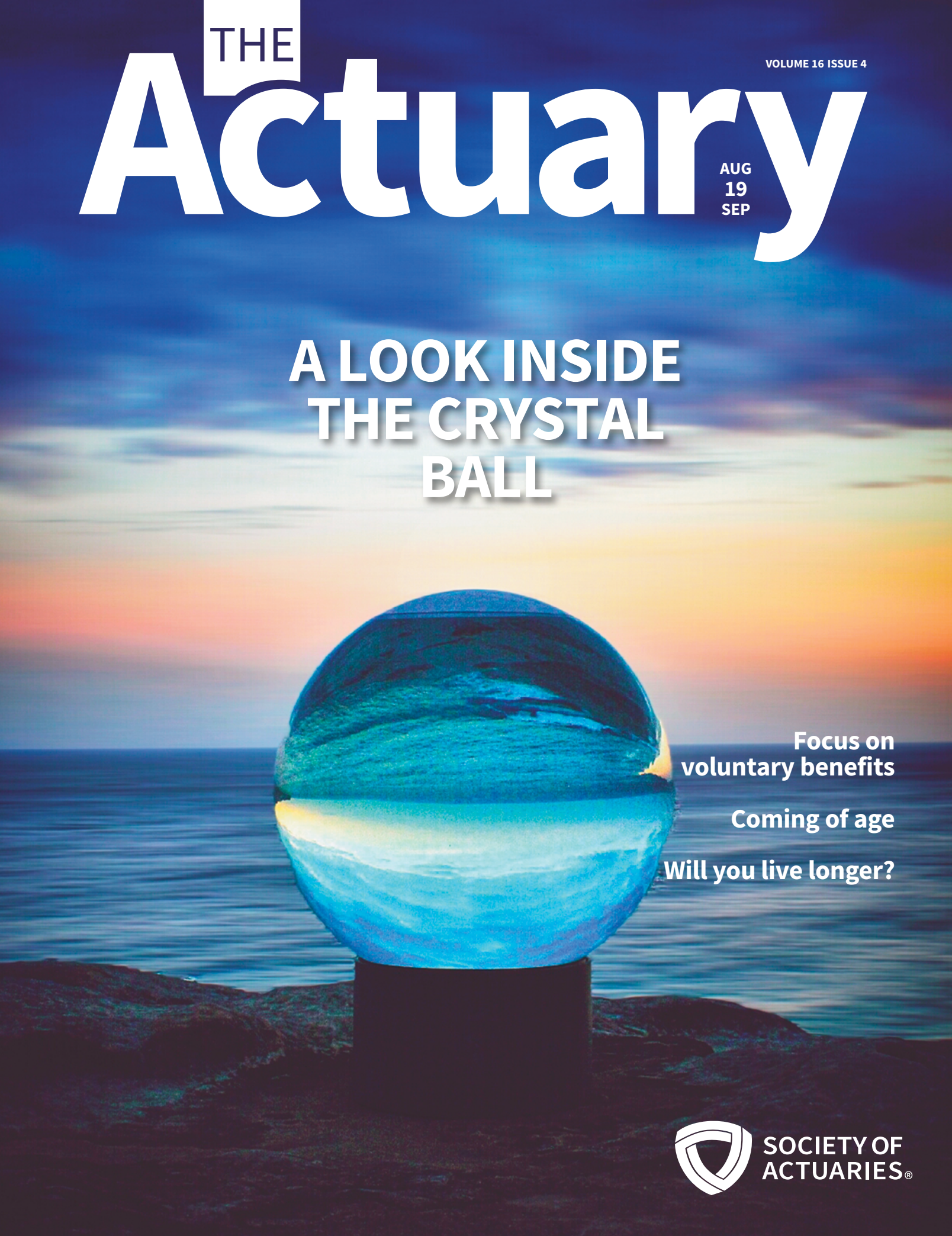
THE Actuary

VOLUME 16 ISSUE 4

AUG 19 SEP

A LOOK INSIDE THE CRYSTAL BALL



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FEATURES

POSTMASTER: Send address changes to the SOA, c/o Communications Department, 475 N. Martingale Rd., Schaumburg, IL 60173-2226.

ONLINE EXCLUSIVE!
Read this issue's online exclusive, "Time for Transformation," by Bill Bade, FSA, MAAA, at ***TheActuaryMagazine.org/Time-for-Transformation***.

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DEPARTMENTS

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Enhancing the Member Experience

I am always looking for ways for the Society of Actuaries (SOA) to improve the member experience. I believe it is crucial to support our next generation of actuarial leaders, and at the same time, empower our members to expand their current skill sets for the opportunities and challenges that lie ahead.

The SOA Board of Directors recently completed a task force review of our millennial generation FSAs, which you may have already heard, as a segment, now encompass more than 45 percent of our total membership. Although we have good engagement with this portion of our membership, it could be much better. However, to achieve this increase in participation, we recognize the need to build modern, digital, cutting-edge tools that will specifically appeal to our newer FSAs. That is why it is an SOA priority, through several recently developed strategic initiatives, to increase participation in professional development, develop a futuristic digital strategy and increase our international offerings.

Over the past few years, we have incorporated webcasts, e-Learning courses, podcasts, predictive analytics certificate programs and virtual sessions into our professional development offerings. However, this is just a start.

Last year, the SOA Board approved recommendations for new international education principles. These recommendations focused on both international content for the basic education ASA curriculum and use of local languages for delivering continuing professional development for credentialed members.

The SOA Board has formed two related task forces to examine further improvements. One is examining a redesign of the professional development materials our organization provides. This effort has just begun and will be continuing through 2020. Its goal will be to analyze not only what we do that works, but also, through market research, determine better ways to engage and offer professional development to our members. In addition, we are examining what the SOA can do to enhance our local actuarial clubs and make their professional development content and other offerings more relevant to their members.

We plan to gain further insights on the latest and greatest professional development delivery methods, including new formats and content we can utilize. Within the coming year, I expect the Board will have reviewed and begun development on a game plan for the future, expanding how and what we offer to members. It should include easy-to-navigate digital delivery, encompassing the latest information, presented in more frequent but shorter bursts of content.

You may have the chance to see some of the first changes to our professional development if you will be attending the 2019 SOA Annual Meeting & Exhibit in Toronto. It will have revised formats for both the Monday morning general session and the Tuesday presidential luncheon. We will feature a more interactive-style discussion format for Monday morning, while the Tuesday luncheon will feature a notable expert in predictive analytics. Also, Monday will feature a virtual session, so those not on-site can participate in additional learning opportunities. All of these efforts help to emphasize our shift to more interactive events.

PHOTO: HYON SMITH

JAMES M. GLICKMAN, FSA, MAAA, CLU, is president of the Society of Actuaries. He can be reached at ***jglickman@soa.org***.

Through another initiative, we are in the process of implementing new member and candidate online services, both web-based and delivery through mobile technology. We have developed a long-range road map for our new digital platform that will better serve the actuarial profession domestically and around the globe. The SOA's browser-based R programming platform, designed to serve our actuarial candidates, is being reviewed to explore how to expand its usefulness to a wider range of actuaries and actuarial applications.

The SOA has, for several decades, continued to seek ways to help support the global profession. As our membership grows internationally, we continue to build our educational offerings and support for members and candidates outside of North America.

You are probably already familiar with the annual symposia we host in China and greater Asia, including this summer's activities in Bangkok. While offering these events, we also take the opportunity to meet with local regulators, educators and employers to hear their feedback and insights firsthand. As a part of our international strategy, we are now exploring how we can support the actuarial profession in India.

I encourage you to continue to learn more about these developments to further enhance your member experience.

Finally, please remember, we need both your feedback and ideas to help us determine how we can best meet your needs and challenges for the future. Thank you. ■

RELATED LINKS

2017–2021 Strategic Plan
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2019 Strategic Initiatives
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2019 SOA Annual Meeting & Exhibit
SOA.org/2019AnnualMeeting

Beyond Risk Management

BY ABIGAIL CALDWELL

As the population changes, so do the needs and ultimate solutions in the areas where we work,and beyond.

THE PRIMARY FUNCTIONS AND RESPONSIBILITIES OF ACTUARIES HAVE TRANSFORMED CONSIDERABLY OVER THE LIFE OF THE PROFESSION. In the February/March 2019 issue of *The Actuary*, the dynamic role of an actuary was explored, highlighting some of the new and changing opportunities emerging in the field.

Our goal for this issue is to continue exploring and celebrating the diversity of what actuaries do, and to move beyond what can feel like an obscure definition of "measuring and managing risk." We explore how actuaries are involved in researching, analyzing and developing solutions related to different benefit needs—from the beginning through the end of life, and the evolution and future of these solutions.

Several changes to life-cycle solutions have occurred in recent years. One example is changes to post-retirement income, as we've seen a significant shift away from employer-driven and employer-funded pension plans in favor of employee-contribution/employer-matching 401(k) plans. Similarly, employers

that previously provided medical benefits to employees after they retire are looking at retiree medical plans to wrap around standard Medicare plans as health care becomes more expensive. In both examples, the trend of people living longer is altering what benefits are provided, as well as how they're structured and funded.[1]

It might be easier to identify changes related to the end of the life cycle. After all, one of the primary functions of actuaries is to project future costs, and we can derive a direct correlation to our work as we see a change in the length of that trajectory. But these alterations aren't limited to that area. Insurers and providers alike are introducing new strategies with regard to health plan benefit designs and delivery, such as high-deductible health plans and accountable care organizations. Transparency in both medical procedure and drug pricing, as well as the concept of "Medicare for all," are becoming prominent themes and part of political platforms.

In this issue, we examine the current options to meet different population needs and where those solutions are headed:

- The development and growth of the **voluntary benefits** market continues to be a response to employers' desire to provide supplemental benefits to employees and their need to remain competitive. Mike Prendes, FSA, MAAA, gives an overview of these products and the risk management issues associated with them.
- As with anything life cycle-related, there is a generational aspect to consider. The article by Ronald Poon-Affat, FSA, FIA, MAAA, CFA, explores **trends in life insurance specifically for the millennial demographic**, a population that is close to surpassing baby boomers as the largest generation population, if it hasn't already.
- Tim Rozar, FSA, CERA, MAAA, provides his top seven predictions on the **future of insurance**, while the online exclusive by Bill Bade, FSA, MAAA, highlights the four **key market forces driving changes in the insurance industry**.
- Scientific research developments and advances with regard to genetics are no stranger to the insurance space. Philip Smalley, M.D., FRCPC, provides an in-depth look at **cancer genomic profiling** and speculates on how that science could affect the future of insurance products in terms of plan design, pricing and underwriting.
- John Dawson, FSA, MAAA, walks us through the **evolution of health care** in the United States and highlights some of the key forthcoming initiatives that may change the market.
- We end the features with an article by Al Klein, FSA, MAAA, with **tips for living a longer, healthier life**.

While the three contributing editors for this issue (Dave Snell, ASA, MAAA; Ricardo Trachtman, FSA, MAAA; and I) have very diverse insurance backgrounds—ranging from reinsurance to life to health—we recognize this still doesn't begin to cover all the areas in which actuaries can work to provide solutions to various life-cycle needs. As we all think about the future, we need to keep this fact in mind: As the population changes, so do the needs and ultimate solutions in the areas where we work, and beyond. ■

Reference

[1] The SOA established the Living to 100 research symposium to discuss many of these changes and accompanying challenges with regard to the downstream societal, financial and health care effects. Visit *Livingto100.SOA.org* to learn more.

ABOUT THE WRITER

ABIGAIL CALDWELL, FSA, MAAA, is vice president, health actuary, at Amwins Group Inc. in Charlotte, North Carolina. She is currently a contributing editor for *The Actuary* magazine and can be reached at ***Abigail.caldwell@amwins.com***.

Marketing & Distribution Section Update

Early in my career, I had the pleasure of working at a large carrier with excellent leadership who understood the importance of investing in data and analytics. What was revolutionary technology in our market at the time could be used to identify underperforming pockets of business that could either be closed to new business or adjusted to maintain the overall health of the block. My successes, which led to a leadership role in a nonactuarial department (account management), were based on using the same technology to incentivize our sales force to grow sales profitably.

I am not unique: The Society of Actuaries (SOA) Marketing & Distribution Section (MaD Section) is a collective "who's who" of brilliant actuaries on the cutting edge of using data to grow sales profitably. Simply put, we represent the larger trend of actuaries using data and analysis to do much more than price and value products. I am incredibly honored to work with a fun group of actuaries and hope you will consider joining us as a member or run for a section council position next year.

During our annual on-site strategy meeting last February, the MaD Section Council identified two topics of interest: direct-to-consumer marketing, and health and wellness InsurTech. All of our 2019 newsletters, webcasts, conference sessions and other content is directed at these two priorities. With your help, we will reevaluate our priorities each year.

In addition to the standard section content, we have agreed to a long-term partnership with Competiscan to publish quarterly reports focused on our strategic priorities. This is fantastic material—exclusively for our section members—that I hope you continue to enjoy. In addition, we will host a wine and cheese reception at the 2019 SOA Annual Meeting & Exhibit to coincide with our InsurTech Competition. Please visit *SOA.org/MAD* to learn more about these exciting events. We can't wait to see you in person!

ABOUT THE WRITER

BILL BADE, FSA, MAAA, is founder and consulting actuary at Sydney Consulting Group, as well as president at Sydney Administrators and Sydney Insurance Agency. He is also the council chair of the SOA MaD Section. Bade can be reached at ***Bill.Bade@sydneygrp.com***.

RELATED LINKS

Marketing & Distribution Section Webpage
SOA.org/MAD

Section Newsletter
bit.ly/MaD-NewsDirect

PHOTO: FEDENCO TASSARA

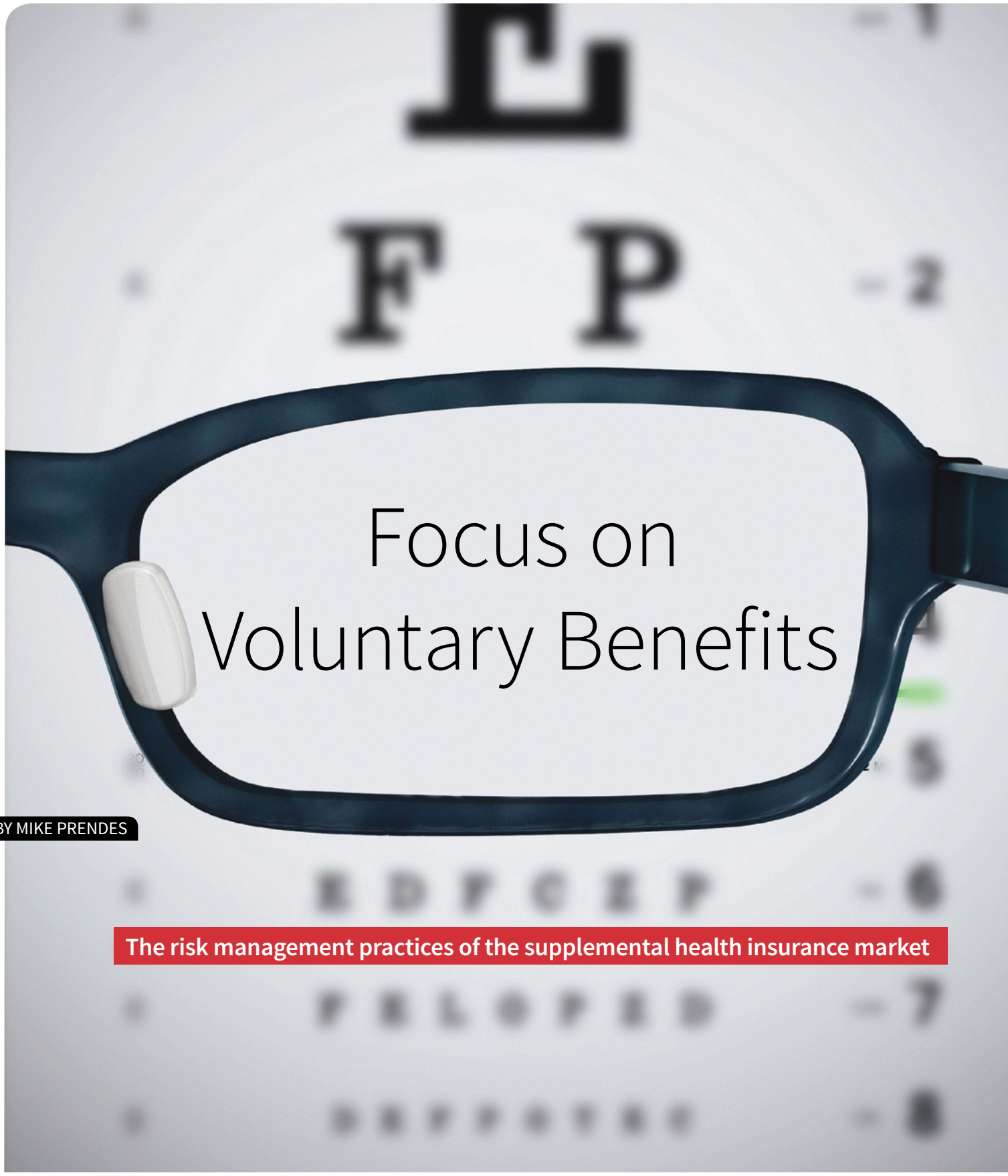
International IFRS 17 in Bogotá

The Society of Actuaries (SOA) Latin America Committee (LAC) sponsored a three-day seminar on International Financial Reporting Standards 17 (IFRS 17) May 29–31 in Bogotá, Colombia. The seminar is one of several professional development events the SOA has sponsored in Latin America, and it is the result of continued collaboration with INS-Fasecolda (National Insurance Institute is the educational branch of the Colombian Federation of Insurers). The seminar is the second international actuarial event held in collaboration with INS.

