



**SOCIETY OF
ACTUARIES**

**PRODUCT
DEVELOPMENT
SECTION**

ISSUE 113 • JULY 2019

Product Matters!

Combination Products: An Accelerated Education

By Robert Eaton
Page 6

3 Chairperson's Corner

By Elena Tonkovski

**6 Combination Products:
An Accelerated Education**

By Robert Eaton

**12 What is In-Force
Management?**

By Jennie McGinnis

**14 Accelerated Underwriting:
Checking the Gauges**

*By Taylor Pickett and
Ryan LaMar Holt*

**18 Product Development
Section Research**

By Jim Filmore

**20 Lifestyle-Related Behaviors
and Mortality: A Comparison
of Physical Inactivity
and Smoking**

*By Julianne Callaway, Jason
McKinley, Richard Russell,
Kishan Bakrania and
Guizhou Hu*

**24 Post-Level Term Mortality
Expectations per
Dukes-MacDonald**

By Michael Parker



Product Matters!

Issue 113 • July 2019

Published three times a year by the Product Development Section of the Society of Actuaries.

475 N. Martingale Road, Suite 600
Schaumburg, Ill 60173-2226
Phone: 847-706-3500 Fax: 847-706-3599
www.soa.org

This newsletter is free to section members. Current issues are available on the SOA website (www.soa.org).

To join the section, SOA members and non-members can locate a membership form on the Product Development Section webpage at <https://www.soa.org/sections/product-dev/>.

This publication is provided for informational and educational purposes only. Neither the Society of Actuaries nor the respective authors' employers make any endorsement, representation or guarantee with regard to any content, and disclaim any liability in connection with the use or misuse of any information provided herein. This publication should not be construed as professional or financial advice. Statements of fact and opinions expressed herein are those of the individual authors and are not necessarily those of the Society of Actuaries or the respective authors' employers.

Copyright © 2019 Society of Actuaries.
All rights reserved.

Publication Schedule

Publication Month: October 2019
Articles Due: July 12, 2019

The digital edition of this newsletter can be found at <https://www.soa.org/sections/product-dev/>.

2019 SECTION LEADERSHIP

Officers

Elena Tonkovski, FSA, Chairperson
Ben Wadsley, FSA, MAAA, Vice Chairperson
Anthony Ferraro, FSA, MAAA, Secretary
Curt Clingerman, FSA, MAAA, Treasurer

Council Members

Michael Cusumano, FSA
Blake Hill, FSA, FCIA
Weiyang Liu, FSA, MAAA
Leonard Mangini, FSA, MAAA
Chris Ryan, FSA, MAAA

Newsletter Editors

Lindsay Meisinger, FSA, MAAA
lmeisinger@rgare.com

Curt Clingerman, FSA, MAAA
curt.clingerman@milliman.com

Blake Hill, FSA, FCIA
Blake.Hill@dacadoo.com

Program Committee Coordinators

Anthony Ferraro, FSA, MAAA
2019 Life & Annuity Symposium Coordinator

Leonard Mangini, FSA, MAAA
2019 SOA Annual Meeting & Exhibit Coordinator

Research Leads

Jim Filmore, FSA, MAAA
JFilmore@MunichRe.com

Donna Megregian, FSA, MAAA
DMegregian@RGARe.com

SOA Staff

James Miles, FSA, MAAA, Staff Partner
jmiles@soa.org

Jessica Schuh, Section Specialist
jlschuh@soa.org

Julia Anderson Bauer, Publications Manager
jandersonbauer@soa.org

Julissa Sweeney, Graphic Designer
jsweeney@soa.org

Chairperson's Corner

By Elena Tonkovski

I write this article as I sit inside Chicago's O'Hare International Airport awaiting my flight home and reflecting on my day. And what a day it was. This trip marked the first time I visited the Society of Actuaries (SOA) headquarters. Walking the halls of current and past presidents, looking at all the artifacts we have received as recognition for our efforts in the profession, hearing the stories that our hosts, Jessica Schuh and James Miles, had to share and talking to the SOA employees who took time out of their day to come and thank us for volunteering was quite the experience.

The Product Development Section Council held its first full-day face-to-face meeting discussing all the things we do within the council and what more we can do. We reflected on our mission statement. Although it was put in place when the council first started, it still rings true to what we strive to do today:

The mission of the section shall be to encourage and to facilitate the professional development of its members through activities such as meetings, seminars, research studies and the generation and dissemination of literature in the field of individual life insurance and annuity product development. The section focuses on new product innovations and the external items related to their development.

Until I joined the council, I didn't realize how much it actually does. We do all that our mission statement says and more. Not only do we organize industry-leading sessions for meetings and articles for our newsletter, but we also agree on what research studies to support, what project oversight groups we need to form, and what webcasts and podcasts our members would like to attend, as well as how to keep listening to what our members want and act on it.

We try to challenge what the current status is and bring you contests to spur new ideas. We have also formed the In-Force Management Subgroup to help those of us working in this area to find ways we can collaborate. To learn more about this area of practice, please refer to Jennie McGinnis' article "What is In-Force Management?" in this issue of *Product Matters!* Also in this issue you will find Jim Filmore's research column, which summarizes all of the section's current and planned research projects. And, as usual, enjoy reading the other interesting



The Product Development Section Council. From left to right: Chris Ryan, Curt Clingerman, Ben Wadsley, Weiyang Liu, Elena Tonkovski, Michael Cusumano, Anthony Ferraro

articles in this issue as listed on the cover page. Thank you to all the authors and editors for making this issue as great as it is!

But we still want to hear from you, our members, on what we should focus on. The Product Development Section pages of the SOA website provide the latest section news and a list of current council members who may be reached if you have any questions or thoughts to share. We look forward to hearing from you.

Last, I want to share a picture of our favorite artifact in the SOA office, the Wright Arithmeter. Elizur Wright (1804–1885) invented this large cylindrical slide rule, patented it in 1869 and sold it to insurance companies for \$500. It is the equivalent of a linear slide rule more than 60 feet long. According to historians, at least three arithmeters still exist. The arithmeter has been described as the historical starting point of the mechanization of the American life insurance business. ■



Elena Tonkovski, FSA, ACIA, is AVP and actuary, Global Products, for RGA. She can be contacted at etonkovski@rgare.com.



