



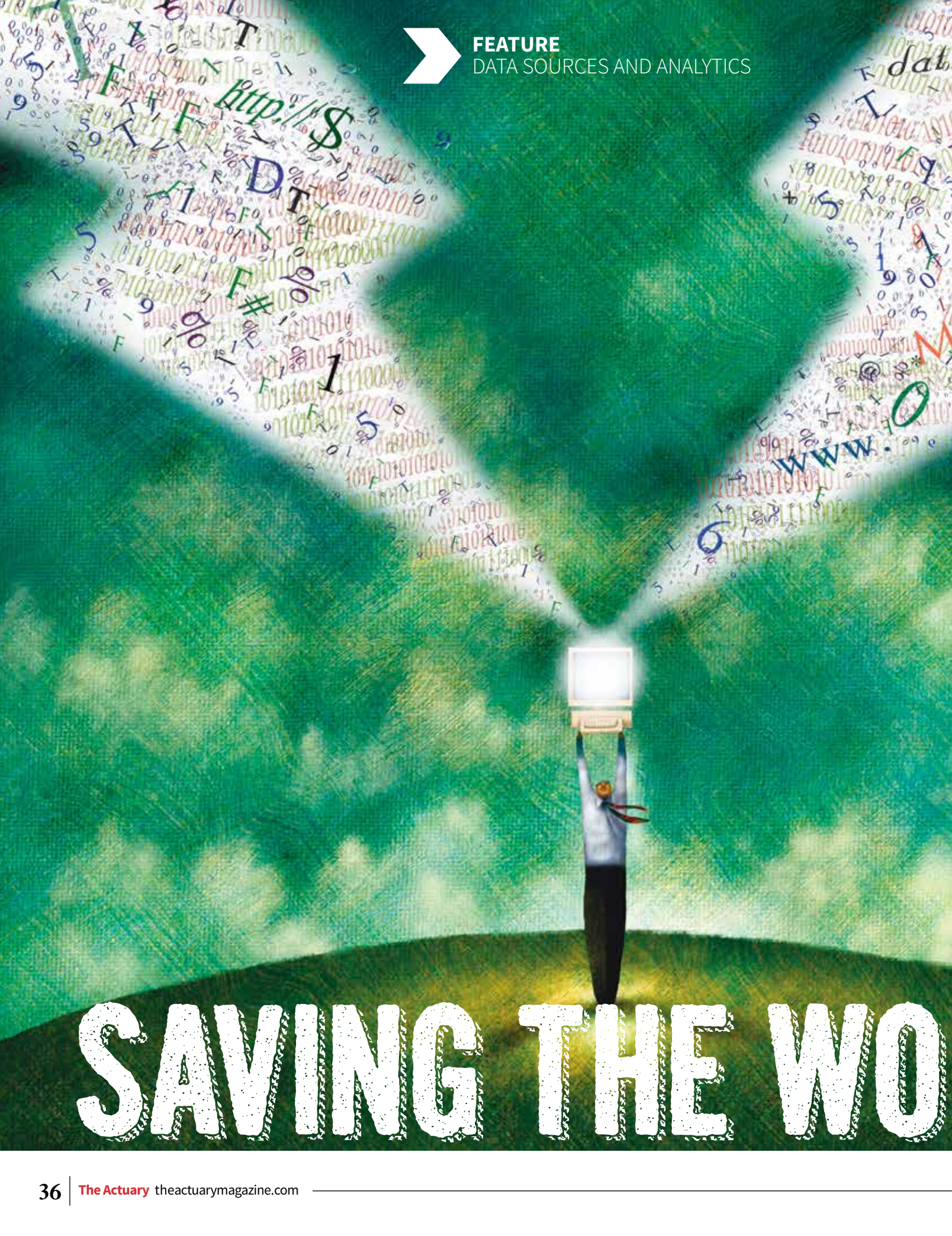
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**FEATURE**  
DATA SOURCES AND ANALYTICS



# SAVING THE WWO



**NEW DATA SOURCES  
AND MODELING  
TECHNIQUES ARE  
CHANGING THE  
WAY ACTUARIES  
ANALYZE RISK**

BY CHRIS STEHNO



It feels like every time you read a newspaper, glance at the cover of a magazine, or turn on the evening news you see or hear the words “big data” and “data scientists.” Long gone are the days of terabytes and petabytes. We now live in the world of exabytes ( $10^{18}$ ) and zettabytes ( $10^{21}$ ). In fact, the world is currently producing over five exabytes of data every two days.<sup>1</sup>

