



2020 SOA Health Meeting Goes Virtual

By Deana Bell and Rick Pawelski

It was only a year ago that we, and many other health actuaries, got together in Phoenix for the premier Society of Actuaries (SOA) Spring Health Meeting. This year, the year of the COVID-19 pandemic, we're all staying home and staying safe. Our community's need for educational opportunities has not diminished, however; if anything, it is more important for actuaries to be exposed to new information, emerging standards of practice and diverse intellectual discourse. And so the 2020 SOA Health Meeting goes on, only this year it has become virtual.

The process for planning the meeting starts early, and the agenda is generally locked in by early February. This year, we were all very excited to showcase approximately 100 sessions in the world-class city of Chicago. However, as we were coming to grips with the fact that we were (and are) in the midst of a serious pandemic, we had to consider the future of the June meeting in Chicago. It was early March when the Health Meeting Program Committee of the Health Section Council, of which we are a part, started confronting the idea that getting 1,000 actuaries together in June might not only be a bad idea for reasons of public health, but might not even be logistically possible. By the end of the month, we were well into planning for an alternative approach where attendees would sign in to online sessions while remaining distanced from each other.

By June, many of us had become used to a new way of living and working. Instead of a trip to the airport, a flight across the country and a shuttle to the hotel, we woke up on June 8 and walked a short distance to our home office setups. By this time in the pandemic it felt normal—we could get settled at our computer, get a few tasks done, and when it was time we all logged in to the conference.



In some ways it was just like attending any other Health Meeting. The topics and speakers were selected from those in the original lineup of sessions for Chicago. We had received over 200 submissions for about half as many slots, so the Spring Health Meeting Program Committee was already adept at selecting sessions based on the quality of the proposals and also the mix of topics and formats. When we knew we had to be prepared for a virtual meeting, we went back to work and winnowed the list down to 13, plus a keynote speaker, actuarial trivia, the Health Section breakfast (at lunchtime) and virtual networking breakout rooms. The main event was spread out over two days; it was structured to keep attendees thoroughly engaged during that time with plenty of short breaks.

Because of the limitations of how many sessions we could feature, an attendee couldn't load up on one topic in a specific track. For example, at previous meetings someone could attend a series of sessions on pharmacy, or on disability, or on financial reporting. In our virtual meeting we could feature only one session for limited sets of topics. To address that, our committee created an opportunity to dive deeper into 10 specific topics via the [Health Meeting Webcast Series](#), scheduled from June 18 through September 22. Each webcast day is devoted to a major topic, with three webinar sessions per day. Topics include provider payment, supplemental health, innovation in health care, pharmacy, Medicare, Medicaid, predictive analytics and artificial intelligence (AI), the Patient Protection and Affordable Care Act (ACA), disability income and group life, and social determinants of health and public health. The webcast days allowed us to feature even more of the sessions from the original

Chicago meeting and to fill in the gap in continuing education offerings. Our hope is that variety is the spice of the 2020 Virtual Health Meeting and webcast days.

WHAT WERE THE STANDOUT SESSIONS FOR US?

Rick: I watched on my computer screen as actuaries—and some M.D.s and Ph.D.s—presented dialogue and visual aids regarding the growth and development of telehealth, the expected end-stage renal disease (ESRD) influx for Medicare Advantage business, value-based care contracting models and other topics. Dr. Joel Selanikio, who I thought was such an engaging and informative keynote speaker last year, returned to start Monday off with a discussion of visualization of COVID-19 data. I found all these sessions engaging, and because I was sitting in front of my laptop I could take the occasional moment to cycle through the visual aids, look up something online or message with my fellow attendees, which enriched the experience. At the end of day two, I got some organized professionalism credits at the Actuarial Professionalism Judge and Jury session, which has appeared on the big stage of other meetings and was adapted to the small screen.

Deana: I moderated the keynote with Dr. Selanikio and, even with some technical glitches, I was so impressed with the powerful data visualizations and their pitfalls. I was also quite pleased with how engaged our audience was during the 45-minute Q&A session. I had prepared my own questions in case there weren't enough from the audience, but I didn't need them because we had so many great ones coming through the platform. I was also very impressed with the Public Health Ignite, Traditional Drug Development Process, Tell Me Something About Telehealth and ACA@10 sessions. Of course, I had the best time playing a judge in the actuarial court during the professionalism session. We had very interesting case studies and again massive audience interaction through our polling questions and Q&A.

We received many responses to the meeting and sessions evaluation, and the attendees were all generally impressed with the quality and content of the presentations. In Figure 1, we show the number of attendees and the average meeting rating for the past six years. We were so pleased with the results because this type of event was new for us and we had to turn it around in very little time.

Instead of a trip to the airport, a flight across the country and a shuttle to the hotel, we woke up on June 8 and walked a short distance to our home office setups.

