized to the project.

Static vs. Dynamic Modeling

Our economic modeling relied on dynamic calculations, where altering one variable caused changes in others. For example, a change in enrollment capture rates might result in a lower aggregate program enrollment, lowering the number of homes, and raising the average price per home due to allocated fixed costs and volume purchasing losses. While it is certainly possible to construct static models as well, we determined that it was better to have a self-contained dynamic model so that the implications of any individual change for other variables was readily apparent.

Finite vs. Stochastic Modeling

We limited our initial economic modeling exercise to finite scenario analysis under a range of sensitivities for a number of reasons. The resources needed to undertake advanced probabilistic modeling techniques are substantial and, in general, the findings are substantially harder to socialize.

We are however, working with a more elaborate financial analysis model.¹³ It uses probability distributions for variables to simulate a multitude of possible outcome scenarios and determine the impact that different distributions have when they interact with each other. For example, we expect the likelihood that a budget will overrun to be substantially higher than the likelihood that there will be reserve funds at the end of the project. Separately, we expect that the likelihood of attrition rate variability over time is not a normal distribution, but rather well skewed but with a real, though remote, possibility of exceeding historical data substantially. While these are independent variables, their interaction has an exponential effect in determining the net value of the projects. This would not have been apparent if we had not undertaken this additional analysis.

Further, we used this technique to remove any biases where we would have to choose project variables that were non-justified. We could simply go back to the data, establish a hypothesis for distribution fitting, and evaluate it for appropriateness, finally using the statistical evidence to assert the appropriate range and variability to the best of our ability. We could, from there, adjust this baseline for other program considerations, but we attempted to ensure that we did so in a moderated manner that didn't overstate the impact we could have.

¹³ This stochastic method is frequently referred to as a Monte Carlo Simulation, one technique for application.