Thirty-five individuals from different countries in Latin America attended the event, including actuaries and accountants with diverse backgrounds such as analysts, directors and consultants. Several industries, including insurance, reinsurance, consultancy and regulatory, were represented.

Carlos Arocha, FSA, and Federico Tassara, ASA, both members of the SOA LAC, led the seminar course. The course included three modules along with practical hands-on examples and presentation of results. SOA President-elect Andy Rallis, FSA, MAAA, gave a keynote speech on his experience with IFRS 17 in an international context. He also spoke about the SOA and the work it is doing in the region. Luis Caro, ASA, member of the SOA LAC, also attended the seminar.

The seminar also included a networking reception with all participants and VIP guests from the region and MetLife.



Focus on Voluntary Benefits

BY MIKE PRENDES

The risk management practices of the supplemental health insurance market

In the vast realm of employee benefit brokers, general agents, carriers, plan administrators and third-party administrators, you probably have heard the term "voluntary benefits" at some point. This in-demand product segment has demonstrated continued secular growth, so it is no surprise various market participants are interested and investing in this market. Yet, for many insurance professionals, these products, their risk management elements and the table stakes can seem an enigma.

What exactly am I talking about here? Often, confusion begins with the nomenclature alone—and for good reason. In the employee benefits world, the term "voluntary benefits" (or "worksite," "supplemental" or "enhanced" benefits) is understood as employee benefits that are:

- Completely optional to the employee
- Entirely or mostly paid for by the employee through payroll deduction

This definition can apply to a wide range of traditional benefits such as group life, disability, dental and vision insurance. However, when referring to voluntary benefits today, the emphasis is often on "growth" products, which fall into one of three categories:

1. **Supplemental health insurance.** This category includes accident, critical illness, cancer and hospital indemnity.
2. **Supplemental life insurance.** This category includes term life, universal life or whole life coverage.
3. **Nonmedical or noninsurance products.** This category includes identity theft protection plans, pet insurance and pre-paid legal service plans.

While brokers today are interested in all three categories, from a product profile and risk management perspective, this article will focus on supplemental health benefit insurance products—the third category of benefits does not contain bona-fide human insurance products. While some element of network contracting, service and business risk exist with such lines, these agreements typically are structured for a renewing term under which time the carrier is insulated from pricing risk itself. In addition, supplemental health products may be sold to individuals or retirees outside of the workplace; these channels represent substantial premium in the marketplace but are not addressed in this article.

Supplemental Health—Understanding the Products

Supplemental health products have a few key defining characteristics:

- The plans are limited benefit contracts, providing benefits only for specific medical events defined in the contract.
- They do not have a coordination of benefits provision with medical insurance.
- There is no component of provider network reimbursement; benefits are paid on a first-dollar basis directly to the employee.

Often, the claims adjudication requires some amount of medical documentation to be provided, but the turnaround can be as short as one or two days. The employee can then use this cash how they see fit—it is not restricted for specific use of medical care alone.

Out of all voluntary benefits, supplemental health products have enjoyed the largest growth rate of new business premium. For example, annual growth for critical illness is expected to be more than 10 percent in 2019. Employee exposure to out-of-pocket medical costs and the employer's need to offer a comprehensive suite of benefits to employees at low or no cost typically drives the growth of this product.

Accident Insurance

Accident insurance is payable in the event of an accident resulting in injury to the

Accident insurance is distinctly separate from traditional AD&D coverage because it covers a broader range of accidental injuries at varying amounts.

insured. Accident insurance is distinctly separate from traditional accidental death and dismemberment (AD&D) coverage because it covers a broader range of accidental injuries at varying amounts. Coverage may exclude accidents in the workplace to reduce price and carve out benefits normally covered by workers' compensation.

The benefits within an accident insurance policy can be structured as either an extensive schedule of fixed indemnity benefits or simply can be based on medical expenses incurred for accidental injuries up to a fixed limit (e.g., $5,000). Most products filed in the past decade have been structured as a fixed schedule design, with a long list of benefits ranging from services like x-rays or emergency room admission to specific injuries such as torn ligaments or bone fractures.

Cancer and Critical Illness Insurance

Cancer and critical illness insurance are both defined broadly under the National Association of Insurance Commissioners (NAIC) type of insurance for specified disease limited benefit coverage. The distinguishing feature between cancer insurance and critical illness insurance is the range of illnesses covered under each plan. While cancer insurance is, as it sounds, limited to various forms of cancer, critical illness insurance covers a broader range of illnesses such as heart attack, major organ failure, stroke, end stage renal disease and coronary artery disease with bypass surgery.

Like accident insurance, there are variations in how benefits are paid out under cancer and critical illness insurance. Benefits may be payable either upon diagnosis of a covered illness, which is typically paid as a lump sum benefit, or for treatment related to that condition. Treatment-oriented product designs can either pay based on a fixed benefit schedule with specified services, or based on incurred medical expenses, sometimes within specific categories of services (such as chemotherapy or surgery). Lump sum critical illness diagnosis plans are the most popular type of coverage in the group market, as they are the simplest to administer and have the broadest appeal to consumers.

Hospital Indemnity Insurance

Indemnity plans generally pay based on a fixed schedule of benefits for specific medical services or types of inpatient confinement. These services can be for treatment of both accidental injury and/or sickness. The plans can be categorized into two subgroups:

- **HSA-compatible hospital indemnity.** These plans are limited to fixed per diem confinement benefits for inpatient hospital or intensive care confinement. These plans are "permitted insurance" under the tax code and represent most sales in the large group market.
- **Non-HSA-compatible hospital indemnity.** These plans include a larger schedule of inpatient and outpatient procedures including surgery, physical therapy, physician services and nursing facilities.

Risk Management Issues

Supplemental health products all have shared characteristics from pricing, valuation and risk management perspectives. While the covered losses are related to medical events, they have other features such as commission structures and continuation provisions that may resemble life products. Furthermore, while claim costs can be derived from medical data, public health care databases or medical journals, actual experience in the industry is affected by various offsetting forces in terms of underwriting risk. It is important for any risk manager in this space to closely monitor emerging experience for signs of anti-selection, poor participation, low persistency or outright fraud.

Anti-selection and Participation

In voluntary plans, there is an element of anti-selection risk as individuals with either

specific knowledge of their own medical circumstances or a lifestyle with a higher risk of a claim are more likely to enroll than other individuals. This may include those who regularly participate in high-risk activities such as mixed martial arts, or someone with a prior history of cancer.

While older policies may have included exclusions for known or pre-existing conditions, or administered simplified underwriting, competition in the market, technology capabilities and customer expectations have limited underwriting in the past four to five years. This includes both guaranteed issued underwriting for actively at-work employees along with the removal of most pre-existing condition exclusions. This alleviation of underwriting protections, coupled with the fact that these plans typically have employee participation in the 10 percent to 25 percent range, necessitates regular monitoring and in-force management. To the extent participation is low, there exists more room for individuals to anti-select against a specific benefit and for such anti-selection to affect overall loss ratios.

Finally, as portability provisions routinely are included in the design of these products, there is a long-term liability component of risk to the extent that covered individuals can continue coverage after leaving their employer. In the industry, portability often is offered at the same rates as employees; however, typical observed rates of exercising portability are very low, leading to a large degree of anti-selection. For certain coverages that have increasing claim costs, such as hospital indemnity and critical illness, portability creates an additional reserving risk concern in that prefunding of claims may not be enough to cover the high incidence of hospitalization and illnesses that occur at older ages.

Commission Structure and Persistency

For many types of supplemental health products, the industry norm is independent distribution through either "voluntary" brokers who specialize in these types of products or traditional benefit brokers who may outsource enrollment to a firm or general agent who is an expert in these products. As such, high first year commissions are common and amount to 50 percent to 70 percent of the first year's earned premium, with renewal compensation schedules in the 5 percent to 15 percent range. It is worth noting that level commission structures are more common on hospital indemnity than accident, cancer and critical illness policies.

To offset this loss in the first year under generally accepted accounting principles (GAAP) accounting, insurance companies will defer the excess of first year commissions over ultimate commissions, as well as some portion of other acquisition expenses, to be amortized over the lifetime of the policy. Much like traditional life products, this creates an important exposure to early duration lapses, as policies need to remain in force for four to five years to hit pricing targets for profitability.

This is an increasing concern in a group market that is flooded with new competitors and consolidation of distribution. In the past, voluntary brokers marketed products separately from benefit brokers, and the changing of a medical or group disability carrier or broker every two to four years wouldn't necessarily impact the persistency of the voluntary plan. However, in a market with more carriers offering voluntary benefits and a greater number of traditional brokers distributing them, this may no longer be the case. Having either a single broker in charge of both core benefits and voluntary benefits, with the added element of a highly competitive market, could result in all benefits being switched to a new carrier with the changing of the broker of record. In this environment, the average duration of a group may decrease.

Wellness or Preventive Care Benefits

Often included as a benefit within all types of supplemental health coverage,

It is important for any risk manager in this space to closely monitor emerging experience for signs of anti-selection, poor participation, low persistency or outright fraud.

wellness benefits pay a nominal benefit (e.g., $50 or $100) when a covered person undergoes a defined form of preventive care. Contracts in the market vary on this definition. Some carriers' products require the insured to undergo a specific set of covered tests, whereas other products will pay a benefit for a routine annual primary care exam by a physician.

Since the utilization of wellness benefits depends more on the individual behavior of the covered population rather than their actual medical underwriting risk or lifestyle factors, these benefits are particularly challenging to price. Several other variables affect the actual frequency of claims, including:

- An insured's awareness that the benefit is included within their plan
- Ease of starting the carrier's claim adjudication process
- The level of documentation required for proof of loss

As carriers continue to market the efficiency of online claim submission capabilities and simplified claim processes, consumer behavior may change as insureds find it easier to file a claim. Furthermore, the emphasis on wellness and preventive screening within a company's employee benefits plan undoubtedly will impact experience. Preventive care is now covered at 100 percent by Patient Protection and Affordable Care Act (PPACA) compliant medical plans, and employers have introduced numerous initiatives to make annual screenings more accessible to their employees through wellness fairs, on-site biometric screenings and other incentives.

It is critical that carriers marketing these benefits monitor loss ratio or claim incidence on such wellness benefits regularly and separately from the core benefits of the voluntary plans themselves. Wellness benefits reach a strong credibility threshold much more quickly than other benefits. Additionally, these types of benefits are more volatile over time, since the experience is driven more by technology and consumer behavior than underlying medical risk itself.

Product-specific Challenges

Accident Insurance

Claim costs for accident insurance in the commercial group market traditionally are assumed to be level for a given population. This implies the incidence of accidental injury for a working age, actively at-work population is largely the same across age groups. As the manual claim costs do not vary by age, base accident insurance products usually do not generate an active life reserve. This makes the product quite favorable from a return-on-capital perspective, as a lower after-tax profit margin is required to meet a given level of return. However, profitability is very sensitive to lapses. Other challenges when predicting morbidity include:

- **Occupation/industry.** The occupational hazards involved with an insured population are strongly indicative of expected claim costs. Most companies include a rating factor for Standard Industrial Classification (SIC) codes ranging between 85 percent and 130 percent of normal claim costs. In some cases, while the industry of the group may be known, it may not be clear as to the portion of high-risk occupations to be insured, such as for city governments, which include both administrators and first responders.
- **Covered dependents.** Covered children are a major component of overall family claim costs for accident insurance products. As these plans are offered on the traditional four-tier basis (often to align with medical), the assumption of the number of covered children per family becomes a significant component of pricing.
- **Standard workplace protocol.** Although accidental injury rates can be predicted by industry and family size of the population, some public sector employers or union groups may have specific protocols related to on-the-job injuries, such as seeing an on-site physician, which can result in higher than expected medical service utilization.

Critical Illness

Competitive pressure over time has led to carriers including a greater number of illnesses under the plan, with most market plan designs now including between 16–30 or more covered conditions. These plans include coverage for advanced neurological conditions like Alzheimer's disease and Parkinson's disease; less severe conditions like carcinoma in situ or benign brain tumors; and loss of bodily functions such as blindness and deafness. There is less population data available for these types of conditions than there is for heart disease or invasive cancer. As such, these benefits may be priced with greater conservatism than more common illnesses.

Premium rates for such products typically are age banded, but the rate can either be locked in from the age of the insured at time of issue (issue age by age or issue age banded) or can increase as the insured ages (attained age by age or attained age banded). Tobacco use is a common rating factor in some plans, with higher rates charged to tobacco users. Many carriers also include industry and group size as a rating factor. For example,

there is clear medical evidence for a higher rate of certain cardiovascular disease for particular industries, such as service and wholesale trade. Unlike accident insurance, children contribute very little to claim costs since the incidence of most covered conditions is very low for younger people.

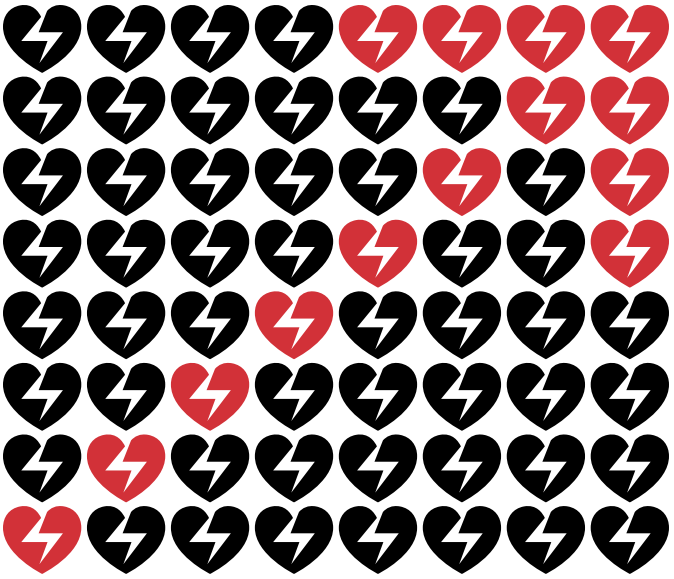
The pattern of claim costs by age for heart attack and cancer follows a steep, increasing slope for most working ages. Termination ages in such contracts are either very high or do not exist due to a one-year pricing term. As such, issue age rated critical illness and cancer coverages priced under a long duration contract generate significant active life reserves, which gives them a very different rate-of-return profile than accident or hospital indemnity. Portability rates and long-term persistency play an important role, as persistency into retirement ages can have a dramatic impact on projected claims. Decreasing long-term lapses result in higher incurred claims in later durations, increasing the overall loss ratio of the block. Therefore, to ensure a block is performing as priced, it is important to regularly review both emerging loss ratio experience and persistency of the block in comparison to pricing assumptions.

Attained age plans, on the other hand, are priced for the morbidity in each age band and do not generate active life reserves. The earnings profile of these plans is much more like accident insurance, with the exception that the average premium per employee will be driven by age demographics due to the premium structure.

Hospital Indemnity

Hospital indemnity products have claim costs that can vary by age group, but premiums either can be age banded or priced to a single rate for all ages. The sickness component of the product often includes maternity care. As such, there is risk for anti-selection, because planned surgeries or maternity care are often covered under such plans. This anti-selection problem is worsened by unwillingness by brokers and groups to introduce some form of medical underwriting. To keep costs sustainable, additional risk protection is included in the design of these contracts.

- Termination ages typically are lower for hospital indemnity than for accident insurance.
- Pre-existing conditions limitations are more prevalent than in other lines of coverage.
- There are waiting periods that apply universally or that specifically carve out confinement due to normal maternity without complications.
- Portability may be limited (i.e., to three or five years) when available.



The pattern of claim costs by age for heart attack and cancer follows a steep, increasing slope for most working ages.

Since anti-selection is a significant element in experience for hospital indemnity plans, and participation is relatively low compared to a normal medical plan, it is recommended that insurers use caution in affording significant rate guarantees. Additionally, group rating at renewal is important to incorporate for this product line, as there is substantially greater variability in year-to-year claim costs based on the behavior and enrollment of the underlying group's population.

Conclusion

This article is intended as a high-level overview. Additional considerations, such as renewability provisions, fraud and other items, are important to the supplemental health insurance market, and in-force management typically includes a robust policy and procedures program. It is critical for actuaries, underwriters, brokers and plan administrators to understand the unique characteristics of this growing and important market so it continues to be a successful insurance solution for the end consumer. ■

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Coming of Age

BY RONALD POON-AFFAT

How life insurers can cater to millennials as they become the largest living adult generation

Millennials have the distinction of being the most intimately observed and analyzed generation in human history. Simultaneously perceived as lazy/hard chargers, self-absorbed/altruistic and technology-addicted, this cohort can be both baffling and fascinating.

Let's begin with some basic facts: The millennial population is, first of all, sizable. According to the U.S. Census Bureau, U.S. millennials will overtake baby boomers as the largest living adult generation in 2019, swelling to 73 million. Meanwhile, boomers, nearly half of whom are at retirement age or older, will shrink to 72 million in 2019, and Generation X, born between 1964 and 1979 (or 1981, depending on the source), will not overtake baby boomers in size until 2028.