2019 **PREDICTIVE
ANALYTICS**
SYMPOSIUM

September 19–20
Philadelphia, PA

Unlock the power of big data
to improve business output and
performance.



Enhance your proficiency in the field of big data at the SOA's third offering of this dedicated symposium. Regardless of your experience with predictive analytics, you will find meaningful sessions that will enable you to take your skillset to the next level.



Register at [SOA.org/2019PASymposium](https://www.soa.org/2019PASymposium)

Combination Products: An Accelerated Education

By Robert Eaton

Consumers and insurance companies have been challenged by traditional stand-alone long-term care insurance (LTCI) products for more than a decade. Consumers have felt the financial strain of rising premiums on a product they likely expected to have level premiums. Companies have responded to the challenging trends in economic and actuarial experience by strengthening reserves and filing for new premium rate increases. The turbulence has seeded the landscape for the growth of an increasingly popular idea: the combined life and health insurance product. In this context, the health insurance coverage is supplemental medical insurance, such as long-term care or critical illness coverage.

MARKET

The combination life and health product has grown more common in recent years. Consumers now increasingly choose these combination products (sometimes called “combo” or “hybrid” products) over stand-alone LTCI to protect against risks of long-term care (LTC) and chronic illness. In 2015, the sales of combination products more than doubled those of stand-alone LTCI in terms of new policy counts, and that trend continued through 2018. Many consumers dislike the “use it or lose it” nature of a stand-alone health product such as LTCI; in turn, they value the promise of receiving benefits from a combination product whether or not they use the health benefits. This effect is magnified by a tendency for consumers to underestimate the eventual need for long-term care services. Agents often find it easier to promote the advantage of adding long-term care coverage to products that consumers already feel they need (such as life insurance) rather than selling them stand-alone LTCI products that they may perceive as less critical.

A large portion of combination products are sold as single-premium policies. Although this does make it an unaffordable option for much of the middle market due to the high up-front price tag, those who can afford it benefit from the typical rate

guarantees in the product. Even though current stand-alone LTCI products are less likely than ever to experience significant rate increases,¹ consumers still perceive these products as risky purchases subject to possibly large future premium rate increases. This perception fuels the attraction consumers feel toward combination products.

BENEFITS

Combination products provide valuable, and often substantial, health insurance coverage in the framework of a life insurance or annuity policy. Insurance companies offer many varieties of benefits in the market. This article addresses a range of combination life insurance and health products.

Consumers now increasingly choose these combination products over stand-alone LTCI.

Indemnity and Reimbursement Models

Similar to stand-alone LTCI products, benefits from combination products may indemnify policyholders a specific amount or may reimburse them for actual chronic illness or LTC costs. For instance, a combination life policy with LTC benefits might reimburse a policyholder for expenses up to \$5,000 per month. A life insurance policy with chronic illness benefits might indemnify a policyholder by accelerating 4 percent of the available death benefit each month.

Acceleration, Restoration and Extension of Benefits

The most common combination products are accelerated benefit riders, which advance all or part of the policyholder’s death benefit for a qualifying event, such as a chronic, critical or terminal illness. As a risk mitigation measure, companies may limit the acceleration amount to a maximum portion of the total face amount (e.g., 75 percent) or to a certain dollar amount (e.g., 50 percent of the face amount up to \$250,000). Furthermore, companies may change the eligible acceleration amount by attained age or other factors.

Companies may also extend the health benefit beyond the acceleration and restoration of benefits amounts to longer benefit periods. These policies carry greater health risk than the acceleration-only riders. Policyholders purchasing a more robust health benefit on their life insurance policies may be more anti-selective in nature. In pricing these products, actuaries should consider the portion of overall benefits that the company expects to pay out for life insurance and for nonlife benefits as well as the profile of the purchaser the product will attract along that spectrum.

In-depth coverage of the tax implications for combination product policyholders can be found in the Society of Actuaries *Life Insurance & Modified Endowments* text.²

REGULATORY FRAMEWORK AND GUIDANCE

Companies developing combination products should review the applicable regulations in the jurisdictions they wish to have the products filed. For accelerated death benefits to life insurance policies, the following regulations commonly apply.

NAIC Accelerated Benefits Model Regulation (620)

The National Association of Insurance Commissioners (NAIC) first issued Model Regulation 620, better known as the Accelerated Benefits Model Regulation (AB Model Regulation), in April 1998. This regulation is the guidance that allows accelerated benefits, including benefits for chronic illness, to be added to life products, provided certain requirements are met. These requirements include:

- obtaining a signed acknowledgment of concurrence for payout;
- certain criteria for payment, including the requirement to provide a lump-sum settlement option; and
- general disclosures, such as the need for a descriptive title, a description of tax consequences and a disclosure of administrative expense charges.



The AB Model Regulation also offers guidance regarding actuarial standards, disclosure and reserves. Note that an actuarial memorandum describing the accelerated benefits, the associated risks, the expected costs and the calculation of statutory reserves should accompany each filing and should be made available to state insurance commissioners upon request. The AB Model Regulation does not govern any qualified long-term care accelerated benefits; these are subject to the NAIC Long-Term Care Model Regulation (640).

NAIC Long-Term Care Model Regulation (640)

The NAIC LTC Model Regulation applies to stand-alone LTC policies as well as to “life insurance policies that accelerate benefits for long-term care.” Because the LTC Model Regulation was primarily written for stand-alone LTC policies, there are many notes and exceptions spelled out for LTC accelerated death benefits, including for the following areas:

- disclosure of tax consequences;
- requirement to offer inflation protection;
- reserve standards; and
- actuarial memoranda, found in the “Loss Ratio” section, 19.C.(5).

IIPRC Additional Standards for Accelerated Death Benefits

Adopted in August 2014 and effective four months later, the Interstate Insurance Product Regulation Commission (IIPRC) Additional Standards for Accelerated Death Benefits amended an earlier set of standards adopted in 2007. Riders filed under the Accelerated Death Benefits standard may not be marketed as LTC insurance. Similar to the NAIC model regulation framework, a separate IIPRC LTC standard applies to products marketed as long-term care offering qualified LTC benefits.

