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Integrating Claims-Based and Survey-Based Data to Estimate Program Savings

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Quantifying savings from medical intervention programs is a task that actuaries are increasingly being asked to address by their employers and clients. The second author's textbook[1] provides considerable guidance on evaluation principles, but new intervention programs are constantly being developed and older programs modified, providing an ongoing challenge for actuaries and others involved in the financial management of health plans. This article describes an innovative approach that was developed to address the needs of a company that provides a number of related and potentially overlapping interventions. While overlapping programs increase the complexity of evaluation, in this case the overlap provides us with a means of estimation for other programs.

The company serves approximately 2 million people with solutions to help individuals and families navigate the increasingly complex health care system. The objective is to help engaged patients make more informed decisions leading to changes in patient behavior (the Holy Grail of so many intervention programs), thereby increasing quality and reducing the cost of care. They offer a number of programs to do this, including surgery decision support (SDS), medical decision support, expert medical opinion (often referred to as "second opinion" in the industry), evidence-based modules (comprehensive modules defining medical topics or conditions and their associated evidence-based treatment options) and a research desk that provides customized solutions for patients with a rare condition or unusual circumstance.

Some clients commission claims-based return on investment (ROI) analyses based on their own claims data. For all other clients, savings are estimated via a participant survey that has been in place for many years. Within this survey patients are asked to provide responses to 11 quality of care measures termed "A–K," each of which is associated with a savings value. Our challenge was to update these estimates and to make them more data- and evidence-based. Table 1 lists the recorded survey variables.

Surveys are administered over the phone, online or through a hard copy mailed to the participant. These variables are recorded in a binary manner. Some are direct questions that patients either respond "yes" or "no," while others are pulled from a single question that asks for a multiple-choice response in terms of behavior changes made (if any). In 2014, the book of business survey response rate for the SDS program was 83

Table 1
Survey Variables

Variable	Description
A	Achieved best practices when conflicting doctor recommendations given OR doctor changed treatment to best practices based on patient's input
B	Eliminated or minimized side effects of treatment
C	Discontinued or avoided unnecessary or questionable treatment
D	Identified an incorrect diagnosis OR a second, unidentified diagnosis
E	Switched to or added a higher quality doctor or specialist
F	Chose a facility with better outcomes
G	Improved quality of life or peace of mind
H	Improved wellness or treatment compliance
I	Improved physical health
J	Sought a second or third opinion
K	Quit smoking

percent, and for all other programs it was 49 percent. SDS has a high response rate because it is a very high-touch solution.

METHODOLOGY

We updated the savings estimates associated with each variable using a combination of (1) direct claims-based savings and (2) a thorough literature review.

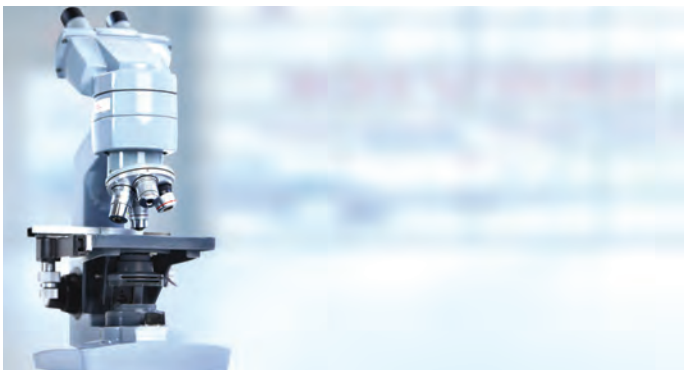
With any financial outcomes evaluation process, the primary challenge involves accurately predicting what costs would have arisen in the absence of an intervention. There are several ways to approach this kind of analysis, including the following:

- **Case-control analysis.** A study group is compared to a control group. The study group receives the intervention while the control group does not.
- **Risk standardization.** A risk model is used to prospectively and/or retrospectively predict what costs should be for a specific population based on a combination of factors. Actual costs can then be compared to predicted costs and the difference attributed as savings.
- **Historical cost trends.** Costs of a cohort subject to intervention are compared longitudinally to observe what costs were before and after the implementation of an intervention program.
- **"Pre-intent versus post-intent" analysis.** An intended course of action and associated cost at the individual level are defined prior to the intervention, and then compared to actual treatment and costs post-intervention. This analysis is particularly well-suited for infrequent events where there are alternative therapies, such as surgeries.