After several up-and-down years on the top-200 chart, the job of an actuary has once again reached the No. 1 spot as the best job in America.<sup>2</sup> However, other recent articles and surveys—such as one in the *Harvard Business Review*—now call data scientist the sexiest job in America.<sup>3</sup> In fact, the article was so bold as to declare data scientist the sexiest job of the 21<sup>st</sup> century. Can you believe that? An entire century of sexiness? To be completely transparent, I was not able to find a single source where an actuary was referred to as a “sexy” job, so this is not exactly an apples-to-apples comparison! However, I hope you get the point; there appears to be a new contender for the coolest math kid on the block.

Consider this a call to arms for actuaries to take back what once was theirs, and once again be known as the original data scientists and the originators of working with really big data. In the remainder of this article, I am going to highlight several examples of projects led by actuaries who are working to push mathematical dominance by applying advanced data analytics and big data to solve industry-specific business problems. In many cases, these actuaries are not just focusing on business results, but also working to improve the lives of our fellow citizens at the same time.

**MORTALITY FOR THE MICRO-MASSSES**

How many times has it been repeated that the life insurance industry has not changed the way it does business for the last 50 years? I am not sure I completely agree with that statement, and I can definitively state certain innovative life insurance companies and the actuaries working within them are now proving this notion false.

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As an example, although the payout for a \$10 million life policy is 100-fold the payout for a \$100,000 policy, the process a consumer goes through to purchase either of the two policies is nearly identical. In both cases, the consumer has to fill out a 10-page application; he or she will need to undergo a paramedical exam including a blood draw and urine sample; and then wait 30-plus days to find out what his or her annual premium will be based on the final underwriting categorization.

However, there are several life insurance companies that have questioned this process and are now using advanced predictive analytics and big data to make radical departures from this antiquated application process. One flavor of this is being called “application triage” and quickly is becoming a best practice in the circuitous routing of an application through the traditional underwriting process.

The new process works as follows: When a completed application comes in the door, an automated IT process calls out to a variety of data sources—both internal and external—containing traditional and nontraditional underwriting elements to pull in all of the required data elements. In many cases this process is completed within seconds of being initiated. These elements are then passed through a scoring engine using both predictive algorithms and business rules to determine what requirements will provide meaningful information to the underwriting process. In a large number of cases (more than 40 percent of the time), traditional underwriting processes such as paramedical exams and attending physician statements (APSs) can be passed over, and an applicant can be underwritten within a day or even in real time.

This is all made possible through

the blending of modern predictive analytics and traditional actuarial analysis. For those of you not in the life insurance domain, a commonly used business value assessment is known as the protective value study. It can be loosely defined as a cost benefit analysis used to determine the financial worth (in terms of mortality) of a particular underwriting requirement, such as a specific laboratory test or an additional data source like a prescription drug history.

It will not take you too much searching to find dozens and dozens of published protective value studies demonstrating the positive effects of all kinds of underwriting requirements. A result of all of these protective value studies has been a continual increase in the number of requirements or data sources used in the underwriting process over the years. This might be attributable to the companies that sell these services using actuaries to develop these studies for them. When you begin to review these studies, you will generally find that the results are reported in aggregate over a broad applicant population base. This in turn suggests that the laboratory or medical test in question will result in a positive return on investment (ROI) when applied to the entire applicant pool. In only a very few of the published studies will you ever find the results subsegmented across basic factors including age, gender, face amount or any one of the numerous basic medical application questions.

Application triage is changing the protective value study by looking at the ROI results over many subsegments. It works by using predictive algorithms that pre-segment the mortality risks of the population in the absence of the more invasive, costly and time-consuming underwriting requirements (paramedical exam, numerous lab

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tests, APS, etc.). Once the population is segmented by the predictive algorithm, individual protective values can be calculated across each of the risk subsegments instead of looking at results across the entire population. The subsegmented protective value studies now reveal that what historically was a positive ROI across the aggregated population base can now be broken out into population groups that show a considerably higher ROI than average, groups of average ROIs, and even groups that show negative ROIs for that particular test.