Consistent with its distinction from LTCI, the potential benefit triggers (i.e., the qualifying events) for an accelerated death benefit are more diverse than for a stand-alone LTCI product. Qualifying events under this standard could be based on the policyholder’s inability to perform a specified number of activities of daily living or cognitive impairment, as is true for LTCI, or there may be qualifying events for terminal illness or various other condition-based diagnoses. Terminal illness benefits must always be included in riders filed under this standard, while other triggers may or may not be included.

The standards also provide guidance related to benefit amount, benefit design options, the effect of benefit payments on other benefit provisions, exclusions and restrictions, expense charges,

incontestability, payment options, payment procedures, qualifying events, reinstatement and termination.

Finally, the IIPRC requires that a qualified actuary certify that the present value of the benefits of the base and rider policy combined is not more than 10 percent of the value of the base policy alone. In other words, the rider shouldn't add more than 10 percent to the expected policy benefits. This test is referred to commonly as the "incidental value test." Similarly, the actuary must also certify that the premiums (or cost of insurance charges) for the rider are less than 10 percent of those of the base policy.

PRICING

This section discusses the pricing of accelerated death benefit riders to life insurance policies, unless otherwise stated. Accelerated death benefit riders are among the most popular forms of nonlife coverage within combination life and health policies currently sold on the market. Many of the concepts discussed here (e.g., modeling, mortality assumptions, expenses) may be extended to other combination product features, such as extension of benefits or inflation benefit riders. Reinsurance on combination products is common, but practices vary as to when reinsurers pay for accelerated benefits; those issues are not covered in this article. A discussion of reinsurance on these riders can be found in the *Report on Life and Annuity Living Benefit Riders: Considerations for Insurers and Reinsurers*.³

Policyholder Behavior

These combination products offer long-term care (or similar) benefits, but companies have reason to believe that purchasers of these products will not behave like purchasers of traditional stand-alone LTCI products. Traditional LTCI policies are health insurance, and they may not carry any cash value. As a result, traditional LTCI policyholders face a "use it or lose it" scenario; if they don't access their LTCI benefits, they will not get any money back from the policy (with some exceptions, such as return of premium riders). A combination product policyholder, however, is guaranteed the life insurance benefit as long as the premiums are paid. At the margin, this will impact the decision-making of combination product policyholders as they balance accelerating a benefit today with reducing or eliminating the life insurance death benefit that their beneficiaries would receive later.

The combination product accelerated benefit typically carries a small value relative to that of the base life policy, because a primary portion of the cost is the time value of money cost involved in paying out benefits on average two to three years prior to death. Moreover, policyholders under some designs will pay no explicit premium for the rider. As a result, the combination

product policyholder likely does not view the chronic illness or long-term care benefit in the same light as the traditional LTCI policyholder who may pay \$2,000 per year or more for the stand-alone LTCI policy.

Financing

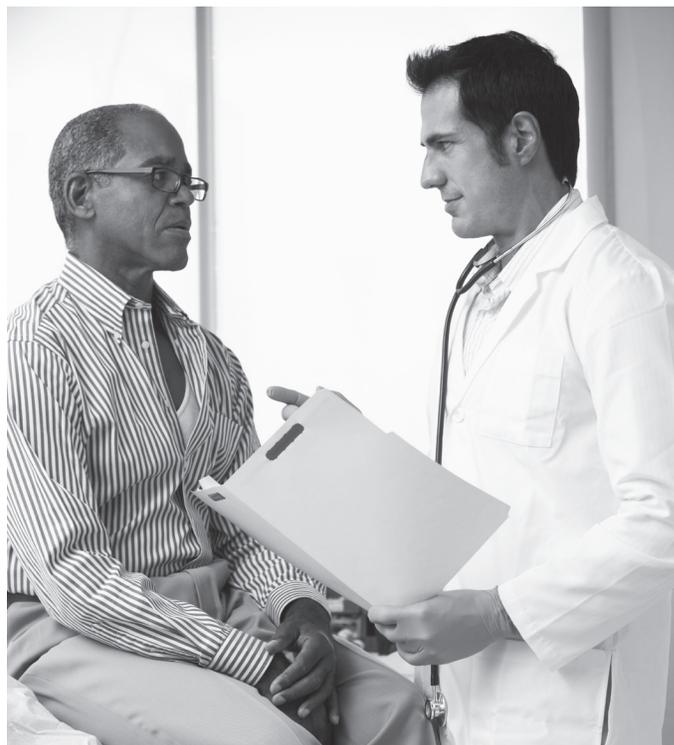
Accelerated death benefit riders are typically financed in one of three ways per NAIC Model Regulation 620: charging an explicit premium, discounting the benefit using a present value approach or establishing a lien on the base policy.

Explicit Premium

Companies that charge an explicit premium will develop premium rates per unit of face amount, or cost of insurance charges, to apply to the net amount at risk. This approach to financing is often referred to as the "dollar for dollar" method, as the policyholder receives 100 percent of the accelerated benefit elected and the death benefit is reduced by the same dollar amount. To file these rates in many jurisdictions, including the IIPRC, the actuary must certify that rider premiums overall are less than 10 percent of the value of the base policy premiums. Companies that charge a separate premium for the rider will also need to reserve for this benefit.

Actuarial Present Value Method

Instead of charging an explicit premium for the accelerated death benefit, companies may instead discount the accelerated benefit



payment. This “actuarial present value method” accounts for the time value of money that the company has forgone by providing the death benefit early. The pricing actuary will determine a set of actuarial discount factors to apply to the accelerated amount. These factors may vary by age at claim, sex, smoking status and so on. Some companies analyze the condition of the policyholder at the time of claim (referred to as underwriting at the time of claim) and determine the discount factor based on the policyholder’s life expectancy at that point. The actuarial present value method of pricing accelerated benefit riders may be appealing for its zero-dollar premium, but the company faces the risk of confusing the policyholder at the time of acceleration. If the rider benefits were not explained clearly at the point of sale, some policyholders may mistakenly assume that they will receive the entire accelerated amount request when in actuality they will receive that amount with a discount applied, which may significantly reduce their benefit.

Lien Method

Finally, companies may offer an accelerated benefit rider by assessing a lien on the policy at the time of claim. Similar to other policy loans, the policyholder pays interest on the lien subject to a maximum interest rate determined by regulation.