The advantage that we had in developing a new methodology was the existence of two separate estimates of savings for one intervention program, SDS. Savings for these patients were estimated by comparing the episode costs of the patient's intended surgical treatment (on entry to the program) with the cost of the actual outcome (either surgery or less-invasive treatment) post-intervention. This program covers only elective, episodic procedures: hip, knee, back, weight loss and hysterectomy surgeries.

For employers who pursue claims-based validation, survey responses are still recorded. Thus, we have the opportunity to compare survey responses for SDS patients to their claims-based savings. Both survey results and claims-based results were available for three distinct employers across seven program years that included a total of 895 participants.

Claims-based savings estimates were first made using the "pre-intent/post-intent" method. A multivariate predictive



model was then fitted to the survey variables to predict individual estimates of claims-based savings. The model fits well (R^2 = 0.82), implying that estimates made from the survey data (in the case of the SDS program) should be reasonably accurate, in the absence of claims data.

We cannot expect that the weight of each A–K variable within the SDS model will be the same for other programs because the conditions, treatments and resulting costs of medical needs addressed by the other programs differ from those met by SDS. For example, Measure C is defined as "Avoiding Treatment." The weight assigned to this variable for SDS is $28,800, which is close to the average savings we would expect to realize for someone avoiding a surgical procedure. However, potential savings associated with treatment avoidance from other programs, for example, chronic condition management, are not likely to be as large.

Our next step was to map out each program and the distribution of diagnoses associated with that program. We then turned to the literature to estimate weights for the other variables using the SDS results as our underlying baseline. Here it is worth noting the importance of looking at results holistically rather than independently. Each variable interacts with each other variable in the equation, and they need to be taken into account together rather than individually. Thus, we started to quantify expected direct claims savings from similar programs for each condition using summarized results reported by Goetzel et al.,[2] Chapman,[3] Cyboran et al.,[4] Aldana[5] and Duncan.[6]

We also had one other piece of data to inform our weight adjustment for other programs: the data on direct savings not related to SDS. For individuals who say they have avoided or discontinued an unnecessary treatment, the name of the avoided treatment is recorded (e.g., "decided against prostate cancer surgery and opted for watchful waiting instead"). It is then mapped by the Impact Specialist to an average cost associated with the avoided treatment. We averaged these avoided treatment savings, which produced a result of $10,166 per "avoided treatment," which represented about one-third of the savings associated with SDS for this specific variable.

Table 2
Updated A–K Variable Weights

Impact Variable	SDS Weight	All Other Program Weight
A—"Best practices" changed treatment	$6,920	$2,307
B—Minimized side effects	$2,160	$720
C—Avoided treatment	$28,849	$9,616
D—Incorrect diagnosis	$4,857	$1,619
E—Added specialist/changed doctor	−$468	−$468
F—Changed hospitals	$0	$0
G—Improved quality of life	$0	$0
H—Improved wellness or treatment compliance	$1,712	$1,712
I—Improved physical health	$1,982	$1,982
J—Sought second opinion	$1,796	$1,796
K—Quit smoking	$0	$0

Our final step was to look at each variable and then fit it to the expected result based on the survey responses. We used a combination of actuarial judgment and results from the literature to derive the final weights in Table 2.

Let us remind the reader that these variables should not be considered independently but rather need to be considered in conjunction with each other. In addition, these variables should not be used to map an individual's savings alone, but they are an estimate of the entire program's savings, or at least those of a group of employees. Obviously, these are averages, and while one individual's changed treatment path may result in a very small savings or even a cost, someone else's changed treatment path may result in tens of thousands of dollars in claims savings.

Not all variables are correlated with savings. For example, Variable E, adding a specialist or changing a doctor, has a negative weight, consistent with the likely increased cost of adding a specialist to the provider panel. However, if that switch or additional provider results in a change in any other variable, the overall result will be a savings.