Figure 1
Health Meeting Ratings, 2015-2017

Year	Location	Attendees	Rating (Scores 1 to 5)
2015	Atlanta, Ga.	925	4.09
2016	Philadelphia, Pa.	1,047	4.14
2017	Hollywood, Fla.	945	4.28
2018	Austin, Texas	983	4.18
2019	Phoenix, Ariz.	995	4.35
2020	Virtual	1,043	4.26

However, many of us did feel that we missed out on some things by not attending in person. There is an undeniable benefit to being in the same place with a thousand other health actuaries for a few days at a time. The hallway conversations one can have with old friends, new acquaintances, colleagues and clients can add great context to the topics you just heard about or the ones you were looking forward to. When you're at the meeting, workplace and industry issues tend to be discussed at lunch and at the bar, and you can count on expanding your professional network. We definitely missed that.

We also are aware that this may be the new normal. Attending this virtual meeting was simpler and less expensive than traveling. The younger generation of actuaries may be more used to doing everything virtually and may simply prefer this format. We heard from many that this was the first Health Meeting they attended because it was a much lower cost and more convenient. Only time will tell how this event and our other education offerings will evolve.

Finally, we are so grateful to our actuarial community for the amazing educational content—each presenter deserves to feel good that the time they invested into this event was valued. We also want to cheer and high-five our small Health Section Council Health Meeting committee for pulling this off. Thank you so much, Heather Jameson, Craig Kalman, Ryan Smith, Joe Wurzburger and many others on the Health Section Council and SOA staff. ■



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A Look Inside the Black Box

By Greg Mottet

It's an exciting time to be a health actuary! The last decade brought with it a wealth of opportunity. And if you blinked, you might have missed some incredible advances in artificial intelligence (AI). Many things that were once impossible are becoming possible. AI has enabled advancements such as the discovery of new planets,¹ the acceleration of drug discovery,² the pursuit of treatments for rare diseases,³ the improved diagnosis and treatment of cancer^{4,5} and convenience like never before.⁶ It will continue to change the world and will be a defining characteristic of our time. Many of us will tell stories to our grandchildren, and they will be horrified anyone gave us permission to drive to work in a car with a steering wheel.

As this change takes place, new frontiers are emerging. Health actuaries have the opportunity to push health care forward

by leveraging AI and machine learning (ML) to improve predictions and provide greater levels of insight. As actuaries learn to blend actuarial judgment with the output of these models, the ability to manage risk will increase, leading to more competitive pricing and better insurance products. For a long time, actuaries have taken advantage of the statistical properties of segments of members to price insurance. But the rich, detailed data underlying these populations has not been fully utilized. Machine learning is the ideal tool to pore over the fine detail behind the data available to actuaries and bring the most critical insights into plain view.

This new frontier also comes with a great deal of responsibility. Used improperly, AI and ML can lead to unintended biases or singling out individuals. For the latter, it is fortunate that regulations exist to protect individuals. For the former, actuaries must be aware of the potential pitfalls and take steps to address them. Care needs to be taken to ensure the model is achieving the intended goal. The actuary must be aware of the potential impacts due to the abundance or sparseness of different types of data and the frequency with which key data is populated over time. Changes in coding patterns, such as the transition from ICD-9 to ICD-10, or the data drift from COVID-19 must be considered. And models must be trained and validated in ways that ensure continuing accuracy on unseen data. The actuary is well suited to address all of these issues. Every actuary has strong domain knowledge, a solid statistical background,



The most effective actuarial departments and health plans will leverage narrow AI and ML models to improve predictive capability.

technical aptitude and a proven ability to learn new things and tackle complex problems.

THE AI-ENABLED ACTUARY

In its current state, the term “artificial intelligence” is perhaps an overstatement. AI can be categorized along a spectrum of increasing capability starting with artificial narrow intelligence (ANI), progressing to artificial general intelligence (AGI) and ending in artificial super intelligence (ASI). Narrow intelligence has been defined as “the ability to carry out any particular task that is typically considered to require significant intelligence in humans.”⁷ This is the current state of both AI and ML. Given sufficient data, they can be used to carry out a specific task and can often do incredibly well! They are both well suited to solve problems involving standard tabular data sets, while AI generally has strong advantages in natural language processing and computer vision. But both lack the qualities of general intelligence.

General intelligence is akin to human thinking. Based on one definition, it sounds very much like the work of an actuary: “General Intelligence is the ability to achieve complex goals in complex environments.”⁸ It has the ability to generalize knowledge from one context and apply it to another. General intelligence is able to understand the impact of regulatory changes. It is able to understand the implications of entering a new market or the presence of a new competitor. It is able to reason through the potential cost of new drugs or medical procedures for which claims data is not yet available.

It will be a long time before AGI is achieved. A recent survey of 352 machine learning and computational neuroscience researchers showed that 50 percent believe that within 45 years “unaided machines [will be able to] accomplish every task better and more cheaply than human workers.”⁹ But many of those 352 researchers believe AGI will either not be achieved in this century or never be achieved at all.