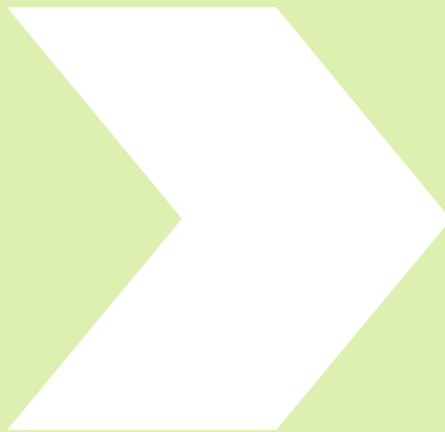
The result is a move away from the one-size-fits-all approach of underwriting requirements to a new personalized approach with individualized underwriting. This has all been made possible by actuaries blending traditional actuarial principles within the world of big data and advanced predictive modeling techniques.

There are numerous benefits to the consumer, including a new expedited approach to underwriting that eliminates the harsh and invasive medical requirements for a large percentage of applicants. The reduction of these expensive requirements can also lead to cost savings being passed on to the consumer. This makes the most sense today in the often underserved and underpenetrated middle-class marketplace, where underwriting expenses and commissions have made life insurance products out of reach for many people. Actuaries are now working on products, cost-effective risk assessment techniques and new distribution means to bring life insurance products back in line with the middle-marketplace pocketbooks.

**THE HEALTH IN HEALTH CARE**

Over the decades, many articles have been written about the alignment or rather misalignment of the health care payment structures and population

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**BY BLENDING ADVANCED PREDICTIVE MODELING TECHNIQUES AND TRADITIONAL ACTUARIAL PRINCIPLES WITHIN THE WORLD OF BIG DATA, ACTUARIES ARE MOVING AWAY FROM THE ONE-SIZE-FITS-ALL APPROACH OF UNDERWRITING REQUIREMENTS TO A NEW PERSONALIZED APPROACH WITH INDIVIDUALIZED UNDERWRITING.**

health strategies in the United States. The majority of provider contracts today are still considered fee-for-service, so the providers (doctors, hospitals, pharmaceutical companies, etc.) don't get paid until they provide a medical service or product to you. This arrangement points to the premise that the biggest revenue-generating customers are the unhealthiest populations.

Some have argued that health plans should be leading the population health management charge as many of their contracts are risk-based—hence, one would assume it would make sense for them. However, in their defense, historically it has been difficult to prove an ROI on wellness and preventive services due to the long-term nature of the return of those efforts compared to the relatively short membership duration of the average plan participant.

However, the stage is changing, primarily driven by the surge in individual policies and the new risk structures being set up between providers and the health insurers. As an example, I have had three different health plans in the last 10 years but the same primary care doctor that whole time. As providers take on risk-related payments, they might be in the exact position to profit from a healthy population.

There are two types of people who need to be considered in population health management: the currently sick and those who are not sick at the current time. For the currently sick, the industry as a whole has done a pretty good job calculating the costs associated with the sick and putting into place disease management programs to aid in curtailing those costs. The not-sick population is a completely different story. Very little has been done—by actuaries or the industry as a whole—with or for the seemingly well population.

One technique that is getting some notice is the use of lifestyle-based

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analytics (LBA) to segment the seemingly healthy into the truly healthy, the average healthy and those unhealthy who appear to be on the verge of the next medical event. LBA uses non-medical data sources to predict medical events. In short, LBA determines correlations between an individual's lifestyle activities, purchase behaviors and hobbies to specific medical conditions, such as chance of diabetes. For example, if you run, hike or bike you will have a lower cardiovascular risk than someone who spends a great deal of time and money on television or gaming devices.

In recent months, actuaries have really stepped up their game by building LBA algorithms that not only find the at-risk populations, but also look at individuals' behavioral aptitudes. Often referred to as change behavior, these models look at an individual's propensity to be ready for change and often contain a timing component as well. By combining at-risk models with change behavior models, actuaries are now able to identify those individuals on whom they can make a positive impact, resulting in both financial savings for the health plan/provider and, more importantly, the potential prevention of an individual's next major health event.

## PROPERTY AND CASUALTY'S (P&C'S) CONTINUED DOMINANCE IN BIG DATA ANALYSIS

I won't spend too much time on this specific area, as it is generally well known that P&C actuaries have been pushing the bounds of big data and risk analytics for many years. The newest example of big data in this domain is the data being collected and analyzed from telematics. Telematics devices can include plug-ins to automobiles' on-board diagnostic computers, the use of the vehicle's OnStar or SYNC devices, and the use of smartphone apps, all of which track metrics like

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**LBA DETERMINES CORRELATIONS BETWEEN AN INDIVIDUAL'S LIFESTYLE ACTIVITIES, PURCHASE BEHAVIORS AND HOBBIES TO SPECIFIC MEDICAL CONDITIONS.**

acceleration, maximum traveling speed, braking and even GPS locations.