Second, millennials are highly educated. The Pew Research Center found in a 2018 study that this generation's members are reaching more advanced education levels at younger ages than their same-age counterparts did in prior generations. Approximately 50 percent hold at least a four-year college degree, and some of these individuals have more than one degree. Some of this is due to factors such as today's need for a college degree for jobs that as recently as 50 years ago required only a high school education (if that), and technology's increasing role both in work and in everyday life, requiring more advanced education and training.[1] Millennials also are currently the largest component of the workforce. As baby boomers retire, millennials' share of the workforce is rising—Pew Research Center reports this cohort comprises one-third of workers as of 2017.[2]

Third, millennials are society's first "digital natives"—the first generation to be fully comfortable with and highly adept at navigating the digital world—and therefore more likely to turn to technology to research solutions for their needs. At the same time, they have a different perspective about business activity: Today's "sharing economy" is a millennial-fostered development that encompasses ride-, car- and bicycle-sharing; crowdfunding and peer-to-peer lending; novel ways to barter for and share talent and knowledge; and more.

One difficulty, however, with analyzing millennials as a market and as a cohort is a basic lack of agreement as to who they are. Both Pew Research Center and Oracle, for example, say millennials (sometimes referred to as Generation Y) are those born between 1981 and 1996. *The Guardian* views 1997 as the end date for this generation, and LIMRA uses 1980 to 2000 as the bracketing years. Internet-based business intelligence provider Statista uses 1980 as the start date but does not yet give an end date, and other research firms use start dates as early as 1977 and end dates as late as 2002.

The one constant with millennials right now is that their basic market characteristics pertaining to life insurance—affluence, attitudes and financial needs—are changing rapidly. This is most likely due to aging: The youngest millennials have, for the most part, graduated from college and entered adulthood (ages 22–23), and the oldest, who are nearing age 40, are reaching their prime career years. This earmarks them as having the potential to be a highly significant market for life insurance.

Do Millennials Need Life Insurance?

The simple answer to this question is: yes. Unusually high levels of economic and social disruption over the past 20 years, stemming from technological advances, globalization and political unrest, are subjecting millennials to higher levels of financial insecurity than any prior generation.

A sizable wealth gap currently exists between this generation and previous ones and is likely to continue to grow. The Federal Reserve Bank of St. Louis reported that in 2016, family wealth for those born in 1980 was 34 percent below what earlier generations held at the same age. Youth unemployment has been high

for more than a decade, and research from the Resolution Foundation in the United Kingdom found that incomes of millennials who are employed are approximately 20 percent less than those of Generation X at the same age.[3]

The two recessions since 2000, coupled with the soaring cost and need for higher education, have saddled millennials with student loans with high face value (approximately $33,000 per individual) and high interest (4.8 percent to 7.4. percent).[4] Millennials also have high and rising levels of credit card debt—approximately 25 percent of their total debt currently.

$$$!

Millennials are less likely than other age groups to know how much life insurance they need, let alone what type to buy, and are likely to assume the cost is far more than the actual cost.

Already it is projected that by 2020—just a year from now—millennials, who will comprise 22 percent of the U.S. population, will be responsible for as much as 30 percent of retail expenditure.[5]

As a result, many millennials have lagged behind prior generations in entering the life stages of early adulthood. Instead of establishing independence, buying homes and starting families, approximately 40 percent are living with parents or other relatives into their late 20s and sometimes beyond[6]—the highest level since the years between the Great Depression and World War II.

Are Millennials Buying Life Insurance?

The simple, yet surprising, answer here is: yes—and according to LIMRA, they are buying it at higher rates than expected. LIMRA's 2016 life insurance ownership study,[7] which encompasses data from 1960 to 2016, found 70 percent of millennial households owned some form of life insurance—the largest percentage of any age group. In addition, LIMRA's Facts About Life 2018 report found more adults under 45 owned life insurance in 2016 than in 2010, while ownership by those over age 45 dropped during the same time period.

Interestingly, millennials, unlike prior generations, are more likely to have a financial plan,[8] and they actually want to buy life insurance. Their financial stability has been hard-won, and they are eager to protect what they have built. However, they are also the age group least likely to have been approached to buy life insurance in the past 12 months, according to LIMRA. And yet, despite the millennials' purported preference for online research and purchasing, 74 percent would still prefer to talk to a financial adviser, either on the phone or in person, when it comes time to buy life coverage. Older millennials especially are more likely to look to professional financial advice. Even if they begin the process online, millennials are most likely to end it with a financial professional.

Although they are buying life insurance, the amount they buy and own, whether on an individual or group basis, is insufficient and declining, leaving them today's most underinsured generation. The 2018 New York Life Insurance Company life insurance gap[9] survey found the life insurance coverage gap for U.S. millennials, at 78 percent, is far higher than that of Generation X and baby boomers (see Figure 1). Currently, only 10 percent have enough life coverage for all of their needs, which can include mortgages, retirement or a child's college education. The rest view their financial challenges, such as high student loan debt, saving for a home

Figure 1 Generational Life Insurance Coverage Gaps

	Median Life Insurance Cover in Place	Amount Needed to Cover Self-reported Needs	Coverage Gap	Percentage Shortfall
Millennials	$100,000	$452,000	$352,000	78%
Generation X	$272,000	$525,000	$253,000	48%
Baby boomers	$190,000	$300,000	$110,000	37%

Source: The 2018 New York Life Insurance Company Life Insurance Gap Survey

and high mortgage payments, as reasons to believe they cannot not afford sufficient life insurance.

What is causing this level of underinsurance? According to LIMRA's Facts About Life 2018 report,[10] millennials are less likely than other age groups to know how much they need, let alone what type to buy, and are likely to assume the cost is far more—by a factor of five—than the actual cost.[11] Figure 2 provides a more robust list of reasons why millennials don't buy life insurance.

Looking Toward the Future

Clearly, millennials see the value of life insurance, and unlike prior generations, see substantial value in obtaining long-term care insurance. This is most likely driven by the fact that many not only saw their parents become members of the "Sandwich Generation," caring for elderly family members while still raising children, but are now entering this generation themselves.

Figure 2 Why Millennials Don't Buy Life Insurance

	Total	Millennials	Generation X	Baby Boomers
Required cost of living expenses	63%	62%	69%	58%
Additional living expenses (internet, cable, phones, etc.)	50%	53%	55%	42%
Building savings account(s) or emergency fund(s)	37%	44%	37%	30%
Managing accumulated debt (credit cards, other loans, etc.)	42%	39%	50%	37%
Saving for retirement	32%	30%	35%	31%
Health expenses	29%	30%	25%	32%
Day-to-day recreational activities (eating out, movies, etc.)	21%	27%	25%	8%
Saving or paying for a new car, boat or second home	23%	32%	22%	12%
Saving or paying for college or student loans	19%	28%	20%	7%
Vacation(s)	14%	20%	14%	6%

Source: LIMRA's and Life Happens' Insurance Barometer Study

Millennial applicants are likely to flee to companies that can provide the near-instantaneous response they've come to anticipate and expect.

Marketing insurance successfully to the millennial generation is evolving into a proposition quite different from reaching past generations. The well-recognized preference for gathering information via user-generated content sets millennials substantially apart. According to the digital marketing company Bazaarvoice, millennials are much more likely to be interested in products or services recommended via social media, even if the content is by strangers. This is diametrically opposed to baby boomers, who are more likely to look to friends and family for recommendations.[12]

Insurers must also be ready to serve the business they attract, in tech-savvy ways that will suit these customers. Frankly, a snazzy mobile app, while attractive, is not going to be enough. If that app is backed by a clunky legacy system that forces the questioner to wait 24 to 48 hours for a response or, even worse, an agent call, millennial applicants are likely to flee to companies that can provide the near-instantaneous response they've come to anticipate and expect.[13]

This is going to require, at the very least, insurers to speed up their end-to-end digitization efforts. Although companies have been working for years to move application processes away from paper, it has not been fast enough. The need to balance the human and the digital aspects of the process will be essential throughout this change. Although millennials are the most tech-savvy adult generation today, there are still nondigital needs, such as access to humans when they have questions, which companies would do well to satisfy.

The characteristics of the millennial generation, much more so than other generations, are not static. The timeline of development of this market likely will reflect that of past generations, where interest in and desire for life insurance protection will grow as they age. As millennials age and their needs evolve, their life insurance needs will undergo substantial change. Life insurers would do well to keep their attention on millennials, so that they can continuously align their product and service offerings. ■

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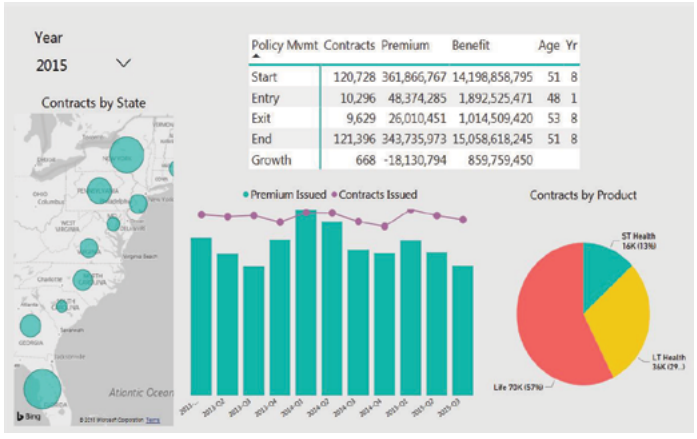

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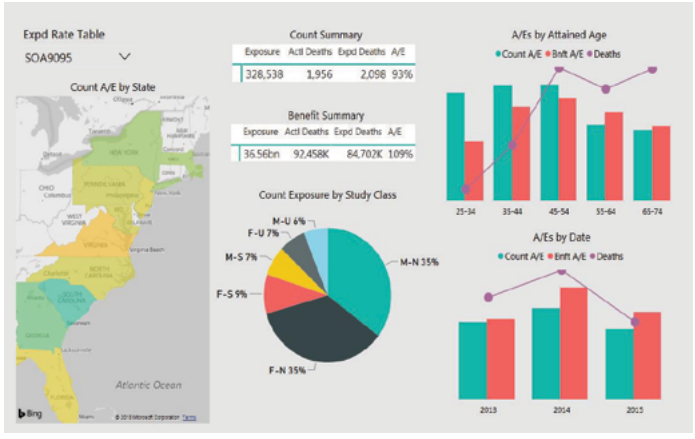

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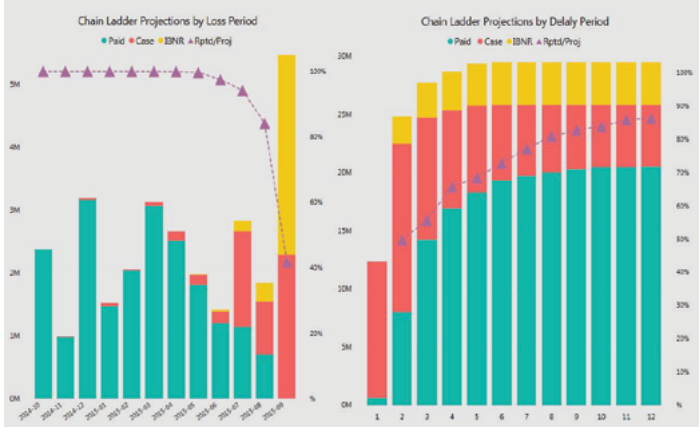

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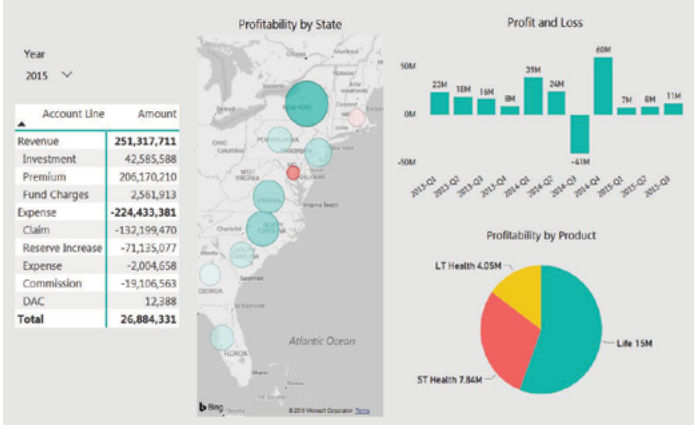
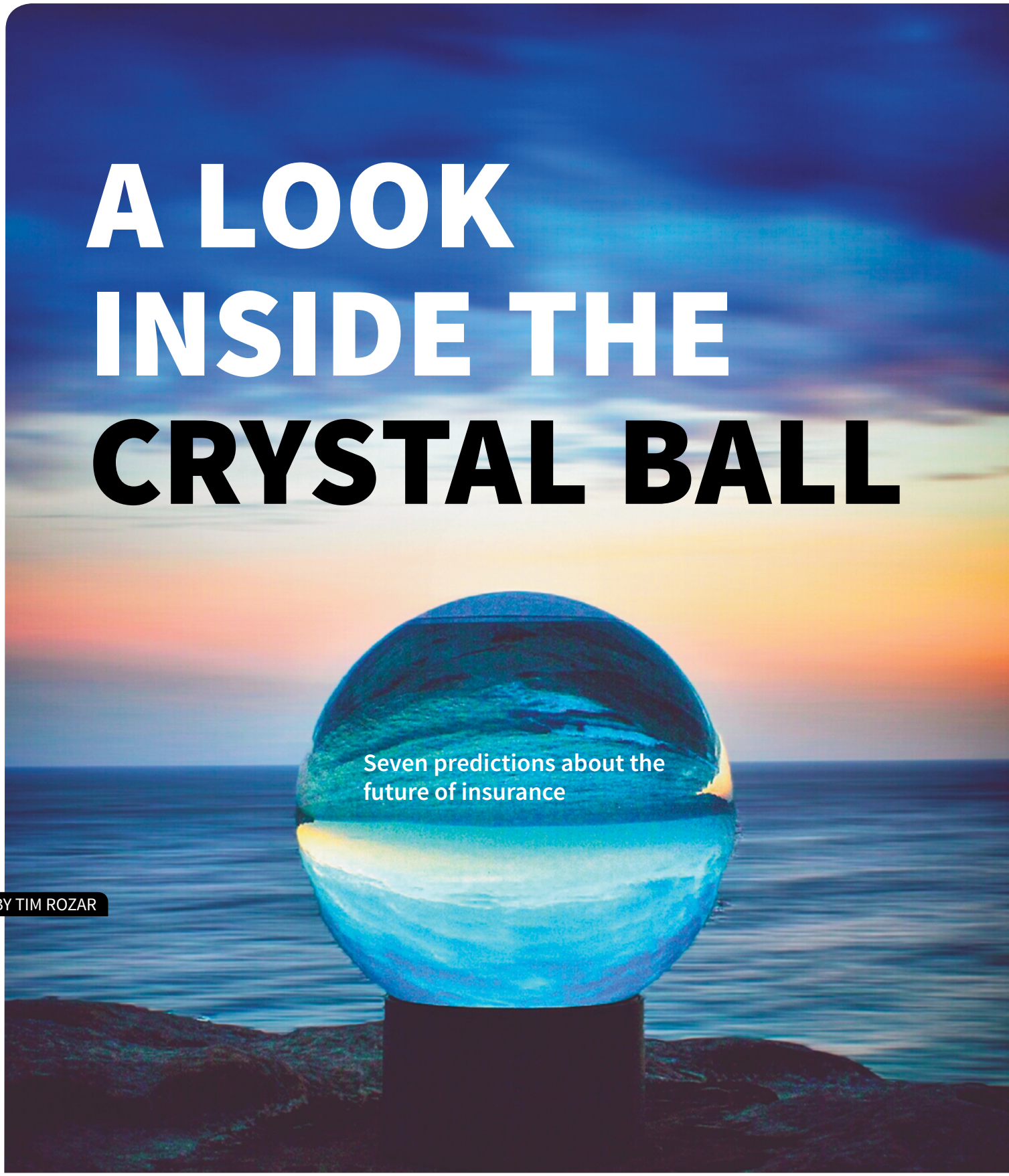


A LOOK INSIDE THE CRYSTAL BALL



Seven predictions about the future of insurance

BY TIM ROZAR

Once a hallmark of staid uniformity, the insurance industry now finds itself at the precipice of transformation. Enablers including technology, data and new sources of capital are helping nudge the industry forward, while derailers including fraud, cybercrime and legacy systems are pushing back against the speed of change. The unknowable direction and magnitude of forces such as medical science, regulation, public policy and the macroeconomy are amplifying uncertainty, further obscuring the future.

In the face of all this uncertainty, I foolishly agreed to make some predictions about what the future of the industry might look like. These predictions consider possible scenarios in which these enabling, derailing and unknowable forces interact, and the responses the industry might develop in those scenarios. Ultimately, history will almost certainly prove my prognostic capabilities to be sorely lacking, but the good thing about the future is that it is in the future. So, I will take this opportunity to stretch my imagination, throw some darts against the wall and name-drop enough buzzwords to make even the most shameless business consultant blush.

Prediction #1: The Robots Are Coming

You can call it artificial intelligence (AI). You can call it machine learning (ML). You can call it cognitive computing. You can call it robotic process automation (RPA). You can even call it Maurice (although that would be weird). The simple fact is we are in the age of the robots, and I, for one, welcome our new robot overlords. The way in which work gets done in the industry is on the verge of upheaval. I predict much of the front-, middle- and back-office work of today will become automated or move to a technology-enabled self-service model. This doesn't mean all sales agents, underwriters, actuaries, customer service representatives and claims specialists are headed for the unemployment line—but they should prepare to adapt.