Impact on Policy Values

Accelerating a portion of the face amount affects the base life insurance policy. The policy form and the actuarial memo will specify the impact of the acceleration to the base policy cash value, policy loans, remaining face amount, net amount at risk and other factors. Typically the policy values are reduced in a pro rata fashion with the amount of the acceleration. For instance, if the policyholder elects to accelerate 25 percent of the face amount of a policy, the policy’s cash value will decrease by 25 percent. A portion of the acceleration may be used to pay back an outstanding loan—for instance, in this case paying back 25 percent of the outstanding loan. The base policy premium may also be reduced in a similar fashion, but this is required only when using the actuarial present value method. Accelerated benefits from products financed using the lien approach do not impact policy values. Instead, the lien amount, up to cash values, is booked as an admitted asset. However, gross policy values are reduced by the lien amount to determine net amounts payable to the insured.

Modeling

The pricing actuary will ideally price combination products using the same model as the base life insurance policy. The health benefit (e.g., chronic illness, LTC, critical illness) cash flows should be included in the calculation of net income. If the company must establish reserves for the health benefit, such as for an explicit premium rider, those reserves may be modeled

alongside the life insurance reserves. The change in total reserves will then be included in the calculation of net income.

Mortality

With the addition of the health benefit to the life insurance policy, the pricing actuary must estimate mortality separately for active and disabled lives. This estimate of mortality is a critical consideration when pricing a combination life and health product. The actuary should make explicit assumptions around the following items:

- If the actuary believes that including the health benefit with the life insurance policy will not materially impact the estimate of future overall mortality rates per life on the policy, a “conservation of mortality” may be assumed. This is a common approach used in pricing combination products. Under this approach, the actuary first estimates mortality for the disabled lives. Then, by estimating the future mix of active and disabled lives, the actuary can calculate the resulting active life mortality such that the total mortality of the base policy is conserved.
- If the actuary believes that including the health benefit with the life insurance policy impacts the total mortality, an adjustment to total mortality may be assumed. This adjustment could take the form of a scalar applied to the base policy mortality estimate, where the actuary can use the same balancing approach as described earlier to determine active life mortality.
- The disabled life mortality may be measured using data appropriate to the health benefit. For instance, the disabled life mortality for an LTC accelerated benefit rider to a whole life policy may be estimated by using LTCI continuance tables as a starting point. Typical LTCI continuance tables include terminations from death and recovery, and they are based on data from traditional LTCI policies. The pricing actuary should make adjustments to those continuance tables to reflect expectations of the future mortality of the combination product policyholder.
- The mix of active and disabled lives will be determined by the actuary’s estimate of the incidence of the policyholder triggering the health benefit. Once the policyholder triggers the health benefit, that person moves into the disabled life pool. For benefits that are paid over longer periods of time—say, a monthly acceleration for chronic illness—the actuary may assume that some disabled lives recover and move them back to the active life pool. This multistate modeling is complex, and the actuary should consider the impact of simplifying assumptions, such as modeling no recoveries when the claim terminates.

- Accelerated death benefits are typically offered as lump-sum accelerations to the base life insurance policy face amount. The company may allow part or all of the face amount to be accelerated. If only a portion of the face amount is accelerated, the actuary will want to consider the entire life to be disabled for the purpose of modeling mortality.

Expenses

Combination product riders are usually ancillary to the sale of the base life insurance products and therefore carry with them mostly marginal expenses. These marginal expenses may be expressed as a portion of premium for those riders that charge explicit premium. Companies may also charge an acquisition cost, typically a one-time expense per policy.

Most combination product issuers are life insurance companies that may not have experience handling complex health-type benefits. Claim expenses for rider benefits, particularly those benefits that reimburse actual costs, may therefore be high relative to expenses for riders paying a single lump sum, multiple lump sums or a stream of indemnity payments.

Companies may charge an administrative fee that can be deducted from the acceleration amount paid to the policyholder. States and other jurisdictions typically limit this fee, capping it at \$250 or in some cases \$100.

Premiums

For companies that charge an explicit premium for combination products, the actuary will target the company's internal profit metric—for example, statutory internal rate of return, profit margin as a percentage of premium or other internal hurdle rates. Companies that file combination products as individual non-LTC accident and health benefits, as opposed to filing them only as accelerated death benefits, will develop premiums that meet the minimum-loss ratio requirements in their jurisdictions. Companies filing acceleration riders that qualify as LTCI coverage are subject only to the LTC Model Regulation, including provisions on rate stability.

Synergies and Natural Hedges

For traditional stand-alone LTCI policies, claims paid in the later durations for a few policyholders are supported by premiums paid early on by many policyholders. The “lapse-supported” nature of this product means that higher-than-expected policy termination is financially favorable to insurers after expenses are recouped. For level premium combination life and health products, health claims may be substantially higher at older ages. If mortality and voluntary lapse are higher than expected on a base life policy, lifetime LTC or chronic illness morbidity experience will be more favorable, all else equal, because fewer insureds will persist into the later durations when most claims

occur. This phenomenon is a natural hedge between the life and health benefits offered in combination products.

There is also a hedge in the inverse scenario, when persistency is greater than anticipated, and this contributes to an increase in earnings on the underlying life policy unless the life policy is also lapse supported. Each of these hedges reduces the volatility of earnings across a range of adverse scenarios in the combination product relative to a stand-alone life policy or stand-alone LTCI policy. The volatility of combination product earnings is muted when considering fluctuation in other assumptions as well,⁴ such as investment earnings, LTC claim termination rates and persistency.

Each of these hedges reduces the volatility of earnings across a range of adverse scenarios.

UNDERWRITING

Companies issuing life insurance products need to address the additional risks of adding health riders to their policies. For companies conducting full underwriting on their base life insurance policies, additional application questions and a detailed medical history can help classify the riskiness of a combination product applicant. The larger the health benefit in relation to the life benefit, in general, the stronger the health underwriting should be to mitigate the risk of anti-selection.

For companies offering relatively small health riders to base life insurance policies, a more limited underwriting approach may be appropriate. The carrier will also want to consider who is making the benefit election and what choices they face.