The reader may also notice no savings for Variables F, G and K. While the literature associates smoking with increased costs, any avoided costs from quitting smoking tend to be very long term. Likewise, Variable G, improved quality of life, has no defensible direct claims savings—especially in light of the presence of Variables H and I, improved wellness and improved physical health. Finally, we have not assigned a value to changing hospitals. Some researchers report an increase in Quality Adjusted Life Years, but this metric is not one that is normally familiar to, nor considered credible by, many employers. While a case could be made that anyone changing hospitals is doing so either to (a) save out-of-pocket expenses for a low-risk procedure or (b) choosing a higher quality facility with better outcomes, we are unable to derive an actuarially justified savings number for this component. Finally, one may notice the relationship among Variables A through D for SDS and all other programs. While Variables E, H, I and J are consistent for all programs, Variables A to D are one-third the value for non-SDS programs. Direct savings resulting from changes in treatment, side effects and an incorrect diagnosis are much larger for the SDS surgeries than for the disease mix of the non-SDS surgeries. After reviewing the literature and the data available for direct claims savings across programs, we believe that one-third is the appropriate weight to use for these variables. However, we believe that physician costs, improvements in health and wellness, and seeking a second opinion are independent of program type and therefore do not require a weight adjustment from the regressed-SDS results.

RESULTS

Table 3 shows aggregate results by program type for a sample of employers from July 1, 2014, through June 30, 2016. This sample covers a total of 12,944 participant responses.

Table 3
Per Participant Average Savings Results

Program	Average Savings per Participant With Updated A–K Weights	Average Claim-Based Savings per Participant
SDS	$12,349	$12,457
Non-SDS	$2,351	N/A

The per participant average savings approximation is very close to the actual claims-based savings result for SDS. While we don't have an equivalent claims-based savings results for this mix of programs and conditions, results are approximately one-sixth of the SDS results based on the survey response behavior as well as the different measurement values for SDS. While we find a fair amount of variation in the literature among reported savings of decision support programs as well as the potential for claims savings, this $2,351 average savings value per participant is by no means inconsistent with the literature.

Reported ROI in the literature typically ranges from 3:1 to 8:1 according to Goetzel et al.,[7] while Aldana[8] concluded the average ROI is around 3.5:1 in direct claims savings, or 5.8:1 if absenteeism is included, based on his review of 72 peer-reviewed articles examining the financial impact of health promotion programs.[9] In 2010, Harvard University published a meta-study in *Health Affairs* that claimed a direct medical claims savings-to-cost ratio of 3.3:1 with an additional 2.7:1 savings-to-cost ratio in reduced absenteeism costs.[10] The Society of Actuaries also published a meta-study of 61 programs and found an average reported savings-to-cost ratio of 2.8:1[11] while noting a large degree of variance in reported results. Meanwhile, Chapman claims that between 30–60 percent of health plan costs could be either modified or avoided in part by intervening among key behavioral risk factors.[12] Furthermore, in their 2012 meta-evaluation, they note an average 24.5 percent reduction in health care costs across the 32 studies that met the inclusion criteria.[13] Our reported ROI in this study is well within this 3:1 to 8:1 range and fairly close to Aldana's 3.5:1–5.8:1 average (book of business ROI averages 4:1). Direct medical claims per employee will average around $13,000 in 2017 according to Willis Towers Watson.[14] It is common knowledge that 80 percent of this cost is driven by 20 percent of the population. Hence, participants coming into the program seeking medical support are more likely to have claims in excess of $13,000 per employee. Thus, $2,350 in savings per participant represents only about 10–30 percent of total medical claims. This falls well below the 30–60 percent potential intervention range that Chapman defines and is close to the 24.5 percent average.

IMPROVEMENTS AND LIMITATIONS

Compared to the prior methodology, the revised methodology includes the following improvements:

- Used an additional, validated source of data (claims) to compare SDS savings against survey-based estimates.
- Validated estimates by an extensive literature comparison.
- Overall, made a more accurate projection of claims savings.

However, the revised methodology still has the limitation of remaining survey-based and being limited to two program types (SDS versus non-SDS).

CONCLUSIONS

For many programs where relevant claims data are difficult to acquire and, because of program overlap, even more difficult to use, we believe that the methodology described here provides a useful and innovative method for using one program's validated results to estimate savings from survey data. ■

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ENDNOTES

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11 Ibid.

12 Summary in Duncan, *Managing and Measuring Healthcare Intervention Programs*, 357.

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14 Willis Towers Watson, *2016 21st Annual Willis Towers Watson Best Practices in Health Care Employer Survey* (London: Willis Towers Watson, 2016).