For the foreseeable future, actuaries will continue to succeed by relying on actuarial judgment and deep domain knowledge. And the most effective actuarial departments and health plans will leverage narrow AI and ML models to improve predictive capability as well as provide continuous retrospective and prospective population insights. Similar to things like provider network discounts, effective underwriting and risk coding, the

ability to leverage AI will become a pillar of an effective health plan such that the first health plans to succeed on this front will possess a substantial competitive advantage.

OPENING THE BLACK BOX

A common complaint against machine learning is that the models are a black box. For an actuary, working with a black box is difficult because it limits the ability to assess reasonableness of results, and actuaries need to explain results to business stakeholders and regulators. Complex ML models typically provide significant gains in accuracy compared to linear modeling, but there has always been a trade-off between accuracy and interpretability. Recently developed open-source tools have chipped away at this black box and enabled users to better understand the connection between data inputs and the resulting prediction.

Shapley Additive Explanations (SHAP) is a computationally efficient Python tool that draws on game theory to produce an “interpretable approximation of the original model.”¹⁰ It can be used to quantify drivers of individual predictions from complex models, including random forests, gradient-boosted trees and neural networks. The drivers of individual predictions are also additive and can be aggregated across individual predictions to produce population-level insights.

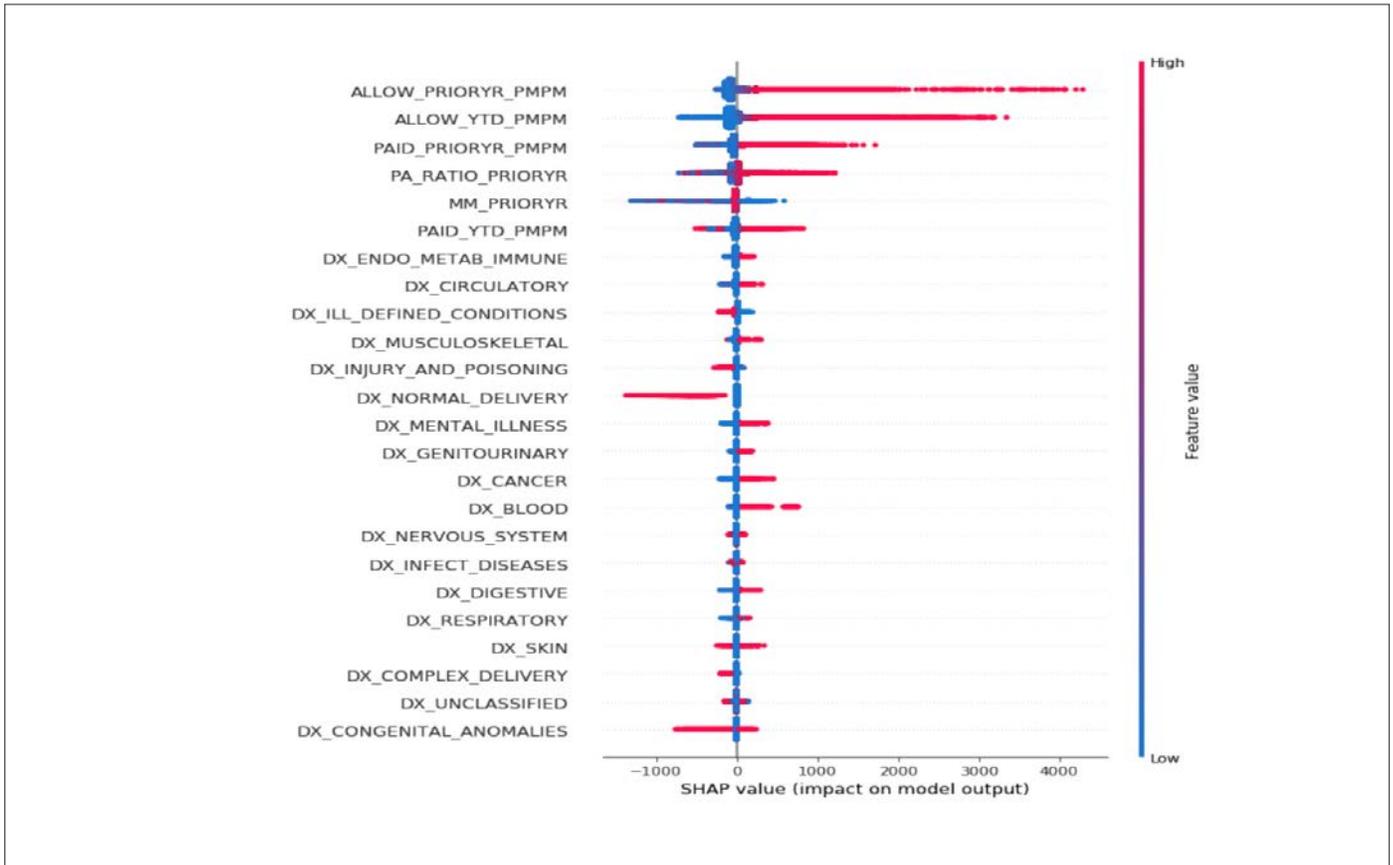
ILLUSTRATION OF SHAP TOOL

For the purpose of illustration, I created a simplified model that predicts member claims for the current calendar year based on data from the prior year and the first month of the current year. The features from prior year data include allowed, paid, paid over allowed, member months and binary diagnosis indicators. The current year features include only paid amounts and allowed amounts for the first month of the year. These features were calculated for a set of members and fed into a gradient-boosting model. The model hyperparameters were then tuned using cross-validation to minimize mean squared error. Next, to avoid displaying the personal data of individuals, two additional rows of data were manually created representing two “pseudo” members. A model like this leaves a lot on the table, but it serves the purpose of illustrating the value of SHAP.