When electronic spreadsheets were introduced, I'm sure more than a few actuaries worried the end was nigh for the profession. After all, a spreadsheet could do the calculations actuaries were doing all at once (just press F9 and voilà!). But the actuarial profession quickly evolved, and rather than being made irrelevant by spreadsheets, actuaries became the masters of the spreadsheet. In fact, spreadsheets became an indispensable tool that in turn made actuaries even more indispensable. Actuaries moved beyond triple-checking each of their individual commutation table calculations to higher-value activities like developing new products, advancing stochastic risk modeling capabilities and even (occasionally) talking to other humans.

Given the exponential growth in processing speeds and performance, it may not seem fair to compare the spreadsheets of the 1970s with the advanced platforms of today. Current technology is moving even faster, and the derailers of cybercrime and legacy systems may make it even more difficult for established companies and traditional professions to compete in the post-robot world. But no matter how "intelligent" the technology of the future gets—and no matter what the latest post-apocalyptic Hollywood movies make you believe—at the end of the day, our relationship with technology is symbiotic. While the robots automate the tasks that can be automated, humans can focus on more stimulating higher-order functions like creativity, critical thinking, communication and compassion.

Prediction #2: Bundle Up

In many markets around the world, bundled products have been a growing trend for many years. The United States has seen a rise in the popularity of products that include various combinations of life, disability, critical illness and long-term care coverage.[1] I predict the future will see this trend become super-charged. Products will be designed to meet all of a consumer's protection needs including mortality, longevity, morbidity, property and

liability, while also supporting their holistic needs like physical, mental and emotional wellness. These future products will flex and evolve their benefits and coverage features along with the consumer's life stage and needs. They will be priced more dynamically to recognize, incentivize and reward beneficial behaviors that leverage advances in quantified self-monitoring technologies.[2] Despite well-founded concerns around derailers such as fraud, moral hazard and adverse selection, insurers will continue to experiment with "on-demand" products that provide limited-time coverage for specific events such as driving, skiing or foreign travel. In short, the protection product of the future will protect what I want, when I want, how I want.

Demographic changes will drive much of the demand for these many-in-one product innovations. Millennial and post-millennial workers have a very different view of ownership and employment than prior generations. This creates different needs. For example, it may be more desirable to get protection as an Uber rider than as an automobile owner. Similarly, a loosening of the historically paternalistic relationship between an employer and its employees will lead to an increasing need for financial protection for contract workers and the self-employed.

Societies also are rapidly aging. Some say there will soon be more grandparents than grandchildren[3] in the world, and that Japan sells more adult diapers than diapers for babies.[4] As global population pyramids invert,

we will see an unprecedented strain on the protection needs and dependency burdens of society. It will be up to the insurance company of the future to provide financial savings and protection across multiple generations while delivering price/benefit transparency.

Prediction #3: Reinsurance Reinvigorated

Apart from a brief, largely unheralded stint as a checker at Shop-N-Save, most of my career has been spent in the reinsurance industry. As such, it would be fair for you to call this prediction a bit of wishful thinking, but I think both the global demand for and supply of reinsurance (or similar risk transfer vehicles) will increase significantly in the coming years.

On the supply side, although there is still considerable concentration in the global reinsurance marketplace, smaller regional and local reinsurers have expanded their footprints. Capital in support of large in-force transactions also has grown as myriad new entrants—including investment banks, private equity firms, asset managers and other nonrated entities—have entered the market. There have even been a few venture capital-backed ReinsurTech startups exploring the market in different ways.[5]

On the demand side, direct carriers increasingly are looking for expertise and reinsurance support for new distribution, product and risk selection innovations including accelerated underwriting programs in North America. As reinsurance companies continue to build out capabilities and service offerings even more broadly across the value chain, they will in turn drive more demand for reinsurance as their remuneration of choice. And as fear and uncertainty around medical trends, cyber-risks, the credit cycle, extreme weather events and other natural disasters grow,[6] companies likely will become increasingly willing to unload this risk to reinsurers or other third-party providers of capital.

Prediction #4: Everyone Becomes a Content Company

In 1895, John Deere, the green and yellow plow company, started publishing *The Furrow*, a magazine that catered to farmers looking to learn about the newest agricultural tips and tricks while also being entertained with stories, photographs and interviews about rural life. Almost 125 years later, *The Furrow* is still going strong, delivering quality content its readers have come to expect while also leveraging the best of modern web design at *johndeerefurrow.com*. *The Furrow*'s art director (yes, John Deere employs an art director), described the approach behind the magazine's success: "Even the most technical subject has to have a human story behind it. We've always been able to convince management that the content shouldn't be about John Deere equipment. We've stuck to that over time."[7] I predict the successful insurers of the future will have a similarly unfailing commitment to delivering engaging, informative and entertaining content for their respective target markets.

It is said that insurance is sold, not bought. The reason is simple: because insurance is not. Back in ye olden days of the mid-2010s and prior, a kitchen-table insurance sale relied on the credibility, knowledge and trustworthiness of the insurance salesperson. As the industry is dragged kicking and screaming into the internet age, the trusted adviser will need to be replicated by trusted advice that delivers a similar level of credibility, knowledge and trustworthiness. That advice will be provided using modern content strategies including blogs, video, infographics, testimonials and social media. The content should educate consumers on how insurance products work to solve their particular protection needs, while also entertaining them and engaging them with things other than insurance in a way that seems authentic and builds trust. For smaller or newer companies (and for established companies looking to remain relevant), digital content is exciting because it is nearly infinitely scalable. An InsurTech CEO whose company had focused its early days exclusively on developing excellent content told me that "content is the great equalizer" because it "makes small companies look big."

Before wrapping up this prediction, let me be clear about one thing: I am *not* predicting the demise of the traditional insurance agent. I believe there are plenty of situations where the complexity of the financial need or the comfort level of the applicant will necessitate the expertise of a trusted human adviser. And even a traditional adviser-facilitated sale can be improved with a well-executed content strategy. However, I predict online channels will come to serve a wide swath of sales for life, health and general insurance, and excellence at online content will be paramount in facilitating these sales.

Prediction #5: The Blood Strikes Back (or the Deceleration of Acceleration)

The U.S. life insurance industry has been obsessed recently with the acceleration of the risk-selection process. New data sources are being utilized and new algorithms are being adopted to replace traditional underwriting rules engines. Most important, we have seen a dramatic increase in the face amount at which fluid testing is required to reduce the time, cost and

(literal) pain historically involved in getting a policy issued. This strategy seems to be a win-win-win for customers, agents and insurance companies—*if* we assume that mortality expectations and pricing levels can be held in check. However, we know what happens when we assume. As much rigor and science is being brought to bear in developing these programs, the inconvenient truth is blood testing still has very high protective value, and when given the choice if there is a difference in price, many consumers would rather give blood than money. This is why I predict the industry will take a step or two back toward a full underwriting paradigm.

The primary derailer in this equation is adverse selection. Individual life insurance is an asymmetric market where the buyers know much more about their risk profiles than the insurance company does.[8] And this trend is only getting worse as privacy regulations become stricter and as the accessibility, sensitivity and specificity of personalized medical and genetic information gets better. I expect many of you to be skeptical and say that young customers of the future simply won't accept a traditional underwriting process, and you may be right. But as long as lower-cost blood-tested products are offered in the same competitive marketplace, the margins on accelerated programs will be squeezed, or worse.

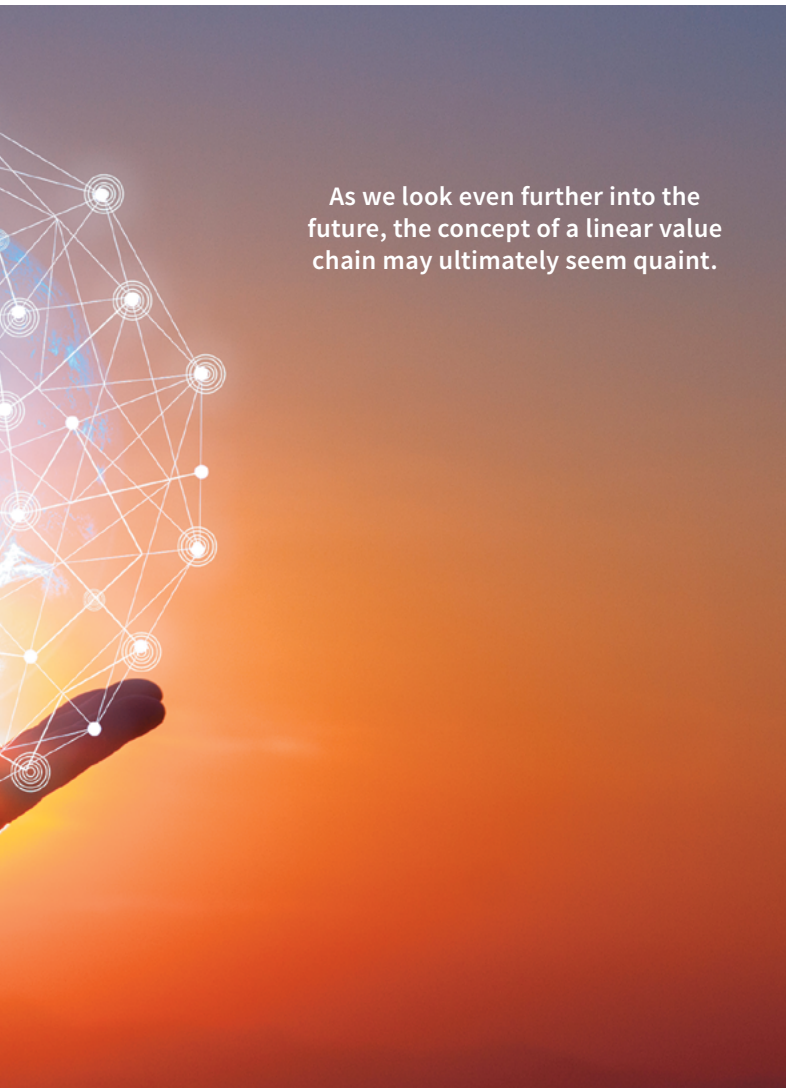
Prediction #6: Wide Beats Deep (and Then Goes Deep)

From its origins in the English-friendly societies of the 1600s to the large U.S. mutual insurance companies of the 20th century, insurance has been, generally, a vertically integrated industry. An insurance company's actuaries developed the products, its career agency force sold the policies, its underwriters assessed an applicant's risk, its home office staff handled post-issue customer service and its claims representatives analyzed and paid claims. Nearly every supporting function of that value chain was tightly integrated. In-house traders and asset managers managed investments. Medical exams, including x-rays, could be completed at home office medical facilities by home office doctors and nurses. In some cases, urine samples could be analyzed at insurance companies' home office laboratories (these samples are referred to as "home office samples" to this day because the word "urine" is, frankly, kind of icky). I have even heard a possibly apocryphal tale of a large Northeastern mutual company whose in-house carpenters once made all the furniture for the home office headquarters at the in-house woodshop. (Even if that one isn't true, it is far too good of an example not to include.)

Those days of vertical integration are behind us, supplanted by an extended era of specialization targeted at

squeezing out redundancy and cost inefficiencies across the value chain and bringing in specialized domain expertise that individual companies can't afford to build on their own. Actuarial consulting firms stepped in to assist with product pricing, reserving, risk management and other technical actuarial functions. Independent agents began to supplement career distribution. Third-party administrators and underwriters took over responsibility for policy administration and underwriting. Third-party laboratories took over analyzing fluid samples.

Much of this breaking apart of the traditional value chain is here to stay. I don't think it will ever again prove to be economical for individual companies to go back to analyzing fluids or building their own furniture, for example. But I predict we will see an increasing amount of re-verticalization in the future. In the past, efficiency



gains and access to expert knowledge could be achieved by offloading functions to third-party specialists, but efficiencies and expertise in the future may be acquired by re-insourcing those functions while leveraging enabling technologies like AI, ML, RPA and perhaps even Maurice. Similarly, as companies seek to provide an increasingly digital customer journey, they will need to have control over middle-office and back-office functions to capture data and change processes to optimize the end-to-end customer experience.

As we look even further into the future, the concept of a linear value chain may ultimately seem quaint. The companies or partnerships that emerge as winners on the back of this wave of verticalization will find themselves in an incredibly strong position with large customer bases, huge amounts of data, world-class technology capabilities and proprietary insights into biometric risk and consumer behavior. The endgame, it seems, will be controlled by a small cadre of giant companies that will control both the width and depth of the industry value chain.

Prediction 7: It's (Still) the Customer, Stupid

Political consultant James Carville famously simplified the 1992 campaign strategy of the then-unheralded Arkansas Governor Bill Clinton to a few short slogans that were intended to focus the message of the campaign squarely on the needs of the voter. One of these slogans was: "It's the economy, stupid." Similarly, the companies that are successful in whatever form the insurance industry takes in the future will need to continue having a laser-focus on the needs of the consumer. No matter how much "wiz-bang" technology permeates our lives, the need for financial protection against uncertainty will persist. And regardless of how risk is mitigated, assumed or shared, insurance at its core always will be a product and an industry founded on trust. And trust is the greatest enabler of all. ■

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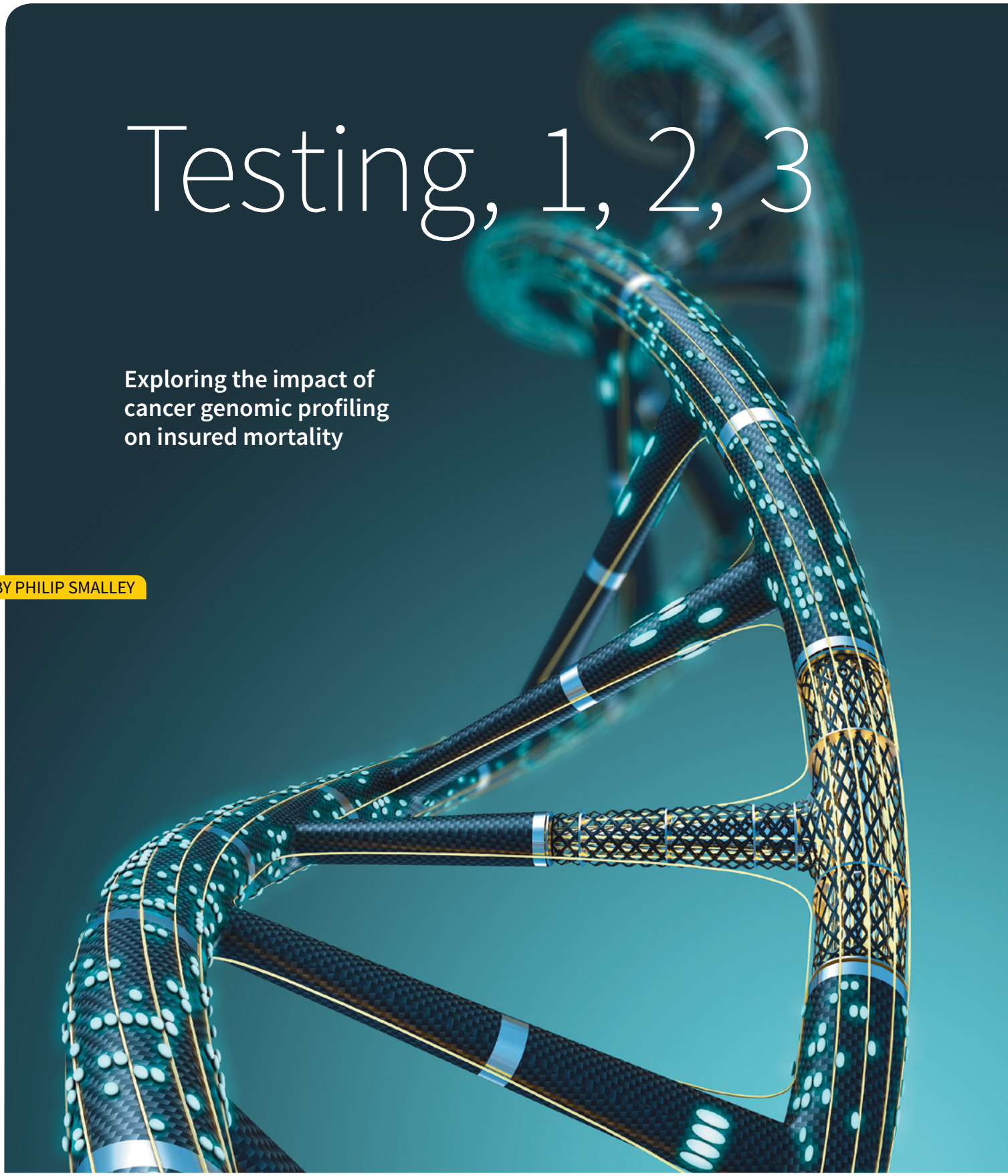
Testing, 1, 2, 3

Exploring the impact of cancer genomic profiling on insured mortality

BY PHILIP SMALLEY



We are in the midst of a genetic revolution. Advances in genomics have implications on pricing, underwriting, claims adjudication and product development. Offering comprehensive cancer genomic profiling to the insured post-policy issuance is a low-risk and affordable add-on feature that could benefit both the client and the insurance company's profitability.

All insurers need a genomics strategy to guide them through these changing times. To date, most insurers have been more concerned about the potential negatives associated with genetic testing and adverse selection instead of looking at the positives that could be gained for both the public and for insurance companies. This article will discuss the benefits of analyzing the genetics of tumor cells, as this testing can help oncologists treat cancer patients using principles of precision oncology and can improve cancer outcomes. This should help to lower insured mortality and enhance client engagement.

Using the numbers discussed in this article, actuaries can calculate a possible return on investment (ROI) associated with insurance companies offering cancer genomic profiling to their insured clients.