For instance, some companies selling voluntary life insurance policies through the work-site market allow the employer to elect the combination rider. In this case, where the employee has little to no say in the election of the rider, and where risk is spread across all employees purchasing coverage, the insurer may elect to ask only one or two “knockout” questions in a simplified underwriting application. In cases where the carrier is charging a zero-dollar premium, financing the rider through the lien or actuarial present value methods, there may be lower risk of anti-selection, as the decision to purchase the policy and rider carries with it no additional marginal cost. Although this may be counterintuitive, think of the example of a combination life and health product with a health-benefit premium that is twice that of the base life policy. Purchasers of that product likely perceive a greater future need for using the health benefit than if the product had minimal health coverage.

RESERVING

The reserves requirements for combination products will depend on how the product is financed and whether the benefit is more substantial than accelerating the death benefit.

Active Life Reserves

The active life reserves required for the accelerated benefit portion of a combination product depend largely on the extent to which the benefit is prefunded. Many accelerated death benefits do not have an accompanying level premium or charge to prefund the benefit, so companies typically hold a minimal explicit active life reserve. The opposite is true for an independent extension of benefits rider, which does have a prefunding component and thus would require an active life reserve.

Claim Reserves

Once a policyholder goes on claim for an acceleration benefit, a claim reserve needs to be established. The mechanics for such a reserve are generally similar to a claim reserve held for a traditional long-term care policy. In theory, this claim reserve may be offset by a reduction in the expected value of future death benefits. Companies will reduce the claim reserve by the life policy account value.

MARKETING

Many companies now offer a combination product rider with their base life or annuity policies in order to stay competitive. Although a health rider is not usually the tipping point in a policyholder's decision to buy a life product, companies without combination products may not even be presented to the customer at the time of sale.

Companies developing combination products with a long-term care or chronic illness benefit will need to make the decision to offer the benefit as tax-qualified long-term care or as "chronic illness." Companies that wish to market their combination products as long-term care coverage must comply with the LTC Model Regulation.⁵

The LTC Model Regulation includes certain exceptions for accelerated benefit LTCI riders to life products—for example, not requiring that the rider have an inflation protection option. If the company has not offered an LTCI product before, it may find it cumbersome to comply with certain elements of

the Model Regulation, such as licensing agents or requiring an inflation protection option.

CONCLUSION

Life and health insurance combination products have been sold for many years and in some cases, such as terminal illness riders, are ubiquitous in today's market. Dwindling sales in the stand-alone LTCI market have prompted more life insurance companies to offer an LTC-like benefit. In this regard, the combination life and health product market may still be in its infancy, as substantial sales and experience continue to emerge. The coming decades could see increasing sales of combination products as insurance companies acclimate to these new risks and develop new benefits. Demography and economics point to a greater demand for solutions to financing LTC costs in retirement. Combination life and health products are paving the way for an expanding insurance market to meet that demand. ■

I wish to thank Joe Wurzburger at the Society of Actuaries for helping me develop this article and Carl Friedrich from Milliman for his peer review.



Robert Eaton, FSA, MAAA, is a consulting actuary at Milliman in Tampa, Florida. He can be reached at robert.eaton@milliman.com.stac.

ENDNOTES

- 1 Eaton, Robert. 2016. *Long-Term Care Insurance: The SOA Pricing Project*. Schaumburg, IL: Society of Actuaries. <https://www.soa.org/sections/long-term-care/ltc-pricing-project.pdf> (accessed March 28, 2019).
- 2 Society of Actuaries. 2015. *Life Insurance & Modified Endowments: Under Internal Revenue Code Sections 7702 and 7702A*, 2nd ed. Schaumburg, IL: Society of Actuaries.
- 3 Friedrich, Carl, Sue Saip, Teresa McNeela, Jody Mistal, and Robert Eaton. 2015. *Report on Life and Annuity Living Benefit Riders: Considerations for Insurers and Reinsurers*. Schaumburg, IL: Society of Actuaries. <https://www.soa.org/Files/Research/Projects/research-2015-04-considerations-for-insurers.pdf> (accessed April 10, 2019).
- 4 Chow, Linda, Carl Friedrich, and Dawn Helwig; Milliman. 2012. *Quantification of the Natural Hedge Characteristics of Combination Life or Annuity Products Linked to Long-Term Care Insurance*. Schaumburg, IL: Society of Actuaries. <https://www.soa.org/research-reports/2012/research-2012-03-quant-nat-hedge/> (accessed March 28, 2019).
- 5 The full text of the NAIC Long-Term Care Insurance Model Regulation is available at <https://www.naic.org/store/free/MDL-641.pdf>.

What is In-Force Management?

By Jennie McGinnis

What's in a name? That which we call a rose by any other name would smell as sweet.

—William Shakespeare¹

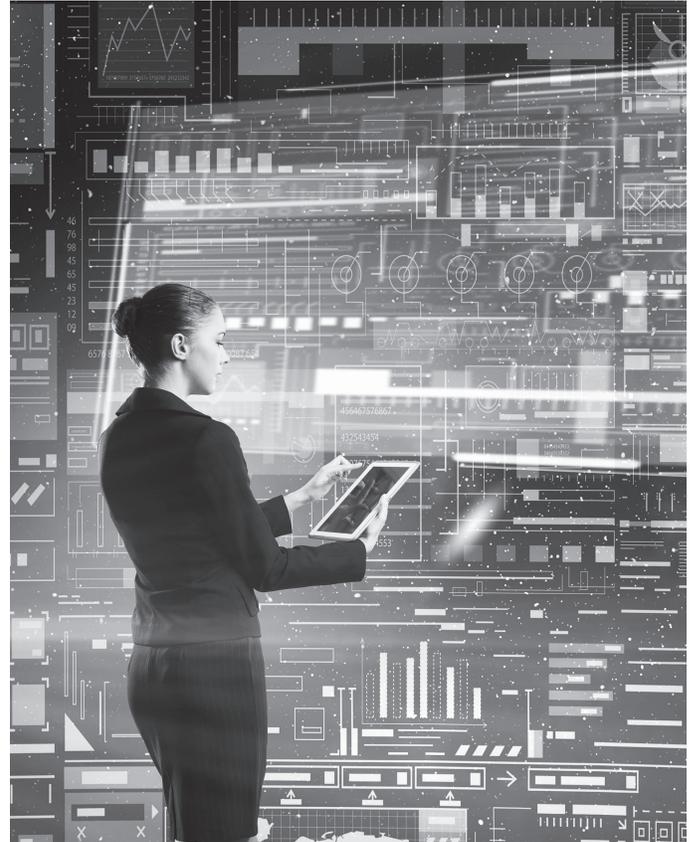
I don't care what you call me as long as the checks don't bounce and the family gets fed.