Figure 1 shows the most predictive features in descending order and how various values of those features influence the prediction. The x-axis represents the impact on the per member per month (PMPM) claims prediction. Each point represents a member, and the color scale corresponds to the value of the feature. Areas with higher member density will allow the points to spread out above and below the horizontal line. For example, the point in the upper right represents a member whose prior year allowed was on the high end (bright red), which contributed around \$4,000 PMPM to the prediction.

A figure like this can be used to assess the reasonableness of the connection between the data and the predictions. Say we unintentionally added member ID as a feature, and it was highly

Figure 1
SHAP Summary Plot: Explaining Feature Impact on Predictions



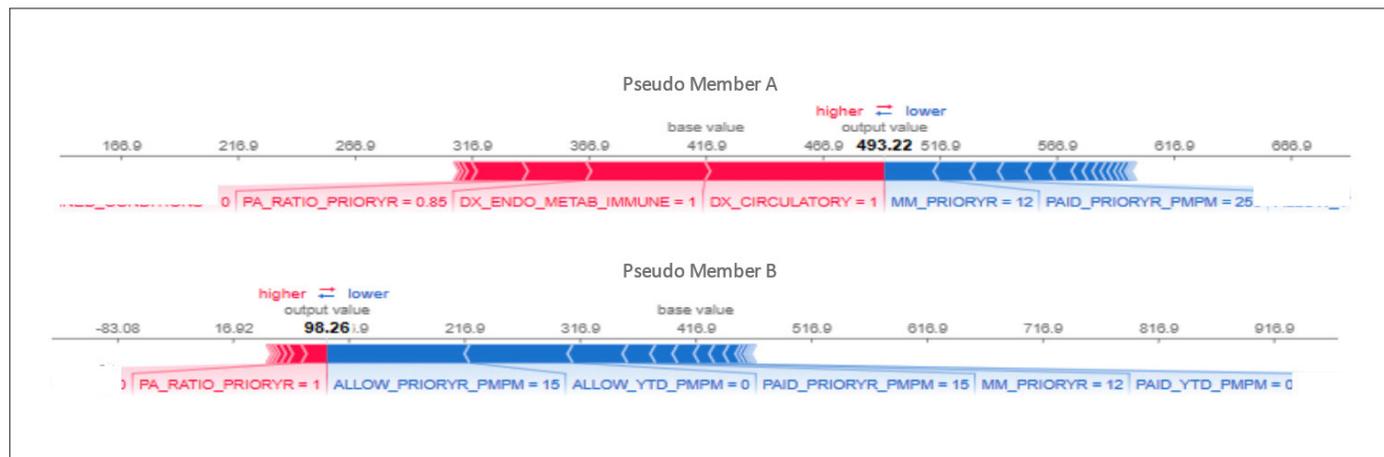
predictive. Looking at this figure would quickly show that the model created a spurious connection between member ID and claim cost. Another insight we can glean from Figure 1 is that the model is lowering cost the year after a delivery occurred. High values of the ALLOW_PRIORYR_PMPM result in higher predictions, but we see that when there was also a delivery in the prior year (DX_NORMAL_DELIVERY = 1), the model learned to reduce the prediction for the subsequent year. What else do you see that would give you reason to believe the model is producing reasonable or unreasonable results? This is the time to apply your judgment.

Figure 2 shows the impact each feature had on the individual predictions for the pseudo members created. The average predicted value across the data set (displayed as the “base value”) is \$416.90 PMPM. The predicted claims for member A are \$493.22 PMPM. A circulatory diagnosis contributed about \$80 to the prediction. A diagnosis in the endocrine, metabolic and immune category contributed an additional \$50 or so. And a relatively high paid-to-allowed ratio pushed the prediction

a little higher. On the other side, there were 12 months of enrollment in the prior year, which lowered the prediction by about \$20. Member B had claims of \$15 PMPM in the prior year and has yet to have a claim in the current year, which are the top drivers of a low prediction of \$98.26 PMPM. Note that the drivers are additive, and provided a link function is not used, results can be directly aggregated to member segments and provide insights into how underlying changes in the population influence overall cost.

Recently developed open-source tools have enabled users to better understand the connection between data inputs and the resulting prediction.