What is Comprehensive Cancer Genomic Profiling?

Cancer is a genetic disease caused by mutations and other genomic alterations. Most mutations develop throughout life from exposures to carcinogens such as smoking, ultraviolet (sun) radiation, chemicals and viral infections. Inherited genetic mutations acquired at birth are responsible for 5 percent to 20 percent of all cancers.

Cancer genomic profiling analyzes a patient's cancer, looking for various types of genetic alterations that are driving malignant transformation and tumor growth. Studies have shown that 37 percent to 49 percent of cancers have actionable genetic alterations where there already exists a targeted therapy to treat cancers that harbor these specific genetic mutations.[1,2]

Oncologists already use single-gene "companion diagnostic" genetic testing of cancer tissue, as these tests are linked to the use of U.S. Food & Drug Administration (FDA)-approved targeted therapies and immunotherapies used to treat specific types of cancer. Finding the same genetic mutation in a different type of cancer might allow the oncologist to get the patient into a clinical trial or use a targeted off-label medication to treat the patient.

Inherited genetic mutations acquired at birth are responsible for 5 percent to 20 percent of all cancers.

Broader and more comprehensive cancer genomic profiling using next-generation sequencing interrogating 300+ cancer-related genes and gene byproducts is starting to be accepted in clinical practice. A recent study reported that 84 percent of cancer patients were found to have clinically relevant genomic alterations detected by comprehensive cancer genomic profiling that conventional testing did not identify.[3]

Currently, most commercial health insurers don't cover comprehensive cancer genetic profiling, which can cost more than $5,800. One study of lung cancer patients showed 41 percent of patients did not follow the recommended clinical guidelines for genetic testing. The study mentions uncertainty regarding cost reimbursement as one of the barriers to ordering these tests.[4] This is where

genomic-based insurance products can play an important role at the time of cancer diagnosis to ensure access and coverage for these tests.

Advances in Genetics Are Lowering Cancer Mortality

Tremendous strides are being made in treating cancer. In the United States, cancer death rates have fallen 1.4 percent to 1.8 percent per year from 2006 to 2015.[5] Cancer five-year survival also has improved. These favorable trends stem from improved cancer prevention and screening, as well as better treatments.

The number of targeted drugs and immunotherapies approved by the FDA for treating cancer is increasing, and each year a new cohort of clinical trials advancing these treatments is added to the queue.

Today, roughly 15 percent of patients with late-stage metastatic cancer undergo comprehensive cancer genomic profiling. Typically, this testing is done after current standard-of-care therapies have failed to stem the spread of cancer.

From the patient's perspective, the prospect of a longer, healthier life is a clear positive. For the life insurer, this provides positive customer engagement and the chance to be viewed as part of a valuable solution for its customer. Life insurers also stand to benefit financially from increased use of this testing through the increased survival of the insureds affected.

Currently, there are no studies in the insured population to directly determine the mortality impact of offering cancer genomic profiling to a block of insured lives compared to the status quo. We have attempted to model these calculations using medical studies to derive key assumptions.

Three critical questions need to be answered in order to quantify the potential ROI for a life insurer that offers cancer genomic profiling to its clients:

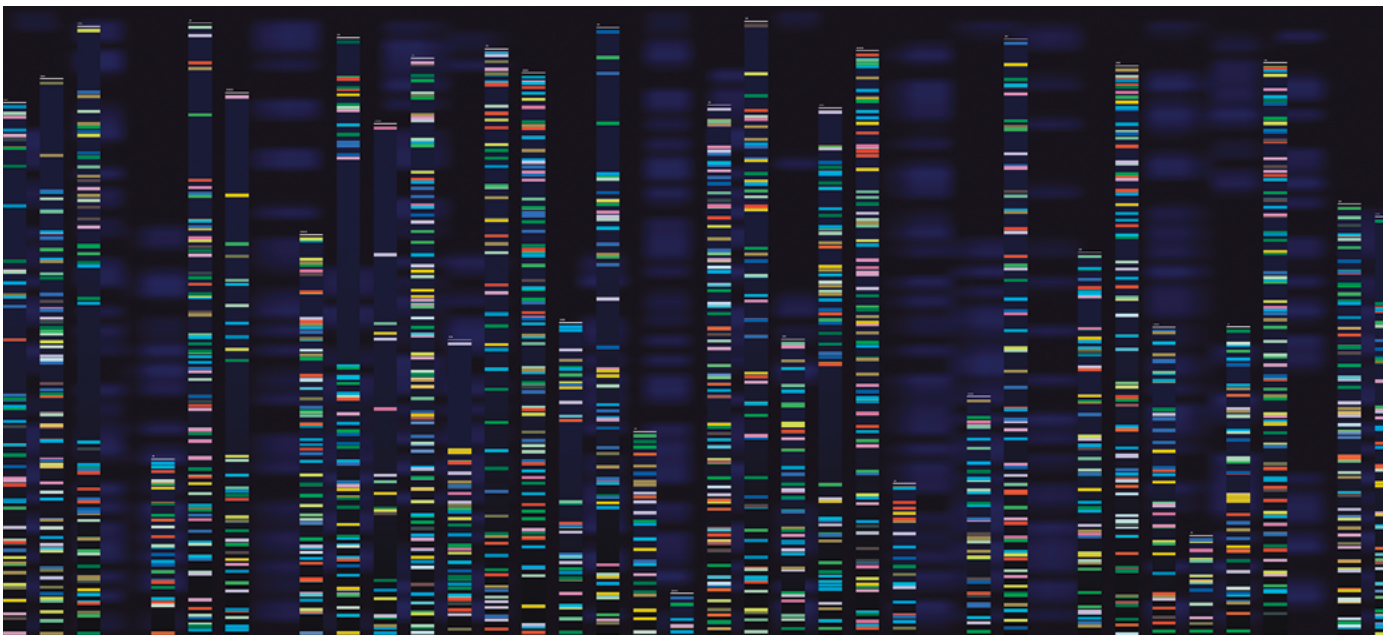
1. Which cancer patients could experience a survival benefit from getting comprehensive cancer genomic profiling?
2. What percentage of advanced cancers receive genomically matched therapies?
3. What is the survival benefit associated with the use of genomically matched cancer treatments?

It is important to recognize that, while we are attempting to answer these questions for the current point in time, it is likely that the numbers and percentages that answer these questions will increase over time. This will clearly support an appropriate "test and then expand" approach to the issue for life insurers/reinsurers.

Figure 1 Potential Benefits and Barriers to the Use of Comprehensive Cancer Genomic Profiling

Benefits	Barriers
Help oncologists to guide treatment upon cancer diagnosis	Availability and out-of-pocket costs/insurance coverage issues for some of these expensive targeted therapies and immunotherapies
Improve cancer outcomes/lower mortality	Cost and reimbursement for genomic testing
Improve diagnosis accuracy	Availability of decision support tools and molecular tumor boards to help oncologists
Avoid unnecessary toxic chemotherapy	Availability of genomic testing
Better predict cancer outcomes	Availability of patient education and support programs
Get more patients into clinical trials	Challenges getting into clinical trials to access some of these new cancer medications
Possibly reduce cancer in family members	Public concerns about privacy and genetic discrimination/ insurability

> ***30 percent** of all cancers reach advanced stage, and patients could possibly experience a survival benefit from getting comprehensive cancer genomic profiling performed.*



Benefits of Comprehensive Cancer Genomic Profiling

Most cancer patients can benefit in some way from getting their cancer genetically profiled as shown in Figure 1. Not only could profiling help guide treatment, but it also could lead to improved outcomes, benefitting both public health overall as well as the mortality in an insurance block of business.

Which Cancer Patients Get the Most Survival Benefit?

The cancer patients who would benefit most from comprehensive cancer genomic profiling are those who have either been found to have advanced stage cancer at the time of diagnosis or who have progressed from earlier stages of cancer to distant metastatic spread cancer.

We know that currently, the five-year relative survival rate for all cancers is 65 percent.[6] We can assume almost all of the 35 percent of patients who die from their cancer will have distant spread metastatic disease.

Derived a different way, we know about 25 percent of all cancers are diagnosed when the cancer already has spread to distant sites.[7] We then need to add for those patients who were unstaged who have distant spread cancer and also add for those patients who progress from earlier stages of cancer to metastatic disease.

We can surmise from these statistics that about 30 percent of cancers are advanced stage, and patients could possibly experience a survival benefit from getting comprehensive cancer genomic profiling performed.

What Percentage of Advanced Cancers Get Treated With Genomically Matched Therapies?

Not every patient with an actionable mutation will get on a targeted therapy because of various adverse factors such as becoming too sick to get any form of therapy.

Studies show 15 percent to 36 percent of advanced-stage cancer patients who get cancer genomic profiling receive targeted cancer therapies matched to the genetics of their cancer, and this percentage is increasing over time.[8,9]

We also need to take into account that comprehensive cancer genomic profiling can lead to treatment with immunotherapies, because one of the FDA indications to treat advanced solid tumors with immunotherapy relates to a particular genomic abnormality called mismatch repair deficiency, or tumors with high microsatellite instability.

In summary, it seems reasonable to assume that about 25 percent of advanced cancer patients who get genetically tested are expected to receive some form of matched cancer treatment as determined by their cancer's genomic profile.

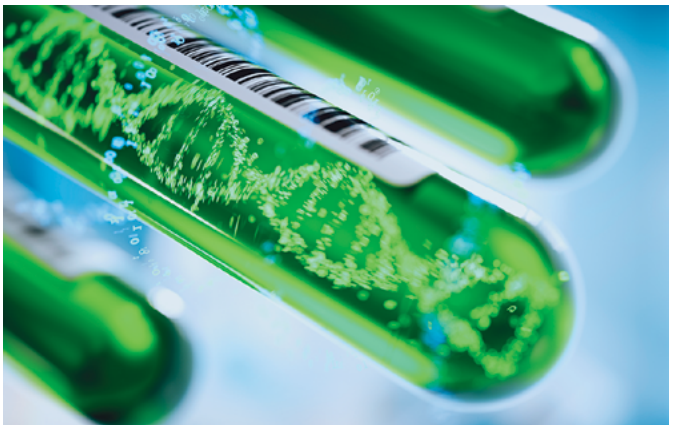
What is the Survival Benefit Associated With the Use of Genomically Matched Cancer Treatments?

Many studies have shown that the use of genomically guided matched therapies improves patient outcomes.[10–19] Using the medical literature to model an expected improvement in cancer mortality is challenging, because many of the medical studies have looked at different end points and use different types of cancer in their analysis. Figure 2 lists studies that report on median overall survival in advanced cancer patients who get treated with genomically matched therapies.

Figure 2 Survival Benefit Using Genetically Guided Therapies

Study Description	Outcome
Meta-analysis of 570 Phase II studies with 32,149 cancer patients[14]	Personalized treatment approach had higher overall survival (13.7 months vs. 8.9 months; p<0.001) **= +4.8 months**
814 patients with advanced stage IIIB and IV non-small-cell lung cancer [4]	Median overall survival 31.8 months in patients who received targeted therapy vs. 12.7 months nontargeted cytotoxic chemotherapy Hazard Ratio for death 0.47 (95% CI 0.36 to 0.63, p<0.0001) **= +19.1 months**
1,542 patients with advanced or metastatic cancer[15]	Median overall survival 11.4 months for the patients treated with matched therapy vs. 8.6 months for patients treated without matching (p=0.04) **= +2.8 months**
1,180 advanced solid tumors[13]	Median overall survival 1,068 days from time of profiling in patients treated with matched therapies vs. 646 days in unmatched cohort (Hazard Ratio=0.68, p=0.0001) **= +13.9 months**
500 patients with diverse refractory cancers[8]	Patients on matched vs. unmatched therapy had longer mean overall survival (8.2 months vs. 5.9 months, p=0.002) **= +2.4 months**
3,743 patients with refractory cancers[16]	Median overall survival was 9.3 months in the matched group relative to 7.3 months in nonmatched patients. (p<0.05) 10.4% of the patients receiving matched therapy had overall survival times of at least three years vs. 4% in the nonmatched treatment group **= +2.0 months**
224 patients with advanced stage IIIC or IV ovarian cancer[17]	Matched cohort had a median overall survival of 36 months compared to 27 months for patients in the unmatched cohort (Hazard Ratio 0.62, 95% CI 0.41–0.96; p<0.03) **= +9.0 months**

> ***25 percent** of advanced cancer patients are expected to receive matched cancer treatment as determined by their cancer's genomic profile.*



These studies show that advanced cancer patients who receive matched therapies live on average two to 19 months longer compared with patients who are treated with unmatched therapies. The University of Texas MD Anderson Cancer Center's Initiative for Molecular Profiling in Advanced Cancer Therapy (IMPACT) study analyzed 3,743 patients with refractory cancers and found that treatment with matched targeted therapy more than doubled the chance of living more than three years. (Results showed a 10.4 percent three-year survival rate in the matched therapy cohort vs. a 4 percent three-year survival rate in the nonmatched therapy cohort, $p<0.0001$).[20]

As comprehensive cancer genomic profiling also leads to an increase in the use of immunotherapies, we need to add for the survival benefit of immunotherapy at least to some degree.

Combining mortality benefits associated with the use of all forms of genomically guided targeted therapies and immunotherapies, we can expect to see approximately a 10 month increase in median overall survival in advanced cancer patients who get treated with genomically matched therapies.

Potential Challenges to Consider With Cancer Genomic Profiling

Barriers to the adoption of cancer genetic testing in the community setting are listed in Figure 1 on page 32.

Even though most physicians are very positive about the role cancer genomic profiling and precision medicine will play in oncology in the near future, some oncologists still debate the current clinical utility of comprehensive cancer genomic profiling, arguing that further research is needed and not all trials have shown statistically significant improved outcomes.[21,22]

Out-of-pocket cost and insurance coverage issues are also concerns. Comprehensive cancer genomic profiling leads to increased use of targeted therapies and immunotherapies that are expensive, costing upward of $12,500 per month. Some of these costs might not be covered by health insurers when these medications are used "off-label." Fortunately, programs exist to help financially stressed patients who need these medications. In addition, new insurance product features such as accelerating part of the life sum assured could be designed to help pay for some of the treatment costs. Modeling research has shown this type of life insurance serious illness benefit rider might be cost effective to the insurer by capitalizing on the improved cancer survival.[23]

Potential technical challenges associated with the use of cancer genomic profiling also include:

- Inadequate cancer tissue sample for genetic analysis
- Ongoing genetic mutations in cancers
- Tumor heterogeneity within a cancer

Treating cancer patients earlier with genomically matched therapies and permitting repeat genetic testing remedies some of these challenges. In addition, the use of "liquid biopsies" is gaining significant research interest, as this type of blood testing might allow oncologists to follow a patient's cancer genetics without the need for repeated tissue biopsies.

Public education is also important to avoid over-promoting the impact of cancer genomic profiling that could lead to overly optimistic public expectations in these advanced stage cancer patients.

Impact of Cancer Genomic Profiling on Health Care Costs

As comprehensive cancer genomic profiling is fairly new, the net impact on health care costs is unclear. This uncertainty is demonstrated in a 2018 Cardinal Health

survey of 160 oncologists. Fifty-eight percent of those surveyed feel genomic tests will lead to health care cost savings in some cases. On a net basis, 69 percent of these oncologists believe genomic tests will increase oncology health care costs, but 31 percent feel genomic testing will either decrease or have no impact on health care costs.[24]

The cost of genetic testing leading to the use of expensive targeted therapies is mitigated at least in part by the cost savings attributed to being able to withhold conventional chemotherapy and possibly decrease hospitalization costs because some targeted therapies can be given orally at home. Some targeted therapies have fewer side effects than conventional chemotherapy, which could also lower health care spend. In addition, comprehensive cancer genomic profiling gets more patients into clinical trials. A recent study has shown that enrolling cancer patients into clinical trials could save the health insurer $25,000 per patient as drug costs are diverted to the study sponsor.[25]

Two small preliminary studies have shown that health care costs are about double in those patients who receive genetic testing guided targeted therapies, mostly due to longer treatment durations secondary to improved patient survival.[26,27]

Conclusion

By providing insured clients who develop cancer access to comprehensive cancer genomic profiling, the insurer stands to benefit directly from improved outcomes from a customer engagement, financial and public relations perspective. Those benefits are likely to increase as more genetically targeted treatments for cancer are developed and approved by the FDA.

Even applying a conservative set of assumptions for all of the topics discussed in this article, it appears that for policies and risks of a certain minimum size, a robust positive financial return can be achieved. A test case attempt focused on a block of policies of sufficient size can also serve to refine the assumptions and pinpoint how far down into an in-force block it makes sense to make these services available to insureds. ■

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Ready to Make a Move

A brief history of the U.S. health care system and a look at its future trajectory

BY JOHN DAWSON

Proponents of a centralized national health care system compare U.S. health care spending to other countries to support their view. Indeed, health care in the United States costs twice the average of other wealthy countries.[1] However, the realities of U.S. health care are complicated and systemic. Moving to a single payer system is unlikely to achieve cost parity with other countries without first addressing the underlying forces that drove us to our present state.

This article offers highlights along the journey to our present-day health care system and concludes with a hopeful view of the road ahead.

A Brief History

The United Kingdom has a national health care system that began with the National Insurance Act of 1911, which introduced compulsory health insurance and physician capitation. At about that same time, Theodore Roosevelt and his supporters also campaigned for state-run compulsory health insurance in the United States.

However, the idea was met with strong opposition in the United States. Health care practitioners worried compulsory insurance would erode their incomes and independence.[2] The American Medical Association (AMA) labeled the idea *socialized medicine*, and socialism was viewed by many at that time as anti-American.