—Stephen King²

In-force management, in force management or inforce management? Or, rather than *management*, perhaps it's *optimization* or *solutions*? Or, rather than *in-force*, perhaps it's *profitability* or *policyholder*?

A realization that quickly came to light upon the formation of the In-Force Management Subgroup within the Society of Actuaries (SOA) Product Development Section last year is that the phrase does not mean the same thing to everyone, organizations set themselves up quite differently to address the topic and people have a variety of names for it. This creates the potential for issues regarding how the subgroup focuses its activities, particularly as the most common request from members has been to share best practices. “Best” practices can be hard to define if there's not a common understanding of the underlying practice to start with.

While I wrote last year about what is known about in-force management (IFM) activities based on polling at SOA meetings,³ this article focuses on what we learned from members of the In-Force Management Subgroup through a survey that was offered in December 2018. About 20 percent of subgroup members participated in the survey, with nearly two-thirds of those working for direct companies and three-fourths focused on life products. One-third of respondents noted spending more than 75 percent of their time on IFM activities, with the same proportion saying they spent less than 25 percent of their time on the same. Equal numbers of respondents identified as having spent more than 20 years in IFM as did those having two to five years of IFM experience (about one-fourth of respondents, in each case). So although the environment in which respondents work was largely consistent (direct writers of life products), the range of IFM experience varied widely.



To the question of what activities “count” as being IFM rather than other types of management, responses were unsurprisingly varied as well. Part of the variation came from respondents submitting lists of specific activities (e.g., nonguaranteed elements management) to sharing higher-level descriptions (e.g., anything post-sale). Among specific activities, themes did emerge relating to analysis (e.g., profitability analysis, experience studies), actions (e.g., policyholder services, cross- or upsell), and risk management (e.g., reinsurance, contractual compliance). Themes also emerged related to higher-level descriptions, pointing more to an ultimate reason for undertaking IFM (e.g., optimizing or improving profitability).

A particularly interesting finding was that activities that some teams include within their IFM scope were explicitly noted as being *outside* the scope for others. These included asset liability management, assumption setting, enterprise risk management, expense management, experience analysis, product development, reinsurance and the (re-)setting of nonguaranteed elements.

While these are all certainly relevant to the performance of in-force business, the question of whether or not they fall within an IFM mandate also raises questions regarding how to best address member needs related to these topics. It creates essentially a dual thread of topic development for the

subgroup—those that will support teams specifically mandated to perform IFM activities and those that will support raising the profile of in-force management activities within organizations, regardless of where they are done within that organization’s structure.

And that raises another area of variety: who has responsibility for managing in-force. Just over half of respondents noted that this mandate fell to a stand-alone team or department, while others made use of cross-functional teams, ad hoc working groups or some combination of all of these. For those with dedicated teams, there was also variety regarding within which part of the organization that team sat.

The most common response related to product development and maintenance—that is, a unit that considers the full product life cycle. Second-most common was within finance (ultimately reporting to the CFO), followed by sitting within a business unit (i.e., with clear profit and loss ownership). Other arrangements included product maintenance areas (covering all activities post-sale), actuarial (ultimately reporting to the chief actuary) and being within a central or group function.

This helps us understand that on top of activities varying, the context in which these activities are completed also varies. For example, the structure in which the team finds itself will influence how it thinks about prioritizing the activities it may undertake, and the team will have a differing sense of who its key stakeholders are.

On top of this, respondents viewed their measures of success differently, falling into two broad categories: financial performance and stakeholder satisfaction. Rising to the top of performance measurements were the usual suspects, whether profit generally or specific metrics such as GAAP income, return on investment, internal rate of return, capital or present value calculations. Comments on stakeholder satisfaction primarily highlighted

policyholder experience and feedback from leadership and other interested parties.

As previously noted, the largest ask from the survey respondents was for the sharing of best practices, along with the exchanging of ideas. Respondents sought to have this accomplished through networking and professional development opportunities. We take these requests seriously and are pleased to find that they align with what was envisioned for the subgroup when it was founded last year.⁴

Anyone with interest in in-force management (or whatever you choose to call it!) is welcome to join the Product Development Section’s In-Force Management Subgroup to enhance their network of individuals practicing in this space. Go to <https://www.soa.org/News-and-Publications/Listservs/list-public-listservs.aspx>, find “In-Force Management Listserv” and join. ■



Jennie McGinnis, FSA, CERA, is the leader of the In-Force Management Subgroup and senior vice president and in force portfolio manager at Swiss Re. She can be reached at Jennifer_McGinnis@swissre.com.

ENDNOTES

- 1 Shakespeare, William. *Romeo and Juliet* 2.2.47–48.
- 2 Tucker, Ken. A Rare Interview with Master Storyteller Stephen King. *Parade*, May 25, 2013, <https://parade.com/15671/kentucker/summers-best-books-starring-stephen-king/> (accessed June 11, 2019).
- 3 McGinnis, Jennie. 2018. In-Force Management: An Informal Survey. *Product Matters!*, October, <https://www.soa.org/globalassets/assets/Library/Newsletters/Product-Development-News/2018/october/pro-2018-iss111.pdf> (accessed June 11, 2019).
- 4 McGinnis, Jennie. 2018. Introducing the In-Force Management Subgroup. *Product Matters!*, June. <https://www.soa.org/Library/Newsletters/Product-Development-News/2018/june/pro-2018-iss110.pdf> (accessed June 11, 2019).

Accelerated Underwriting: Checking the Gauges

By Taylor Pickett and Ryan LaMar Holt

Accelerated underwriting (AU), a fully underwritten process in which some requirements are waived for a portion of applicants demonstrating favorable risk characteristics, has swept the industry at an incredible pace in recent years. Virtually nonexistent five years ago, AU is offered by more than 45 U.S. life carriers today, with still more on the horizon. For many of these carriers, the most pressing questions have now shifted in theme from the development and launch of an AU program to strategies for effective monitoring and management of an AU program.