Figure 2
SHAP Force Plot: Explaining Predictions for Individual Members



APPLICATIONS FOR HEALTH ACTUARIES

The value gained from applying these methods in health insurance is only beginning to be realized. New applications will continue to emerge, and with enough vision and grit, the health care we have in the future will look much different and better than what we have today. As health actuaries branch out of traditional areas of practice, opportunities to improve health care will expand. But even now, we can start thinking about some of the ways we have done things in the past that can be done better with new tools. In many cases, standard models and actuarial judgment will continue to be the wisest course, while in others, AI and ML models will offer strong advantages. With that in mind, these are some areas where it makes sense to search for innovation in the near term:

- **Financial forecasting and monitoring.** Data from the current and prior years can be used to complete member claims for the current year. Combining these predictions with SHAP output and aggregating to lines of business can provide continuous feedback into drivers of claim cost, strategic insight and improvement of trend estimates.
- **Large group rating and underwriting.** A traditional rating formula trends and adjusts from a group’s last year of experience. Credibility is used to control rate fluctuations, but often no attempt is made to control for mean reversion and future rising risk, which is left to the underwriter. The predictive power of diagnosis codes, prescription drugs and procedure patterns can be used to systematically improve both pricing accuracy and long-term rate stability. Further, combining predictions with SHAP output can give underwriters confidence in knowing when to hold the rate or make concessions.

- **Risk coding.** AI and ML models can leverage patterns in data that identify missing or inaccurate diagnosis codes. This information can be used to supplement existing methods for complete and accurate coding of members that would otherwise be hard to identify.
- **Case management.** ML models excel at predicting the high end of risk. They are able to capture more complex interactions than traditional linear models, such as the timing of events in relation to one another.
- **Reserving.** AI and ML models have shown promise in predicting reserves with high accuracy. Interpretable output would also allow actuaries to blend their unique insights from factors not present in data.

THE FUTURE IS BRIGHT

The pace of change and adoption of AI over the past decade has been remarkable. Looking ahead, this trend is very likely to continue. In another decade, I believe the achievements relating to health insurance will be far greater than suggested by the list in this article. As we increase our understanding of AI and ML, new opportunities will be discovered. And as we work across organizations, we will be better equipped to solve some of the toughest challenges in health care. Blending together AI and ML with our domain knowledge and actuarial judgment will cut through barriers that were once difficult to overcome. Some

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things that once seemed impossible will become possible. Keep learning and develop a skill set in AI and ML! This trend is here to stay and is certainly an exciting one to be a part of. ■



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ENDNOTES

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Behavioral Economics: Overview and Health Care Applications

By Jeff Chanin, Randy Herman, Tony Pistilli and Brian Plaskow

Authorities at Schiphol Airport in Amsterdam etched an image of a fly into each urinal in the airport. This was very effective and is a good example of an application of behavioral economics.

“Wait, what?”

Sorry, we should have provided a better explanation of that example.

Behavioral economics is “a method of economic analysis that applies psychological insights into human behavior to explain economic decision-making.”¹ The most significant difference between traditional economics and behavioral economics is that the former assumes an individual “thinks and chooses unfailingly well,”² whereas the latter assumes an individual is “not only irrational, but predictably irrational.”³ Behavioral economics attempts to identify and quantify suboptimal and biased choices commonly made by individuals. By understanding behavioral economics, actuaries can better explain, predict and promote consumer behavior.

The clever people at Schiphol Airport wanted to reduce maintenance costs. The urinal fly etchings provided men targets at which to aim. These targets were effective in focusing attention and associated accuracy in the use of the urinals. Spillage was reduced by 80 percent!⁴ Traditional economics has little to say about this mechanism to reduce maintenance costs (there is little to no gain to the user from better aim), but behavioral economics took advantage of individual human behavior to the benefit of the airport, with no loss or harm to its customers.



This article provides an overview of behavioral economics theory as it relates to health and welfare insurance plans and provides summaries of two sample applications of the theories: enrollment in health insurance exchanges created by the Patient Protection and Affordable Care Act (PPACA), and product design considerations in light of vast health illiteracy.

OVERVIEW

Behavioral economics theories involve various aspects of instinctive and socialized human behavior. For example, common theories address the tendency of individuals to:

- prefer the status quo over making and implementing decisions to change,
- dislike losses more than they value gains,
- prefer certainty over variability,
- become overwhelmed when presented with too many choices,
- rely too heavily on the first information received,
- be influenced by the actions of peers,
- defer or disregard restrictive or bothersome actions, and

- perceive round numbers as more trustworthy and representing higher quality than other numbers.

These types of theories can and have been applied to a wide range of economic activities, such as:⁵

- **Automatic magazine subscription renewals.** Through inertia, under an automatic renewal option, people will tend to subscribe longer, even if they do not read the magazine.
- **Software defaults.** Due to inertia, status quo bias and perceived effort needed, people tend to “choose” the defaults embedded in the software—for example, not customizing the ribbon in Microsoft products—even if another option would better suit their needs.
- **Promoting fuel efficiency.** Through (perceived) competition, fuel economy stickers with estimated fuel cost and ranking of miles-per-gallon ratings, incent consumers to purchase more fuel-efficient automobiles.
- **Encouraging retirement savings.** To overcome inertia of not joining a retirement savings plan, and then to retain the inertia of participating, automatic enrollment and automatic contribution increases in retirement savings plans increase overall retirement savings rates and levels.