The idea of a state-run health care system surfaced again in 1933, as part of the New Deal legislation. But publicly funded health care was dropped from the New Deal because of the AMA's continued strong opposition.[3] This opposition was largely responsible for pushing the United States toward private health insurance.

Enter Private Health Insurance

Three private sector initiatives laid the foundation for what would become a thriving health insurance industry. Hospitals and physician groups began selling insurance programs to cover hospital and physician-related expenses. These programs would later become the first Blue Cross and Blue Shield programs.[4] These were largely health care financing mechanisms with virtually no direct influence on health care decision-making.

Henry J. Kaiser employed a different approach, using health care providers on-site to meet the needs of his construction site, shipyard and steel mill workers. These programs evolved into today's Kaiser Permanente.[5]

Wage and price controls during World War II prevented employers from competing for employees by offering higher wages. Health insurance and benefits became an alternative way to compete for talent. Employers gained tax advantages for providing health care benefits in 1943 and enhanced tax benefits in 1954, further supporting an emerging health insurance marketplace.[6]

Several insurance companies entered this growing space. Over time, health care decision-making authority started to shift from treating physicians to insurance companies as managed care programs emerged and began to evolve. Early managed care components included hospital precertification, utilization review, case management and provider networks [preferred provider organization (PPO) networks].

Impact of Managed Care

For many years, most physicians delivered care out of their private, independent offices, and they had nearly total control over medical decision-making. Most hospitals were passive participants in health care delivery, essentially providing a place for physicians to do their work.[7]

By the 1970s, this was starting to change. Spurred by the passage of the Health Maintenance Organization Act of 1973, a new kind of insurer—health maintenance organizations (HMOs)—began to grow rapidly, covering 29 million people across 662 HMO plans by June 1987.[8] HMO plans generally featured much narrower provider networks and transferred more of the medical decision-making and authority to the insurer.

HMO plans were attractive among healthier people who were not concerned about the narrower HMO networks, because HMOs generally offered rich benefits and lower premiums. As a result, anti-selection became an important factor in financial performance, because HMO plans often attracted the lowest-cost risks, leaving other insurers to cover people with more costly health conditions.

Over time, the distinction between PPO plans and HMO plans became blurry. Some HMO plans started offering benefit plans with deductibles and coinsurance that looked more like PPO plans, and PPO plans adopted many of the managed care features espoused by HMOs. Larger insurers began acquiring smaller insurers and

HMO plans, blurring the distinction even further. These larger insurers were amassing negotiation power over health care providers.

While most hospitals were passive throughout most of the 1900s, there were notable exceptions such as Johns Hopkins, Cleveland Clinic and Mayo Clinic. Organizations like these developed group physician practices long before it was fashionable, and they are responsible for many of the health care innovations we've come to rely on.

As insurers began to consolidate, more hospitals and physician groups combined as well. While providers sometimes consolidated to gain efficiencies, provider desire to negotiate better deals with insurance companies fueled much of the consolidation activity.[9] And with this consolidation, physicians gave up even more individual autonomy.

Major Legislative Actions

From 1965 to today, legislation has played and continues to play a critical role in shaping our health care system. From Johnson to Reagan to Clinton to Obama, significant laws regulating health care coverage and access have been signed during the past 50 years.

Medicare (1965) was established to provide national health insurance for eligible people over age 65, and Medicaid (1965) was created to provide medical insurance for people who qualify by virtue of low income. Subsequent legislation has expanded both programs.[10]

The Consolidated Omnibus Budget Reconciliation Act (COBRA) (1985) has provided employees the ability to continue employer-based health insurance coverage after terminating employment for a period of time.[11] COBRA has been unpopular with employers because it effectively increases employer cost and risk exposure.

The Health Insurance Portability and Accountability Act (HIPAA) (1996) has served two important functions. The first has been to effectively eliminate health insurance waiting periods when a qualified individual changes jobs. Second, HIPAA has provided privacy and security protection relating to health care data generated by health plans and health care providers. While these objectives are important, HIPAA has increased the administrative burden and cost for employers, insurance companies and health care providers.

The Patient Protection and Affordable Care Act (PPACA) (2010) significantly changed the rules employers must follow to provide health insurance to employees.[12] One goal of the PPACA was coverage expansion. The year before major PPACA coverage provisions went into effect, 44.4 million nonelderly persons lacked coverage. Three years later, the number of uninsured people had dropped to 26.7 million, but that number rose to 27.4 million in 2017.[13]

Current Health Insurance Distribution

In the early 1900s, most people were uninsured because health care costs were relatively low and the need for health insurance was only beginning to emerge. Today, some form of insurance covers the vast majority of people in the United States. As shown by Figure 1, employer-based insurance is the most common source, covering more individuals than the entire public insurance sector.[14]

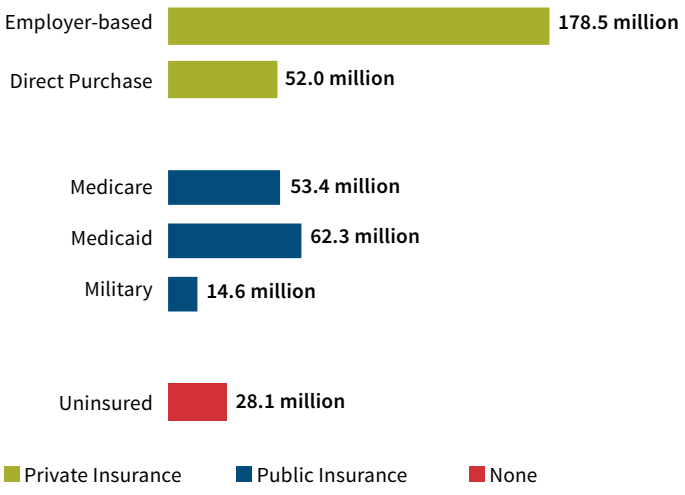
Medical Advancement/Chronic Disease

Much of our health care cost acceleration has been blamed on advancements in medical science, including diagnostics, surgical procedures and other treatments, and pharmaceuticals. These advancements improve quality of life and save lives. And patients want them.

For example, from 2006 to 2015, the mortality rate associated with coronary artery disease decreased 32.4 percent from 186.6 to 126.2 deaths per 100,000 adults. Over that same period, the mortality rate associated with stroke declined 20.5 percent.[15]

Even so, heart disease continues to be the leading cause of death for both men and women. About half of the U.S. population has at least one of the three key risk factors for heart disease: high blood pressure, high LDL

Figure 1 Number of Individuals With Health Insurance Coverage in 2016 by Source*



*Some individuals may be represented in more than one category.

Source: Developed with data from the U.S. Census Bureau (see reference 14)

cholesterol and smoking.[16] According to the Centers for Disease Control and Prevention (CDC), 80 percent of premature heart disease and strokes are preventable.[17] But most cardiovascular medical advances have focused on treatment rather than prevention.

The death rate from all cancers fell by 26 percent between 1991 and 2015. The breast cancer death rate fell by 39 percent from 1989 to 2015, driven primarily by improvements in early detection. The death rate from colorectal cancer fell by 52 percent from 1970 to 2015, driven by increased screening and advances in cancer treatment.[18]

We also enjoy many other medical advances that are too numerous to list. Thanks to these advances, many of yesterday's terminal illnesses are now survivable as chronic disease. But this reduced mortality doesn't always translate into reduced health care cost and improved quality of life. Following a major stroke, many patients face long-term debilitation.

Chronic disease is a huge health care cost driver, and we seem to be losing the battle against it and its related costs, especially those driven by obesity. As of 2015, two-thirds of U.S. adults are either overweight or obese. Several studies demonstrate that being overweight or obese increases the risk of death from cardiovascular disease, diabetes, cancer or accidental death. Certain cancers, surgical complications and mental health issues also are associated with being overweight and obese.[19]

The AMA recognized obesity as a complex chronic disease for the first time in 2013.[20] Prior to that, health care providers were seldom paid for treating obesity—treating it was *not* viewed as the responsibility of the health care delivery system. And although the PPACA made insurance coverage for obesity care the law, obesity care in the traditional health care setting is still rare.

Employer-based insurance is the most common source of health insurance, covering more individuals than the entire public insurance sector.

Health Care Cost Trends

In 1965, total U.S. health care expenditure was 5.6 percent of the gross domestic product (GDP). Spending increased by 11.9 percent from 1966 to 1973 as a result of rapid coverage expansion and increased utilization. From 1974 to 1982, price inflation drove an average annual increase of almost 14 percent. By the end of 1982, both private and public health care expenditure accounted for 10 percent of GDP.[21]

Since 1982, public and private efforts to reform health care led to trends rising and falling, but generally staying below 10 percent of GDP. In a 2018 report by Willis Towers Watson, the overall health care trend in the United States decreased year over year from 8.7 percent to 7.9 percent.[22] U.S. health care expenditures reached 17.9 percent of GDP by 2017.[23]

The health care trend affecting employer spending is less than the nation's total. Willis Towers Watson reported the average health care cost increase before benefit design changes was 5.0 percent in 2017, and it was expected to be 5.3 percent and 5.5 percent in 2018 and 2019, respectively.[24]

Potential Hope for the Future

A health care model incentivizing treatment of the sick rather than keeping people healthy has led to high rates of chronic conditions such as heart disease, cancer and diabetes, which are our nation's leading cost drivers. Often a byproduct of lifestyle, most chronic disease burden is preventable.

According to the CDC, 90 percent of our nation's health care spend is on people with chronic and mental health conditions.[25] The U.S. health care delivery system is known for a high standard of care when treating chronic disease, yet most of this treatment is avoidable by changing lifestyle and behaviors.

But why is now different than past efforts? There are appealing forces that hold promise for managing chronic disease and reducing its burden on the U.S. economy.

Accountable Care Organizations

The PPACA authorized the Centers for Medicare and Medicaid Services (CMS) to define parameters that help health care providers establish accountable care organizations (ACOs) to ensure patients get the right care at the right time and avoid unnecessary and duplicative care. ACOs enable doctors, hospitals and other providers to coordinate high-quality care.

CMS provides incentives for effective care coordination through a Medicare Shared Savings Program. Providers

who perform well are rewarded, and providers who fall short receive reduced reimbursements under this program.[26] These incentives reward health care providers for addressing the underlying risk factors and care gaps associated with chronic disease.

Many ACOs provide the same coordinated care for non-Medicare patients, and they seem poised to realize benefits from economic efficiencies and intelligent coordination available through integrated provider systems and large group practices. ACOs enable and require new levels of health care innovation to achieve success.

Primary Care Incentive Programs

Private insurers deployed incentive programs designed to change how providers are paid for primary care. Past reimbursement strongly incentivized more care and tests to earn more income. New incentive models aim to tie provider income to closing gaps in care and achieving desired outcomes.

These programs hold promise for enabling primary care physicians to help people get and stay healthy. Patient engagement will drive success for both ACOs and Primary Care Incentive Programs (PCIPs). The old paradigm encouraged patients to seek care only when they were sick. This paradigm, too, must change and may be the most difficult task of all.

On-site and Near-site Health Care

The National Association of Worksite Health Clinics reported one-third of employers with 5,000 or more employees provide an on-site or near-site employer-sponsored personal health care clinic, and an additional 11 percent are considering a clinic for 2019. Among smaller employers (500 to 5,000 employees), 16 percent currently offer an employer-sponsored clinic, and another 8 percent are considering one for 2019.[27]

On-site health care programs can remove the barriers of time, distance and cost that keep patients from receiving the care they need, when they need it. Programs focused on health improvement can change how employees and their dependents consume services and can encourage more effective patient engagement.

Well-designed incentive programs, effective communication strategies and risk-based patient outreach are powerful tools for engaging employees and their family members in understanding and managing chronic disease

Well-designed incentive programs, effective communication strategies and risk-based patient outreach are powerful tools for engaging employees and their family members in understanding and managing chronic disease risks and conditions.

risks and conditions. For example, the company for which I work, Healthstat Inc., uses predictive modeling based on current claims data and patient biometrics to identify high-risk patients, drive patient outreach and inform the patient-provider relationship with knowledge and insight at the point of care. This point-of-care insight supports risk mitigation through behavior change and helps close gaps in care.

For specialty care outside the scope of the clinic, providers connect patients to a qualified community-based specialist who can provide information and support, ensuring the patient receives the care to manage their condition and regain full health. On-site clinics also provide follow-up care after a specialist visit, which can reduce readmissions and complications from recovery.

Conclusion

The United States spends nearly twice the average of other wealthy countries on health care per person. Despite critical opinions regarding commensurate quality, I believe our nation's health care providers are delivering the highest quality care when we are sick. But as a nation, we need to do more to avoid sickness to begin with.

Many forces and events influenced our state of health care today. As we turn our attention toward managing chronic disease through ACOs, new primary care incentive models, and effective on-site and near-site health care, we have an opportunity to change our nation's trajectory, with an aim of helping our country's population to be as healthy as it can possibly be. ■

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FEATURE

Will You Live Longer?

Tips on what to do, how to do it and what not to do in order to live healthier and longer

BY AL KLEIN

I am going to start by answering the question: Will you live longer? My answer is: Yes, you may live longer than you might otherwise, given your individual situation, but only if you:

- Know how to do so.
- Do it to the best of your abilities.
- Don't have an unfortunate accident.

In this article, I hope to explain what to do, how to do it and what not to do in order to live both healthier and longer. You do not need to be perfect, but try to follow the advice to the best of your ability. This information is based on my review of scientific studies over the last 20-plus years. These are my opinions based on this research and not necessarily those of my employer or the Society of Actuaries (SOA). I cannot cover everything you need to know in this article, but I provided references and suggest you do your own research and decide what the right path is for you.

A couple of caveats: If you are allergic to something I say is good for you, certainly do not follow my advice. If you have religious or other beliefs that contradict what I say, again, do not follow my advice.

Most people believe they know how to live healthier and longer from news and advice from other people. However, the advice is often misleading or wrong. I made many mistakes doing what I believed to be true before beginning my own research. I study information on healthier living on a regular, almost daily basis, and I am still learning.

I will focus on items you may not be aware of, but that you have control over. Why should you want to live healthier and longer? Because you will enjoy life more and be able to do much more of what you want.

Please note there is no one pill to make you live longer. While studies on Metformin,[1] for example, are underway, I don't believe there will ever be a single step or process that by itself will extend healthy longevity. I believe a longer and healthier life is achievable through a series of behaviors and actions.

You probably can guess some of the topics I will be covering in this article, such as diet, exercise and smoking, but I hope to explore them in unexpected ways. I will also cover the topics of inflammation, attitude and mental health, vitamin D, pollution and health care.

Diet

It is common knowledge that fruits and vegetables are good for you. However, did you know, according to the Environmental Working Group's 2019 "Dirty Dozen,"[2] strawberries are the most contaminated with pesticides of all fruits and vegetables? Spinach and kale come in second and third, respectively. Knowing this, you can purchase an alternative version of the most contaminated fruits and vegetables.

Did you know, according to the Environmental Working Group's 2019 "Dirty Dozen," strawberries are the most contaminated with pesticides of all fruits and vegetables?

While crop yields have increased, the nutritional value of fruits and vegetables has declined over the last 50 years.[3] Protein, calcium, phosphorus, iron, riboflavin and vitamin C were specifically mentioned in research. Fertilizer and irrigation have led to higher crop yields but have also lowered nutrient value. This means that in order to get enough nutrients, you may need to eat more fruits and vegetables than in the past.

Another reason for the increase in crop yield is genetically modified organisms (GMOs). GMOs have been engineered in a way that make them tolerant to large applications of pesticides and herbicides.[4] Many of these pesticides contain glyphosate, which was found by the World Health Organization in May 2015 to be a "probable human carcinogen." Also, according to this same research, GMOs have caused the use of herbicides and pesticides to increase significantly, leaving more chemical residue on crops for consumers to ingest. Autism, gluten intolerance, birth defects and many more health issues are all linked back to glyphosate. Most corn, soy, canola, sugar beets and processed foods contain GMOs.

While others, including the manufacturers, may disagree, I suggest avoiding crops and products that contain GMOs. Unfortunately, glyphosate recently has been found in common beers and wines.[5] Most studies indicate moderate drinking is beneficial for your health and longevity, so rather than eliminate drinking altogether, try to understand what you eat and drink. Kimberton Whole Foods has put together a list of GMO foods[6] to which you can refer. I also recommend carefully reading labels of any processed foods you purchase, because most contain GMOs. Finally, a list of GMO foods by Organic Hawaii has some items that may surprise you, such as flax, salmon, bananas and pineapples.[7] Again, I am not suggesting you not eat these otherwise healthy foods, but rather to look for non-GMO alternatives.

My next topic is red meat. Is it good or bad for you? You probably have heard different opinions, largely because all meats are grouped together. I will explain it simply (and I believe accurately). If the meat comes from a grass-fed animal that has not been given hormones or antibiotics, it is healthy; maybe even healthier than fish. It contains less total fat; more heart-healthy omega-3 fatty acids; more conjugated linoleic acid, a type of fat that's thought to reduce heart disease and cancer risks; and more antioxidant vitamins, such as vitamin E.[8] If the meat is processed or does not come from a grass-fed animal, was given hormones or antibiotics (to either keep it healthy or to make it grow faster and get to market

quicker), it is not good for you and should be avoided.