Obviously, your speed, acceleration and braking make sense as risk metrics for underwriting. However, many of these telematics devices are now providing feedback to help you improve your driving habits. My first telematics report showed my daily driving metrics were in the worst 10 percent of drivers using the device. This took me by surprise, especially because I thought I was taking extra precautions knowing I was being tracked. It only took several weeks of reviewing my daily feedback before I was able to get my metrics within a more acceptable range—still above average, but acceptable nonetheless.

Did you know that with historical P&C underwriting you might have been paying more for living in a neighborhood with a busy intersection known to be hazardous nearby? With the new telematics devices, can you now be rewarded for driving an extra block out of your way to avoid busy intersections? I suspect in the near future your P&C carrier will team up with Google Maps to provide a couple of choices (the quickest route home, or one that takes an extra minute, is twice as safe and knocks \$0.50 off of your next insurance premium, for example).



**IF YOU RUN, HIKE OR BIKE YOU**

**WILL HAVE A LOWER CARDIOVASCULAR RISK THAN**

**SOMEONE WHO SPENDS A GREAT DEAL**

**OF TIME AND MONEY ON TELEVISION OR GAMING DEVICES.**

## THE NEWEST OF THE BIG DATA

The Internet of Things, the cloud, Facebook, Twitter. The list goes on for the hottest topics in the world of big data. However, I would suggest that in



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the domains of life insurance and health care, the biggest of big data will be the rapid emergence of electronic health records (EHRs). If you are an actuary working in either of these two domains, and if you have not, at a minimum, pulled your own EHR, shame on you!

For life insurance products, EHRs will revolutionize the way we assess risk. In many cases, no longer will paramedical exams be needed, nor the taking of additional fluids and lab work for many applicants; the waiting for APSs will diminish; and prescription data will be readily available.

Our snapshot look at health risks as seen through the paramedical exam can now be extended to years of lab results, body mass indexes (BMIs) and annual exams.

The long-standing approach of mortality regressing to the mean very well could be proven wrong as longitudinal data used for underwriting will become the norm. Applicant A, whose BMI, cholesterol and blood pressure have been increasing each year, will rightly have a different mortality than applicant B, whose BMI, cholesterol and blood pressure have remained flat for the last five years. In fact, with EHRs, simplified issue products (which in the future would include an EHR component) could be priced at similar rates to today's fully underwritten products.

In health care, the addition of lab data, physician and nursing notes, height and weight, and a longitudinal view of all of this information will make the prediction of future health risks and claims much more precise than the current methods, which primarily rely only on medical and/or pharma claims data. Most importantly, this data will allow us to engage the at-risk individuals, get them seeking preventive services, and prevent or deter that major medical event from ever happening.

Many have suggested that it will be another four to five years before EHRs are available and standardized into a commonwealth dataset. However, if you wait until that time, I guarantee you will be far behind the curve as many of your fellow actuaries are already working in this domain. They are finding creative means to collect EHRs from a wide variety of providers by writing and screen scraping direct pull programs. They are working on standardization protocols that use the continuity of care document (CCD) formatted data to identify and translate medical procedures, diagnoses, prescription codes, height and weight, and lab results, plus many other important variables contained within the EHRs into datasets that can be used in statistical analysis and predictive modeling.

### POSTPARTUM

The world of the actuary is changing; it may no longer need life tables, compound interest theory or actuarial claims triangles. What is surely needed are statistical software skills, data mining skills, and the thirst or desire for uncovering new data sources and/or modeling techniques to further our expertise in risk analysis and the resulting business implications.

If the above examples have not brought the sexiness into the actuarial profession, I am not sure what will! ■

<sup>1</sup> Gantz and Reinsel, "The Digital Universe Decade—Are You Ready?" May 2010, <http://www.emc.com/collateral/analyst-reports/idc-digital-universe-are-you-ready.pdf>.

<sup>2</sup> Tony Lee, "Jobs Rated Report 2015: Ranking the Top 200 Jobs," April 2015, <http://www.careercast.com/jobs-rated/jobs-rated-report-2015-ranking-top-200-jobs>.

<sup>3</sup> Davenport and Patil, "Data Scientist: The Sexiest Job of the 21st Century," October 2012, Harvard Business Review, <https://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century/ar/1>.

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