Behavioral economics theory applicable to health care insurance plans include:

- **Weight loss programs.** Using the effectiveness of personal commitments and the tendency of loss aversion, some online

vendors provide forums for public declarations of personal health goals or provide a mechanism for people to create a financial risk for themselves to meet personal health goals. For example, a person can pay the vendor a self-determined amount of money. If the person achieves a self-predefined goal (e.g., losing at least eight pounds in the next 60 days), the money is returned to the person. If the goal is not reached, the money is donated to a charity. In some cases, it is more effective for the money to be donated to an organization that is objectionable to the person. This provides tangible incentives for a person to achieve goals, or disincentives for not achieving goals. The goals and risk levels are self-determined and real.

- **Promoting better diet and nutrition.** In a buffet, people tend to take and eat more food if they are given larger plates, and people tend to take and eat more of the food that is provided near the beginning of the layout. People will tend to eat healthier from buffets with smaller plates and healthier options placed near the beginning of the food options.
- **Smoking cessation.** Loss aversion leads to the reduction of cigarette use when significant cigarette taxes are instituted.
- **Organ donation.** Based on inertia, presumed consent—an opt-out (as opposed to opt-in) process—for organ donations tends to increase potential donor consent rates.

Table 1 presents a summary of examples of possible applications of behavioral economics theory to health and welfare insurance plans.

Table 1
Sample Applications of Behavioral Economics Theories to Health Care Insurance Plans

Behavioral Economics Concept	Possible Health Care Insurance Application
Anchoring bias: People tend to rely too heavily on the first information received.	Design of open enrollment material (e.g., presenting the high-deductible consumer-driven health plan first, if that is the preferred option for the employer) Structure of provider listings and provider search results (e.g., showing higher-ranked or lower-cost providers first in a provider search)
The choice paradox: Offering people too many choices creates indecision and suboptimal decisions or decision avoidance.	Plan offerings on public Medicare and commercial health care plan exchanges (e.g., when employees are given an array of benefit levels, network options and supplemental benefits to choose from, offering predetermined “bundles” of coverage can reduce choice anxiety)
Prospect theory and loss aversion: People tend to prefer avoiding losses to acquiring gains.	Balance of and communication of cost-sharing provisions and employee contributions/premiums (e.g., this theory may explain why insureds may pay more in premium than the deductible difference for a lower deductible plan) Decision framework for voluntary benefit enrollment hospital indemnity and critical illness insurance (e.g., framing the benefit as helping cover the out-of-pocket costs associated with illness even though the benefit can be used for anything)

Behavioral Economics Concept	Possible Health Care Insurance Application
Certainty effect: People tend to strongly prefer certainty and are even willing to sacrifice income to achieve higher levels of certainty.	Balance of and communication of cost-sharing provisions and employee contributions/premiums (e.g., many insureds prefer copays to deductibles)
Present bias: People tend to give stronger weight to payoffs that are closer to the present time when considering trade-offs between two future events.	Design of health and wellness rewards programs (e.g., a series of immediate or intermediate rewards can be more effective in a weight loss program than a single long-term goal or reward)
Preference for round numbers: People tend to perceive round numbers as more trustworthy and easier to understand.	Premium and employee contribution rates (e.g., a monthly premium of \$240 versus \$239.57 is a less complicated number for a consumer to process)
Status quo bias: People tend to prefer the current state.	<p>Framework to incent subscribers to keep or change plans or carriers (e.g., automatically enrolling employees into an alternative plan when previous plan options are discontinued)</p> <p>Framework to incent employers to keep or change carriers (e.g., offer a renewal discount to employers to avoid carrier shopping)</p>
The goal gradient effect: People tend to complete a task if the task has been started for them.	<p>Open enrollment (e.g., prepopulating open enrollment material with known personal profile data, making a form look partially completed)</p> <p>Retention programs (e.g., personalized retention marketing materials showing that the company did the work to determine the “best fit” plan option, based on the consumer’s health care needs, with a simple “check the box” response option)</p>
Framing effect: People tend to react to choices differently depending on whether the choices are presented as losses or gains.	<p>Design of wellness incentives (e.g., some exercise programs offer rewards if goals are achieved while others offer penalties, such as the loss of a gym discount)</p> <p>Structure of one-way and two-way risk-based provider contracts (e.g., gain-only provider incentives may be less effective than gain-loss incentives)</p>
Relative positioning: People tend to be more interested in relative gains and losses than in absolute income and wealth.	Communication of provider quality-of-care scores to providers and to members (e.g., “relative to peers” is a more effective motivator than absolute number)
The bandwagon effect: People are more apt to agree with a proposition if they are aware others agree with it, regardless of the actual or self-perceived underlying value of the proposition.	Patient care decisions (e.g., influencing decisions by providing information such as “This is what the majority of patients in your situation decided” or “This is what the majority of physicians recommend for someone with your symptoms and diagnosis”)
Small probabilities: People tend to underreact to low-probability events.	Health care decisions regarding rare diseases (e.g., vaccine avoidance)
The Zeigarnik effect: People tend to remember uncompleted tasks more than completed ones.	Communication and impact of a wellness credit earned in the previous plan year (e.g., do people appropriately value the credit?)
Reciprocity: People tend to respond positively to friendly and cooperative actions; conversely, people tend to react nastily to hostile and brutal actions.	Care advocacy and benefit concierge services (e.g., automated responses and call center representatives using pleasant, respectful voices and scripts achieve higher member satisfaction ratings)