I would like to discuss several other food items: fat, sugar, salt and eggs. A recent review of 72 studies found that saturated fats are not harmful and do not cause heart disease.[9] In fact, butter, for example, has many benefits, including anticancer properties, improved cardiovascular health, better thyroid health, eye care, powerful antioxidant properties, improved bone health, improved nutritional absorption and healthy sexual performance. (I hope I didn't just start a run on butter!) Besides butter, good fats include those found in avocados, cheese, coconuts, dark chocolate, whole eggs, fatty fish, nuts, chia seeds, extra-virgin olive oil and full-fat yogurt. Avoid trans fats, such as margarine, as they raise your risk for developing many chronic diseases.[10]

Sugar is bad for you, particularly high-fructose corn syrup (HFCS). HFCS consumption can lead to diabetes, metabolic syndrome and damage to the immune system. It also speeds up the aging process.[11] Additionally, sugar can lead to cancer, heart disease and Alzheimer's disease. Foods that contain carbohydrates and are converted into sugar during the digestion process include grains like baked goods, bread, crackers, pasta, rice and starchy vegetables.

Certain forms of salt contain trace minerals essential for your body. The benefits of salt include strengthening your immune system and helping with skin conditions, asthma, muscle spasms, heart health, diabetes, depression and osteoporosis.[12] Sea salt and Himalayan pink salt are good for you. Table salt is missing the healthy natural minerals.

Views on whether eggs are good for you or bad for you seem to fluctuate every couple of years. The answer is eggs are good for you. They contain protein, amino acids in the right proportion for your body to use, omega-3 fatty acids, lutein and zeaxanthin for eye health, many important vitamins and minerals, and they reduce the risk of heart disease.[13]

Exercise

Several of the best exercises you can do are swimming, strength training, tai chi and walking. Possibly the best exercise for you is interval training, but also think of natural motions, such as lunges, squats and crunches.[14] It might surprise you that people who work out too hard for too long may be less healthy than sedentary people, and they are more likely to die earlier than moderate exercisers.[15] Based on this, it is not surprising that running a marathon increases cardiac strain.[16]

As with food, think about doing what comes naturally when deciding on an exercise.

People who work out too hard for too long may be less healthy than sedentary people, and they are more likely to die earlier than moderate exercisers.

Smoking

E-cigarettes, in their various forms, have become more popular in recent years. The question is whether e-cigarettes are healthier than combustible cigarettes. The United Kingdom is encouraging cigarette smokers to move to e-cigarettes, and the United States is trying to discourage e-cigarette usage. There is not enough data to answer this question, partly because e-cigarettes continue to change form. However, here are some considerations:

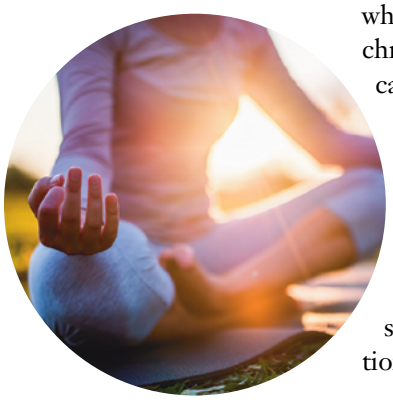
- Combustible cigarettes create more than 7,000 chemicals, at least 69 of which are known to cause cancer, and many of which are toxic.[17]
- E-cigarettes do not contain many of these, but they contain microbial toxins, which can lead to respiratory disease.[18]

My recommendation is to stop or limit smoking of either kind. Mortality studies of combustible cigarettes show smokers have about double the mortality of nonsmokers.

The United Kingdom is encouraging cigarette smokers to move to e-cigarettes, and the United States is trying to discourage e-cigarette usage.

Inflammation

The causes of chronic inflammation include mental and physical stress and toxins from the environment. Stress, toxins and injuries



Ways to reduce stress include deep breathing, meditation, exercise and talking to someone.

all lead to inflammation. If this happens occasionally, your body can generally heal itself. However, if the stress is continuous, you can develop chronic inflammation, which can lead to many of the common chronic diseases such as heart disease, cancer and Alzheimer's disease.[19] I believe chronic inflammation is one of the primary causes of heart disease.

While you cannot eliminate stress, you can control its impact by recognition and acceptance of issues beyond your control. Other ways to reduce stress include deep breathing, meditation, exercise and talking to someone.

Attitude and Mental Health

A positive attitude,[20,21] laughing and enjoying life all help you live longer. Loneliness[22] and depression[23] shorten life. One beneficial activity for some forms of depression is to go outside in the sunlight.[24]

Vitamin D

Lack of sunshine (really the lack of vitamin D from the sun) can lead to depression and premature death. Low levels of vitamin D also lead to an increase in cancer, heart disease and dementia.

The best source of vitamin D is the sun, but there are two problems I see happening today. One is the extensive use of sunscreen, which blocks the ultraviolet UVB rays of the sun.[25] These are the rays your body needs to generate vitamin D. Therefore, my recommendation is that you should go out in the sun for a short period of time without sunscreen to absorb the vitamin D you need, and then get out of the sun before getting burned. The amount of time you can spend in the sun will vary from person to person, based on your complexion (darker skin can stay in the sun longer), the time of year, time of day and your latitude (the sun is more intense closer to the equator).

Figure 1 Total Cholesterol and Relative Mortality Levels

Cholesterol Group	N	exp_yrs Sum	Deaths Sum	2001 VBT Expected	Deaths 2001 VBT A/E	Standardized A/E	Cox HR
059–140	987	13,385	156	58.4	267%	155%	155%
141–160	1,836	25,515	281	148.0	190%	110%	113%
161–180	2,675	36,256	518	248.6	208%	121%	120%
181–200	3,171	42,873	686	397.7	172%	100%	100%
201–220	2,884	38,366	750	451.3	166%	96%	95%
221–250	3,158	40,813	979	573.3	171%	99%	96%
251–275	1,288	16,360	452	256.3	176%	102%	99%
276–300	659	8,309	254	142.4	178%	103%	101%
301–325	248	3,038	95	52.1	182%	106%	103%
326+	188	2,286	86	37.5	229%	133%	130%

Source: Reprinted with the permission of *On the Risk, Journal of the Academy of Life Underwriting*

Lack of sunshine can lead to depression and premature death.

The second issue is that your body needs cholesterol for the process to convert the rays from the sun into vitamin D (actually vitamin D3).[26] The problem here is many people are on statins, which lower cholesterol, leading to less conversion of vitamin D. I am not suggesting you stop taking statins—that is between you and your doctor—but I wanted to make you aware of this fact.

Figure 1 is reprinted with the permission of *On the Risk*, *Journal of the Academy of Life Underwriting*.[27] The data comes from the Framingham study.[28] The "N" column shows the number of lives, and "exp_yrs" represents the number of exposure years for each cholesterol level. My focus in Figure 1 is on the last two columns, which show that total cholesterol levels up to 325 have lower levels of all-cause mortality than cholesterol levels of 161 to 180. This indicates cholesterol levels may not need to be reduced by as much as is commonly thought. If you continue on statins, use vitamin D and CoQ10 supplements for better health and longevity.

Pollution

Environmental toxins are often cancer-causing chemicals and endocrine disruptors—both human-made and naturally occurring—that can harm your health by disrupting sensitive biological systems.[29] Environmental toxins include lead, mercury, radon, formaldehyde and cadmium. Endocrine disrupters include man-made BPA, phthalates and pesticides. They can be found in the environment and home, including in paint cans, lead pipes, plastic bottles, food can liners, detergents, flame retardants (e.g., on furniture and carpet), toys, cosmetics and pesticides. They can cause cancer and organ failure, and can lead to obesity, infertility and early puberty, among other serious problems. Based on one study, 93 percent of children six years of age and older have detectable levels of BPA in their urine.[30]

Being aware of this allows you to potentially make different purchases and/or improve the ventilation in your home.

Health Care

Have regular checkups to make sure all is OK. You know your body better than anyone else. If something doesn't seem right, have it checked out. Don't wait.

Try to avoid hospitals, but if you need to be admitted, make sure you have an advocate who can watch out for you. Medical errors are the third-leading cause of death in the United States.[31] Medical errors resulting in death are a leading cause of death in other countries[32] as well.

While you cannot control your genetics, understanding them is beneficial. The use of genetics in the treatment of individuals (precision medicine[33]) will increase in the future. One reason for this is that genetics provide information on which drugs work for you, that is, which ones you can metabolize more quickly.[34] This is important because, if you metabolize a drug quickly, you may be able to get by with smaller dosages. On the other hand, if you do not metabolize a drug for a particular condition, then treatment should begin with another drug.

BPA can be found in the environment and home, including in plastic bottles. It can cause cancer and organ failure, and can lead to obesity, infertility and early puberty, among other serious problems. Based on one study, 93 percent of children six years of age and older have detectable levels of BPA in their urine.

In the future, I believe you will hear about one or more of the following as breakthroughs: slowing the aging process; gut microbiome, which affects your brain, immune system and much more; cleaning out senescent cells; stem cell technology; and genetic editing.

Concluding Comments

I have covered a lot of information in this article, but only scratched the surface on the items to help you live longer. Again, I encourage you to do your own research and look into the following additional vitamins and supplements to help you lead a healthier and longer life: astaxanthin, curcumin, glutathione, resveratrol, quercetin, and vitamins B and C.

In the future, I believe you will hear about one or more of the following as breakthroughs: slowing the aging process; gut microbiome, which affects your brain, immune system and much more; cleaning out senescent cells; stem cell technology; and genetic editing (e.g., CRISPR).

I often get asked if I follow my own advice. My answer is: I try, but I am not perfect. My hope is that you will also try, and give yourself the opportunity to live a healthier and longer life. ■

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MORTALITY TRENDS

"Will you live longer?" is an interesting question. U.S. population mortality began to increase and life expectancy decreased in 2015,[1] for the first time in decades. This was driven by increases in almost all causes of death besides cancer. The deterioration in mortality continued in 2016 and 2017, while preliminary results for 2018 from the Centers for Disease Control and Prevention (CDC) appear to indicate an improvement in mortality and life expectancy again. It is difficult to say the direction mortality will take in the future. It depends on a number of factors, such as the environment and medical advances.

This deterioration in mortality was not seen in U.S. life insurance industry experience over the same period of time, but it was seen in the population of other countries beginning in 2015. Some European countries saw a slowing of mortality improvement, while others saw a deterioration in mortality.[2]

There are different theories as to why we have seen this deterioration in U.S. mortality. These theories include:

- Case and Deaton[3] believe this is due to "deaths of despair" among the white working class. More specifically, middle-age, less-educated, low-income, non-Hispanic whites died from chronic pain, obesity, stress, and alcohol and drug addiction.
- Masters, Tilstra and Simon[4] believe this is due to increases in metabolic diseases and drug use, and the start of the effects of obesity.
- Auerbach and Gelman[5] believe this is due to higher mortality from non-Hispanic white women, generally from the South.

I believe these theories all have elements of truth. However, more important, they all show a widening differential in mortality among different groups of people. Which brings me back to the question: Will you live longer?

In addition to reading the entirety of this article, I recommend reading the book *The Blue Zones* by Dan Buettner. Dan and his colleagues found four places around the world where more people than average live to beyond 100. They studied those regions, which all had completely different cultures, and found nine "reasons" for this longer life. One of those reasons is to have a purpose in life. I encourage you to read more.

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Competition Master

Q&A with Carlos Brioso, FSA, CERA, director, Center for Data Science and Analytics, New York Life

You recently earned the title of Kaggle Competition Master. What keeps you coming back to Kaggle's data science competitions?
There are several reasons why I keep coming back. First, this a great way to apply my analytical skills—I get to solve a variety of problems and be measured in a very objective way. Second, there is an active interaction with a very talented community that provides a feedback loop, enriching my experience and knowledge. Third, the competitions give me the opportunity to develop different ideas and apply state-of-the-art machine learning techniques.

How did you get involved in Kaggle competitions?
My previous employer organized an internal Kaggle competition. The objective was to estimate the expected insurance payments for claims in a business with long-tail risk. My team finished third in the competition. The proposed solutions considerably outperformed traditional actuarial methods used for reserving. This demonstrated the value of using new methodologies and software to tackle traditional problems in a different way.

What does it take to be successful?
Most people have the impression that applying new algorithms and having a powerful computer available are what make the difference. These things are important and help, but the key to being successful in these competitions is to do the basics of modeling correctly: Know your data, try to understand the problem, get some domain knowledge and learn from what others have tried. It is also important to understand what the advantages and disadvantages of the different algorithms are and use them tactically. Usually, a single algorithm is not sufficient. Combining different approaches to the problem and using a variety of algorithms are the keys to succeeding.

What can actuaries do to position themselves for data science roles outside of the insurance industry?
Actuaries are good at understanding business problems and using analytics to make business decisions. These skills are sought-after by data science teams. Actuaries should acquire additional skills such as programming and machine learning to be competitive outside of the insurance industry and participate in projects outside of the insurance domain. Credit risk is very close to insurance in terms of the types of problems that need to be tackled, so this is a good area to begin exploring problems outside of insurance.

What is your best advice for staying ahead of the competition?
Look for areas where you can provide value in the industry. Update your skill set. Step outside of your comfort zone, and you might be surprised how you can excel in new areas.

What is the most satisfying facet of your current position at New York Life?
Our data science group is trying to address different business problems with new techniques and data. The satisfaction comes from knowing our work can provide value to the company and our customers.

Describe a successful day.
A successful day is when we strike a good balance between the complexity of our technical work and the effectiveness in communicating these results to our business partners. ■

Step outside of your comfort zone, and you might be surprised how you can excel in new areas.

Carlos Brioso can be reached at ***carlos_brioso@hotmail.com***.

PHOTO: ROB TANNENBAUM

Inclusivity for an Innovation Mindset

BY SARA TEPPEMA

I have been the chair of the Society of Actuaries (SOA) Inclusion and Diversity Committee for a few months now, and I continue to talk to others, observe diversity and inclusion (D&I) practices wherever I go and read everything I can get my hands on. I hear a lot about the business case for D&I, but what does that mean for the actuarial profession?

In my view, the foremost reason to incorporate diversity, equity and inclusion (D, E & I) into our workplaces and professional activities is best viewed through the lens of social justice. It's simply the right thing to do—to recognize the value each human being brings to our workplaces.

Another related reason we need to weave D, E & I into what we do is that it's vital to our future workforce. Forty-seven percent of millennials consider the D, E & I policies of a workplace an important criterion in their job search.[1] Indicators show the up-and-coming Generation Z, now becoming our actuarial candidates and entry-level employees, care about D, E & I even more than millennials.

A third justification for D, E & I activities is the financial business case. Business results are better at organizations that are strong in diversity and inclusion.[2] Organizations in the top quartile of gender and ethnic diversity continue to outperform those in the bottom quartile by significant margins.[3]

I want to go beyond the financial business case to a related area where D, E & I matters: innovation. Innovation is certainly an overused buzzword and has many meanings. The actuarial profession, though, is currently threatened by competitors like data scientists and InsurTech startups that are claiming the innovation territory for themselves. We can sit in our actuarial ivory tower of "how we've always done it," or we can seize these new opportunities and begin to venture into new frontiers through innovation.

And, guess what? Innovation cannot happen without a business culture that embraces D&I and weaves it daily into the creative process.

One of the core tenets of innovation and design thinking is empathy, also frequently framed as human centeredness.[4] When at least one member of a team has traits in common with the end user, the entire team better understands that user. For example, a team with a member who shares a client's ethnicity is 152 percent more likely to understand that client.[5]

The need for connection to the user or customer may seem obvious, but a great example of a failure to understand a customer sits, ironically, with the best-known innovation company of our time. When Apple Health debuted in 2014, Senior VP of Software Engineering Craig Federighi told users, "You can monitor all of your metrics that you're most interested in." However, his design team missed a critical market: The estimated 100 million (yes, 100 million) women who track their menstrual periods on their phones. Period tracking—one of the applications most utilized on smartphones—was finally added to Apple Health after a year of operation and a lot of feedback. It seems unlikely that women were included in decision-making on that initial design team.

Accenture has done considerable research on how innovation is closely linked with D&I, studying more than 18,000 employees in 27 countries. In its report, "Getting to Equal 2019: Creating a Culture That Drives Innovation," Accenture expands on basic diversity and calls for a "culture of equality."[6] (I'll talk more about the concept of equality in a future "Inclusive Ideas" column.) This culture of equality becomes a powerful multiplier of innovation, developing an organization's "innovation mindset."

An innovation mindset is six times higher in the most equal organizational cultures that Accenture studied, compared to least equal. Accenture measures an organization's culture of equality with 40 factors that are organized into three pillars: bold leadership, an empowering environment and comprehensive action.

The research defines an innovation mindset with six elements:

1. **Purpose.** Providing alignment around and support for the organization.
2. **Autonomy.** Being shown a clear mandate for change and trusted to follow through.
3. **Resources.** Having the tools, time and incentives necessary to innovate.
4. **Inspiration.** Tapping into inspiration from beyond the organization.
5. **Collaboration.** Working with other departments or in cross-function teams.
6. **Experimentation.** Experimenting with new ideas quickly without fear of failure.

The link between a culture of equality and an innovation mindset is nicely summarized by Mastercard President and CEO Ajay Banga: "We're in an industry where technology and innovation flow around you all the time. If you surround yourself with people who look like you, walk like you, talk like you, went to the same schools as you and had the same experiences, you'll have the very same blind spots as them. You'll miss the same trends, curves in the road and opportunities."

I invite you to share with me your stories of innovation mindsets as we work to bring a culture of equality to the actuarial profession. The more we can learn from each other to iterate (iteration is another core tenet of innovation and design thinking!) and improve, the further we can push the limits of innovation. ■

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Innovation cannot happen without a business culture that embraces D&I and weaves it daily into the creative process.