The longevity of the prior fully underwritten paradigm has given us a much clearer picture of how key assumptions will be impacted when a new product—or even a slight underwriting change—is introduced, a direct result of 20-plus years of credible experience. Accelerated underwriting is so new, there is no credible experience available yet, and adjustments may be needed when using fully underwritten experience to inform development of assumptions for an AU program. Adding to the challenge, many of these adjustments by their very nature cannot be estimated from historical analysis, and those that can may manifest at different levels in production.

This uncertainty underscores the risk of letting an accelerated underwriting program run on autopilot. Any AU program will, at a minimum, require monitoring to gauge performance against initial expectations. It may also need to be refined and updated over time. Monitoring results may also be requested by reinsurers and regulators who consider its impact to reinsurance pricing and the appropriateness of valuation assumptions under principle-based reserves (PBR). This level of program management is achieved only by analyzing data captured from real production cases that have been processed by the AU program.

COLLECTING THE DATA

Monitoring is important for any AU program, but exactly what kind of data should be collected, and how is this accomplished?

At a basic level, it is beneficial to store all evidence used in making an accelerated decision, including third-party evidence and, to the extent possible, application disclosures. Beyond that, most

AU-monitoring programs use some combination of pre- and post-issue auditing. Pre-issue audits are most commonly performed through random holdouts in which all age and amount requirements are ordered and full underwriting is applied to a certain percentage of cases that would ordinarily qualify for an accelerated offer. Post-issue monitoring involves ordering additional evidence after the policy has been placed in order to check for undisclosed information. Attending physician statements (APS), post-issue prescription histories and MIB Plan F are commonly used here.

A robust monitoring program will provide leading indicators of program performance and will also highlight areas for potential improvements.

Both pre- and post-issue audits can be beneficial, but they should not be viewed as interchangeable. Pre-issue audits provide the truest comparison between results from the new AU program and the prior fully underwritten process, as all of the necessary evidence is available to produce both an AU and a fully underwritten risk class determination. This apples-to-apples comparison isn't possible with post-issue auditing, because the underwriter will not have access to all of the evidence that would have been used in full underwriting. A post-issue APS, for example, will almost always be missing key lab tests (e.g., a cotinine test) performed as part of an insurance lab panel, if it has blood work at all. Pre-issue audits also have the secondary benefit of catching and removing misrepresentation before policies are issued for audited cases.

Post-issue audits are performed on policies that have already been issued through the AU process. Therefore, deliberate action, including after-issue rate class adjustments and possibly even live rescissions, is required when material misrepresentation is discovered if the quality of the business is to be impacted. However, post-issue audits may uncover types of targeted misrepresentation that could be missed through pre-issue auditing. For example, if an applicant is aware of a medical risk factor but avoids consulting a physician until after applying for life insurance, evidence of this condition may be absent at the time of initial underwriting. Cases like this could possibly be discovered through tools such as a new post-issue prescription history check.

Many carriers have found a combination of pre- and post-issue audits to be the best approach.

Whatever tools and methods are used to audit the AU program, it is critical to capture information on both the class that would have been offered through the AU program and the class that would have been offered based on the additional information discovered through the audit process. In cases where these two are different, the information leading the underwriter to make a different decision with full evidence should also be captured.

Accelerated cases should also be distinguishable from cases for which full requirements are still ordered so that these two pieces of the business can be studied independently as experience emerges. This should make its way into administration reporting for reinsurers as well so that any downstream reporting can appropriately reflect the differences between these two groups.

USING THE DATA

Once the data are captured, it is possible to start evaluating the AU program performance against initial targets and expectations. The key performance indicators (KPIs) used to quantify the main program goals at launch will often guide the focus of these efforts. Goals are commonly developed for acceleration rate (what percentage of applicants receive an accelerated offer) and mortality slippage (how much mortality changes relative to the prior fully underwritten baseline), along with others related to expense reduction, increase in placement rate and more.

With any of these metrics, it is first critical to understand the basis for the calculation. When calculating the acceleration rate,

the numerator is generally very clear: the number of applicants who received an offer without fluid testing, paramedical exam and/or other necessary tests. The denominator, however, can vary significantly from one carrier to the next. It could represent all applicants within the age and face amount limits of the AU program, or it might be limited to applicants who use a particular process (e.g., tele-app) or ones who first pass a list of prescreen questions and criteria. Whatever combination of restrictions apply, it is imperative to be consistent between the definition used when setting goals for the program and the calculation used when analyzing production results.

Many carriers use a confusion matrix to estimate mortality slippage by comparing the prior fully underwritten class of an applicant to the class that person would receive under the new AU program. A live confusion matrix (see Figure 1) can be populated based on results from random holdouts in order to evaluate the program’s performance in production. In this example, the level of accurate classification is mostly as expected in the top two classes. However, more tobacco cases than expected slip through to an accelerated non-tobacco class.

This technique can also be used with post-issue audits, in which case it will also be important to consider the impact of information available from prior evidence (generally an insurance lab panel and a paramedical exam) that may not exist in the evidence used in the audit (e.g., an APS). Once again, the more consistent the confusion matrix is with the targets developed when the

Figure 1
Example Live Confusion Matrix

Expected Audit Decision	AU Decision		
	Best NT	Preferred NT	Standard NT
Best NT	70	0	0
Preferred NT	15	70	0
Standard NT	7	20	80
Rated NT (Tables 1–4)	2	2	10
Rated NT (Table 5+)	1	2	2
Preferred Tobacco	1	1	1
Standard Tobacco	0	1	2
Rated T (Tables 1–4)	0	0	0
Rated T (Table 5+)	0	1	0
Decline	1	0	2
Cancel/Withdrawn	3	3	3

Abbreviations: NT, non-tobacco; T, tobacco.

Actual Audit Decision	AU Decision		
	Best NT	Preferred NT	Standard NT
Best NT	68	0	0
Preferred NT	12	72	0
Standard NT	8	15	75
Rated NT (Tables 1–4)	2	2	11
Rated NT (Table 5+)	0	1	1
Preferred Tobacco	3	2	2
Standard Tobacco	1	2	4
Rated T (Tables 1–4)	0	1	1
Rated T (Table 5+)	0	0	0
Decline	0	1	2
Cancel/Withdrawn	6	4	4

program was designed, the more valuable it will be—a principle that applies for all of the program’s KPIs. Taken together, this analysis shows whether or not the program is meeting its targets and the magnitude of any discrepancies.