ENROLLMENT IN HEALTH INSURANCE EXCHANGES CREATED BY THE PPACA

Despite great coverage gains as a result of the implementation of the PPACA, an estimated 30 million people remain uninsured.⁶ Surprisingly, nearly half of the uninsured are eligible for some form of subsidized coverage. From a purely rational economic point of view, we would expect all consumers to assess their available choices and make optimal decisions given their

preferences and risk tolerances. As a result, we might conclude that those who remain uninsured do so because they have made an optimal choice to forgo the cost of insurance in exchange for taking the risk of paying for medical services on their own should the need arise.

But the evidence suggests very strongly that rational decision making is not the driving factor in remaining uninsured. An

issue brief from the Kaiser Family Foundation suggests that as many as 4.7 million of those who are uninsured have access to zero-dollar Bronze plans through the PPACA marketplace.⁷ In a purely rational world, it doesn't make sense for people to remain uninsured if a free coverage option is available to them.

Consider this extreme end of the choice spectrum where a consumer must decide between remaining uninsured and obtaining coverage without paying any premium. The choice to obtain coverage should be obvious, as they are better off on all key measures of health spending:

- **Up-front costs.** You can't beat \$0 premiums.
- **Cost of services.** Most Bronze plans have relatively high deductibles, which may be daunting for some consumers. But that's no worse than having no insurance coverage at all. In addition, all qualified PPACA plans cover certain preventive services, such as flu shots and mammograms, with no cost-sharing.
- **Catastrophic protection.** Something is better than nothing. Like high deductibles, high out-of-pocket maximums provide at least one layer of protection against large medical bills. Two-thirds of all bankruptcies filed in the United States cite medical issues as a key contributor.

The question we should be asking ourselves as actuaries is, why is this happening at such a large scale? Perhaps some of the decisions can be explained by behavioral economics principles. In a Commonwealth Fund survey of the uninsured,⁸ consumers who chose to remain uninsured were asked why they didn't try to obtain health insurance coverage through the PPACA marketplace exchanges. Many of the responses allude to underlying behavioral principles rather than purely economic calculations.

Let's look at the responses and the potentially relatable behavioral economics principles (Table 2).

These are by no means the only explanations for why some subsidy-eligible people remain uninsured. However, as actuaries we should strive to be aware that policies and models will never represent the full spectrum of human behavior.

PUBLIC HEALTH INSURANCE LITERACY AND BEHAVIORAL ECONOMICS-INSPIRED PRODUCT DESIGN

Health insurance is an area of significant uncertainty and misunderstanding for many. Actuaries have an important role in helping consumers interact positively with health insurance products, but actuaries may also need to think more deeply than the technical details we interact with daily. Product designs

Table 2
Possible Behavioral Economics Explanations for Uninsurance

<i>Survey Question: "What was the <u>main</u> reason you did not try to get health insurance through the marketplace?"</i>	
Answer Option	Behavioral Economics Concept
You did not think you could afford health insurance.	Anchoring bias. Initial impressions of affordability may have been based on early negative press on PPACA.
You did not think you needed health insurance.	Small probability. "It's not going to happen to me." Perhaps this kind of attitude reflects people's willingness to gamble with their own health. Bandwagon effect. People may choose not to pursue coverage if peers with similar demographic, cultural or political beliefs do not have coverage.
You did not think you would be eligible for health insurance.	Status quo bias. People prefer the status quo over making and implementing decisions to change. Remaining uninsured is easier than signing up for new coverage. Anchoring bias. Consumers may continue to have a pre-PPACA view of health insurance underwriting and not be aware of guaranteed issue requirements.
You were not aware of the marketplace.	Choice paradox. People tend to become overwhelmed when presented with too many choices. Consumers are inundated with advertisements from insurers and agents and may find it difficult to home in on the public marketplace, where subsidized coverage is most readily available.

Source: Rachel Fehr, Cynthia Cox, and Matthew Rae. *How Many of the Uninsured Can Purchase a Marketplace Plan for Free in 2020?* Kaiser Family Foundation, December 10, 2019, <https://www.kff.org/health-reform/issue-brief/how-many-of-the-uninsured-can-purchase-a-marketplace-plan-for-free/> (accessed July 12, 2020).

focused on aligning consumer incentives through higher cost-sharing or rewards for healthy behavior are effective, but not as effective as theory might predict (not to mention consumers can resent the first and ignore the second). This may be, in large part, due to widespread health insurance illiteracy.