Training for the Future

During the 2019 Actuarial Teaching Conference, educators gather to share ideas for preparing leading-edge actuaries

BY MARTA JIMENEZ-LUTTER

Actuarial Teaching Conference (ATC) attendees listen to presentations on creative ways to teach actuarial science and integrating data science to meet professional demands.

Vicki Zhang, FSA, ACIA, CERA, MS, talks to the group about statistics and data science.

The Society of Actuaries (SOA) developed the Actuarial Teaching Conference (ATC) in 2015 to support faculty members from actuarial programs both large and small. As funds for such conferences can be limited for university faculty, it was important to keep the registration fee reasonable and the event location within driving distance of many universities in North America. This summer marked the third North American ATC. The program also was held for the first time in Asia in 2018 with events in Hong Kong and Qingdao, China.

PHOTOS: NANCY LAMBERT

The SOA has long believed research at universities is important for scholarship and the profession. But with many research conferences already in place, there was a need for a conference for faculty members focused on actuarial teaching, methods and efficacy.

2019 Actuarial Teaching Conference

As actuaries' roles evolve, so does the way they are trained for the future. During the 2019 ATC that took place June 27–28 in Columbus, Ohio, faculty members who teach future actuaries came together to share ideas, learn and network. Presenters focused on a variety of issues including:

- Integrating data science and practice courses to meet professional demands
- Creative ways to teach actuarial science
- Creative-thinking skills for actuarial students

Integrating Data Science and Practice Courses

During the presentation, "Redesigning Actuarial Science Curriculum; Integrating Data Science and Practice Courses to Better Meet Professional Demands," Vicki Zhang, FSA, ACIA, CERA, MS, associate chair of undergraduate studies in actuarial science at the University of Toronto, explored how educators can arm actuaries with the sophisticated knowledge in statistics and data science that employers require. "One of the key additions to the SOA's new curriculum is an exam in Statistics for Risk Modeling [SRM], which includes modern statistical and data science techniques," she explained. "At the University of Toronto, we underwent a major actuarial science curriculum redesign last year in order to stay current with new trends and demand from the profession, and [to be] in line with the SOA's new curriculum."

Zhang's session focused on the data science component of the new curriculum—specifically a sequence of statistical learning and data science courses incorporated into the curriculum, and the various practice-oriented courses offered to improve the balance between theoretical and practice knowledge and skills for students. "The new curriculum enhances actuarial students' learning experiences by providing pathways that best suit individuals' academic and professional goals and interests," Zhang concluded.

Creative Teaching

Because engaged students are better students, Diana Skrzydlo, ASA, continuing lecturer and MActSc director in the department of statistics and actuarial science at the University of Waterloo, during the session, "Creative Teaching in Actuarial Science," shared tools she employs to make her classes interesting. Skrzydlo discussed how she uses classroom response system (CRS, or also known as clickers) and YouTube videos.

Skrzydlo has used CRS in an introductory probability course since 2015. "I use clickers to engage students, keep track of their skills and collect data to use in class examples," she explained. She discussed the advantages, drawbacks and best practices for their successful use, and presented survey data about how students perceive clickers and quantitative data about how clickers affect performance on final exams.

When Skrzydlo teaches a Life Contingencies and Stochastic Processes class, she often has a bonus assignment where students can create a YouTube video explaining a course concept in an interesting way. "Many of the videos are really creative and fun," she noted. "Some of the topics of the videos included Harry Potter petrification insurance, a zombie apocalypse multiple decrement table and a fake movie trailer for *A Random Walk to Remember*, in which a woman has to gamble to save her boyfriend from the mob."

Creative-thinking Skills

Stefanos Orfanos, FSA, CERA, Ph.D., assistant professor at DePaul University, discussed the need for creative-thinking skills in an actuarial context during the session, "Creative-thinking Skills for Actuarial Majors."

"Actuarial exams are demanding, and students spend hundreds of hours poring over past exam questions and memorizing formulas to prepare for them," Orfanos noted. "It is true that actuaries need to know a wide range of actuarial topics well enough to perform calculations correctly and efficiently. And yet one wonders, 'Is that the kind of reasoning skills they will be using in their future careers as actuaries?'"

During his presentation, Orfanos showed concrete examples of creative-thinking skills and what they mean in an actuarial context. He also assigned projects from his Loss Models class that required participants to put their creative-thinking skills to use.

The 2019 Actuarial Teaching Conference also included an actuarial employer panel and small group discussions, along with many networking opportunities that allowed attendees to exchange ideas in an informal setting. A full list of the 2019 ATC sessions is available on the SOA website at *bit.ly/2019-ATC*. For more information on university programs, contact Gena Long, director, Professionalism and University Relations, at *glong@soa.org*, or Tiffany Tatsumi, academic administrator, at *ttatsumi@soa.org*. ■

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Actuarial Innovation and Technology

Q&A with Kevin J. Pledge and R. Dale Hall

Last year, the Society of Actuaries (SOA) developed the Strategic Research Program Initiative to determine key themes of strategic research for the future. One of these areas is on Actuarial Innovation and Technology. Kevin J. Pledge, FSA, FIA, chairperson of the initiative's task force, and R. Dale Hall, FSA, CERA, MAAA, SOA managing director of Research, discuss this strategic research program and the initial reports released.

What is the core focus of this strategic research program?

Pledge: The Actuarial Innovation and Technology Research Program focuses on the impact new technologies have on actuarial work and on traditional employers of actuaries. We have several projects in development that include studying accelerated underwriting, machine learning, telematics and other innovations relevant to the actuarial field and the insurance industry. This research program purposefully covers both global and country-specific topics. In fact, the members of our Strategic Research Steering Committee reflect this international mix of ideas and representation. You'll notice a variety of topics that are global, while still providing research specific to Canada, China and the Asia Pacific region, and the United States.

Can you please tell us about the initial research released?

Hall: We're proud to have completed around 10 papers on topics covering technology and innovation. There's certainly more to come in the future. The best place to start is our paper identifying the top technology developments and tools of particular interest to actuaries. These include data visualization, predictive modeling, cloud computing and storage. We've also explored big data, looking at how insurers currently are using technology to compete on more than price by developing proprietary platforms and connected products that empower consumers to better connect their decisions to their health, safety and wealth. This work also reveals that insurers are offering more user-centered solutions.

Pledge: I'm particularly excited by the research on behavioral science and ethics in artificial intelligence, as these are topics that impact me almost every day. There is also research in progress to be updated on a regular basis, such as on top technology developments and property and casualty insurance policies involving autonomous vehicles. We've also released literature reviews on microinsurance and predictive modeling in insurance applications. The microinsurance research examines challenges in microinsurance, rating processes, distribution, payment and claims. The predictive modeling report documents the processes used in our industry today, and it also offers case studies on model evaluation, deployment and governance.

What are some of the other topics related to this program?

Hall: Our research involving technology and innovation includes a variety of subject areas and past reports from our organization. For instance, we've released a study on the impact of cancer genomics, providing insights on the cost effectiveness of tumor genetic analysis and immunotherapy. We also have research that explores the potential impact on the U.S. life insurance industry if there were legislative changes to ban the use of genetic testing information in the life insurance process.

What are the next steps and upcoming developments?

Pledge: In addition to the research, we have also gathered a collection of articles to serve as a resource in

RELATED LINKS

Actuarial Innovation and Technology
SOA.org/programs/act-innov-tech

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Visit *SOA.org/research/about-research* for the latest updates on research opportunities, data requests, experience studies and completed research projects.

further learning about technology. These topics include cloud computing, blockchain, cyber risk, InsurTech, telematics, wearables and the Internet of Things.

We have about 20 volunteers on this strategic research committee. While this may seem like a large group, we cover a wide range of topics and geographical regions. We are also open to suggestions from SOA members. That's the exciting thing about innovation—you don't really know what is next. So, send us your ideas at *research@soa.org*.

Some of our research projects' findings will be presented at the 2019 SOA Annual Meeting & Exhibit in Toronto this October. We look forward to continually creating more research studies and reports covering innovation and technology, including in the near future. And, also, we want to thank all of the steering committee members and the various Project Oversight Group members for their ongoing support and guidance in launching and building upon this research program. ■

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RESEARCH READS

Student Research Case Study Challenge Winners
The SOA announced the winning entries of the 2019 SOA Student Research Case Study Challenge. Sixty-three teams of actuarial students from colleges and universities around the world participated in this research challenge, where they designed an autonomous vehicle insurance policy and actuarial projections of loss costs. Students from Drake University in Des Moines, Iowa, received first place. Their entry highlighted a variety of new policyholder behaviors, cybersecurity risks and changes in vehicle-miles exposures that would emerge with the implementation of autonomous vehicles.
bit.ly/SOA-Student-Research-2019

Living to 100 Insights on the Challenges and Opportunities of Longevity
The SOA Research Expanding Boundaries Pool, the Committee on Life Insurance Research, the Product Development Section and the Committee on Knowledge Extension Research released a report that provides an overview and analysis of the mortality models, theories and trends. This literature review offers context on longevity challenges.
bit.ly/100-Insights-2019

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DISRUPTING NORMS

Online Exclusive

Time for Transformation: Market Forces That Drive Change in the Insurance Industry

In this online exclusive, writer Bill Bade, FSA, MAAA, contends that, to stay relevant, insurance carriers should embrace at least four key market forces driving changes in the insurance industry: customer expectations, technology, demographics and regulatory oversight. These changes create investable opportunities as well as potential challenges.

"If our industry started with a blank sheet of paper, an unlimited amount of funding and unlimited resources, what could we build in the next five years?" Bade questions. "It would certainly be something different than what we have today. And to be certain, there are efforts to move our industry incrementally forward. I sincerely hope actuaries, uniquely positioned with a keen understanding of risk and an analytical approach to problem-solving, will be among the first to support change within insurers."

Visit ***TheActuaryMagazine.org/Time-for-Transformation*** to read this online-only article in full.

Meeting

Destination Toronto for the Annual Meeting

Evolve with today's disruptive technology. Empower yourself through innovation. Elevate the actuarial profession. It all begins at the 2019 SOA Annual Meeting & Exhibit, Oct. 27–30, in Toronto, the provincial capital of Ontario. Learn new techniques, examine current industry trends and witness the technology defining the actuarial future. Embrace it all—the informative sessions, the innovative exhibits and the unmatched networking opportunities.

SOA.org/2019AnnualMeeting

Video

Looking at the Big Picture

Robert Eaton, FSA, MAAA, shares how he uses predictive analytics to create models with a big-picture focus, such as determining the causes of long-term care claims. Eaton discusses how the SOA Predictive Analytics Certificate Program benefits both actuaries and employers.

bit.ly/Eaton-Video

bit.ly/SOA-PA-Cert

Reports

U.S. Population Mortality Observations

The SOA posted early insights of 2018 population mortality in the United States, which notes the lowest mortality rate in the country's history.

bit.ly/Pop-Mortality

Behavioral Science

Access the SOA report exploring behavioral science and emerging underwriting techniques.

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- **350,000 HIGH SCHOOL STUDENTS** have learned from our financial literacy curriculum
- **14,000 TEACHERS** have used our financial literacy resources and curriculum
- **565 COLLEGE STUDENTS** have received a scholarship from the Foundation
- **582 ACTUARIAL EXAMS** have been passed by our Diversity Scholarship recipients
- **$55,000 IN SCHOLARSHIPS** is awarded to high school juniors and seniors each year through our Modeling the Future Challenge
- **500 STUDENTS IN 20 SCHOOLS IN 7 CITIES** are receiving tutoring through our award winning Math Motivators program

Please join us at our celebratory luncheon at the 2019 SOA Annual Meeting & Exhibit on Monday, Oct. 28, to continue the Foundation's legacy of math education.

Register for session #036 today!

Timeless

THE PAST, PRESENT AND FUTURE OF THE SOA

1952 When those who knew Robert J. Randall, FSA, speak of him, they use words like "hero," "industrious," "leader" and "bigger than life."

Randall, who became the first Black fellow of the Society of Actuaries (SOA) in 1952, was born in 1922. He was a Yale graduate, a first lieutenant with one of the most highly decorated units of the military—the Tuskegee Airmen—and held two master's degrees (from Columbia University and New School of Social Research). He was also the first Black president of a national insurance company, Intramerica Life.

Robert J. Randall (center) was a Tuskegee Airman in the Army Air Corps in 1944.

Randall mentored college students, helping them to become proficient in actuarial studies and seek employment in the field. He also accelerated the representation of Black actuaries in the profession as a member of the International Association of Black Actuaries (IABA) and helped launch the SOA's minority recruiting program.

After retirement, Randall aggressively worked for the actuarial profession. He coauthored papers about the negative impacts of changing the Social Security system. He authored an article on the impact of Social Security on minorities. He was a member of the Social Insurance Committee of the SOA. Most important, he was a frequent attendee of the IABA meetings.

"Bob encouraged young people to stand up and take a lead," said Stafford L. Thompson Jr., FSA, MAAA, a founding member and past president of the IABA. "He encouraged me to dare to be different, bigger and better than even I believed I could be. For those of you who never met him, quite simply he beat the odds and changed the world."

Randall passed away on April 17, 2012, and left an impressive legacy of firsts.

Sources

Thompson, Stafford, L. 2014. "He Beat the Odds," *The Voice*. West Hartford, CT: International Association of Black Actuaries.

Greb, Richard. 1999. *The First 50 Years: Society of Actuaries 1949–1999.* Schaumburg, IL: Society of Actuaries.

Send us information about SOA history that will enlighten everyone about our organization's past, and serve as a springboard for future growth, as the actuarial profession continues to inspire and evolve. Write to *theactuary@soa.org* and share.

2019 ANNUAL MEETING & EXHIBIT

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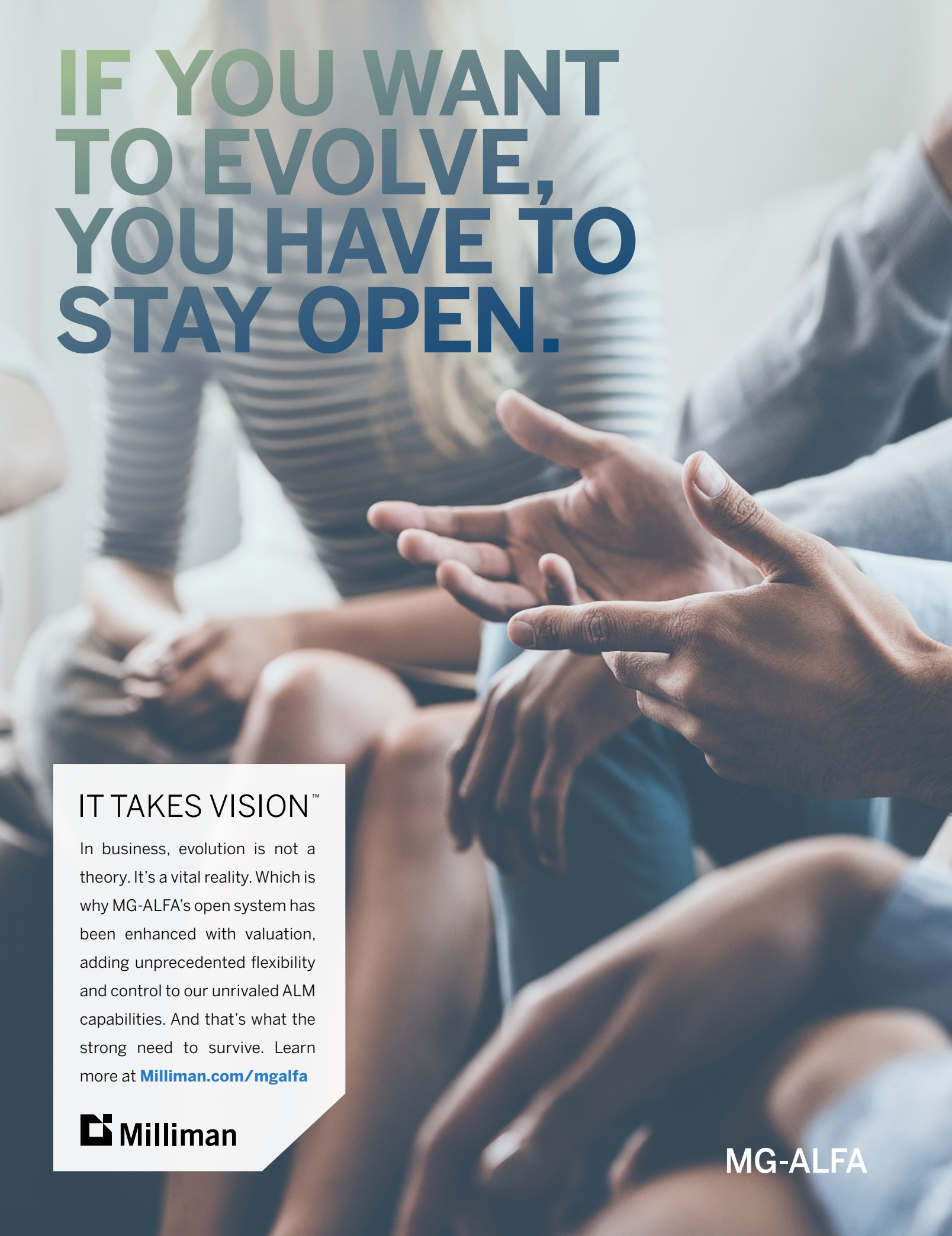
Register Now at *SOA.org/2019AnnualMeeting*.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