A 2017 UnitedHealthcare Consumer Sentiment Survey found a significant, but perhaps not surprising, lack of knowledge about health insurance among the public.⁹ Only 9 percent of individuals surveyed understood all four of the following basic health insurance terms: “health plan premium,” “health plan deductible,” “out-of-pocket maximum” and “co-insurance.” In an environment where the majority of consumers do not understand key components of the products actuaries are designing, a new approach may be necessary. Using knowledge of behavioral economics to inform health insurance product design may provide a new path forward.

Increasingly, incentives and rewards are being introduced as alternatives to cost-sharing designs to promote desirable health behavior. This approach is especially pertinent in Medicaid programs, where cost-sharing and benefit incentive approaches may not be feasible. Although this is largely an untested area, there are some interesting first efforts that we can review.

We are beginning to see a new approach implemented in Medicaid plans. Section 4108 of the PPACA authorized grants to states to provide incentive to beneficiaries who participate in prevention programs and demonstrate changes in health risk and outcomes. These PPACA grants (enacted under the Medicaid Incentives for the Prevention of Chronic Diseases model) must be “comprehensive, evidence-based, widely available, and easily accessible.” Studies of the emerging impacts of these PPACA programs provide an interesting look at how the behavioral economics mechanisms that were employed in some cases are working.

A successful program in Wisconsin provided smoking cessation services to adult smokers enrolled in a cessation program, with some participants receiving incentives contingent upon participation in treatment and attainment of cessation goals, while a randomized control group received only treatment.¹⁰ Members were generally eligible to receive a maximum \$350 over 12 months, with pregnant participants eligible to receive \$595 over the course of pregnancy plus 12 months postpartum. Money was awarded for taking counseling calls and for biochemically verified abstinence. The study found that the incentive group had significantly higher smoking abstinence rates ($p < 0.0001$). Secondary outcomes observable in the early data included an increased use of cessation medications based on pharmacy records and an increased rate of self-reporting smoking status. Including all program costs, the cost per individual cessation was nearly \$1,100 lower for the incented group.

By understanding behavioral economics, actuaries can better explain, predict and promote consumer behavior.

At least two other states enacted similar smoking cessation plans. California reported a statistically significant increase in smoking cessation attempts, but without a corresponding decrease in inpatient admissions or emergency room visits. The California model offered less incentive money than the Wisconsin program, and also offered incentive payments only for taking counseling calls and not for verified six-month abstinence. A smoking cessation program in Connecticut offered money for verified abstinence—\$15 for up to 12 tobacco-free tests with a \$10 bonus for three consecutive tobacco-free tests. Connecticut found statistically significant decreases in inpatient spending during the program and also found that raising incentive payment amounts later in the study resulted in increased engagement.

The differences in program design and results from these programs provide a clearer picture on how the behavioral economics mechanisms of these programs are working. A Duke study of these initiatives found a few key recommendations on what worked well in these programs and presented some alternative ways to leverage behavioral economics.¹¹ They found:

- Providing tangible rewards (e.g., gift cards and other prizes) can be more effective than reduced cost-sharing, which may go unnoticed by members. The study cites a Kaiser Family Foundation focus group composed of Michigan Medicaid beneficiaries, which found they perceived immediate gift cards as more motivating to complete behaviors than future reductions in premium payments. The study also notes that “while behavioral economics research suggests that incentives framed as losses can be more effective than rewards [loss aversion], penalties in a financially disadvantaged Medicaid population could hinder access to needed care or discriminate against beneficiaries with certain health conditions.”
- Immediate incentives can be crucial to achieving effectiveness. A meta-analysis of incentives concerning smoking cessation found that a delay of more than one day between target behavior change (e.g., biochemical verification of smoking cessation) and incentive delivery was associated with a 50 percent reduction in effectiveness.
- Frequent, smaller rewards can be more effective than larger, one-time or annual rewards. In addition to providing more immediate incentives to beneficiaries, the former also

provides the program with more real-time data. One state changed a \$200 gym voucher to a monthly voucher program to enable more insight into how beneficiaries were sustaining behavior.

There are still more questions than answers about how these programs can work, both for Medicaid and for commercial or Medicare products, with these early Medicaid pilots serving as a proof of concept. Leveraging behavioral economics insights can be an effective tool to incent member behavior and may be a fruitful path forward as public literacy about health insurance products remains low and financial mechanisms for managing costs become increasingly difficult to use.

CONCLUSION

Behavioral economics theories are being used in the design of health insurance products and the broader health care system. Actuarial practice is enhanced by actuaries learning about and implementing these theories.

Behavioral economics can help people lead healthier lifestyles and better understand and appreciate their health insurance plans. As people change behavior, the health insurance system should become more efficient and cost increases should decline. The authors hope actuaries will embrace this nontraditional area of study. ■



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ENDNOTES

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- 5 The examples briefly described in this section are from Thaler and Sunstein.
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