If variances exist from expectations (as in Figure 1), other metrics can be useful in determining the causes for that deviation, answering the questions “How?” and “Why?”

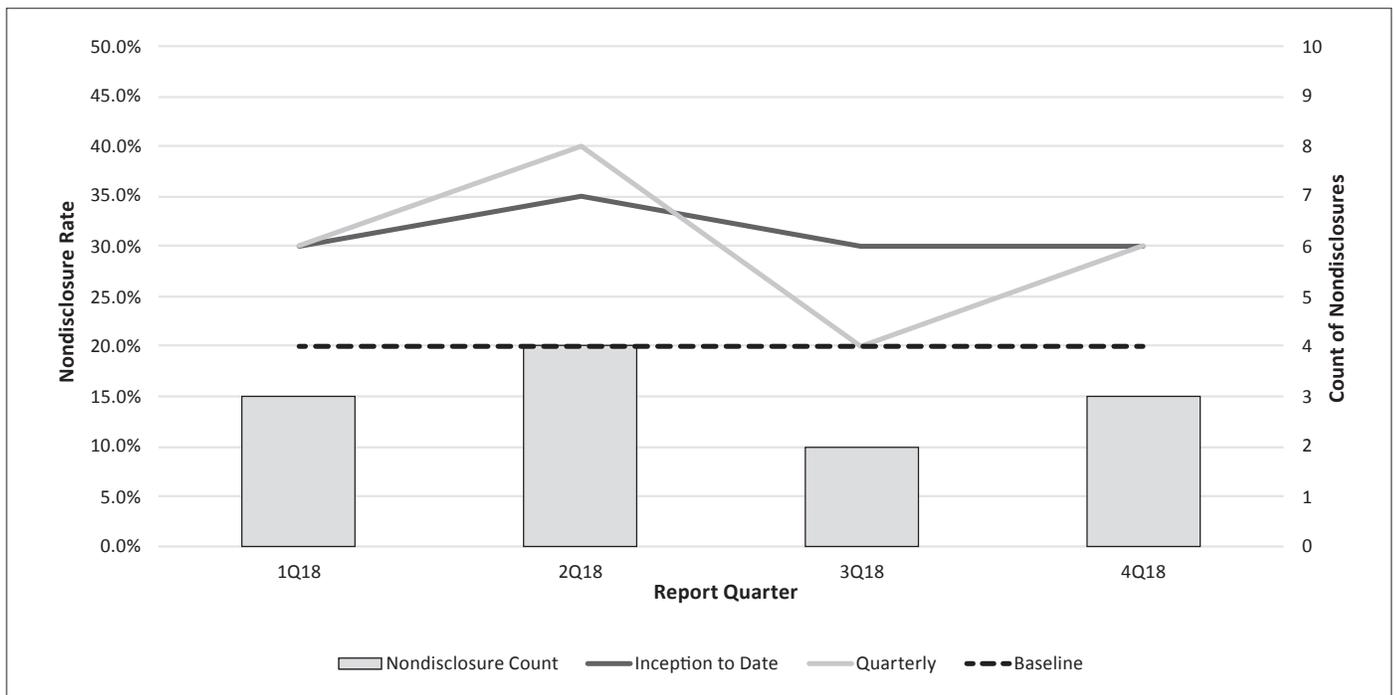
Applicant (and, in some cases, agent) behavior is a major unknown when introducing an AU program. How will applicant disclosure change in the absence of known testing? Will the change in process encourage agents to engage a materially different group of risks than they have in the past, or could the introduction of the AU program attract new applicants? Comparing distributions by demographic variables (age, gender, risk class, etc.) and third-party evidence pre- and post-AU can illustrate whether the applicant pool is changing. Analyzing misrepresentation for verifiable risk factors can show how applicant behavior is changing.

In Figure 2, tobacco nondisclosure seems to be tracking at a 50 percent increase relative to the pre-AU baseline. Similar analysis can be performed for other risk factors, such as build (Figure 3). Results like this can help identify the root causes for variance from expectations uncovered in the confusion matrix.



Analysis of more traditional measures can be useful as well. It will likely take some time for credible mortality experience to emerge, but analyzing causes of death on early claims (particularly for accelerated cases) can help identify possible holes in the AU process. Tracking distributions by risk class can show

Figure 2
Random Holdouts, Tobacco Nondisclosure



if the shifts projected at program launch are materializing. For example, if more individuals than expected are offered Super Preferred, this could suggest that nondisclosure is higher than expected or that certain application questions or rules allow more cases than expected to slip through the cracks. Similarly, face amount and tobacco disclosure trends by agent, such as an agent suddenly selling many more cases at the maximum AU face amount or an agent with no admitted smokers, can indicate areas for further investigation.

Even the rate at which applications are withdrawn—particularly at certain points in the process—can provide useful information. Although somewhat informative on its own, this type of data is most useful when paired with pre-AU values to provide context. Referring back to Figure 1, the withdrawal rate is higher than expected for the best class. If these applicants withdrew when additional testing was required, that could be an indication of possible anti-selective behavior. Similarly, in Figure 2, the level of tobacco nondisclosure would be less of a concern if the prior baseline were 30 percent, as that would seem to indicate applicant behavior is not changing in the absence of testing, and this would have been reflected in the initial assumptions.

CONCLUSION

As more carriers move past the launch of their accelerated underwriting programs, the ongoing management of those programs

will start to become an area of much greater focus. A robust monitoring program will be at the core of these efforts for many carriers. This will provide leading indicators of program performance and will also highlight areas for potential improvements (e.g., revised application wording and adjustments to score cut points), both of which will be crucial to sustainable success. This becomes more critical in a PBR world as carriers seek to justify their mortality assumptions in the absence of a credible experience study for their AU programs.

It is crucial that carriers check the gauges on their AU programs frequently in order to both capitalize on the opportunities presented by accelerated underwriting and steer clear of obstacles in the road. ■

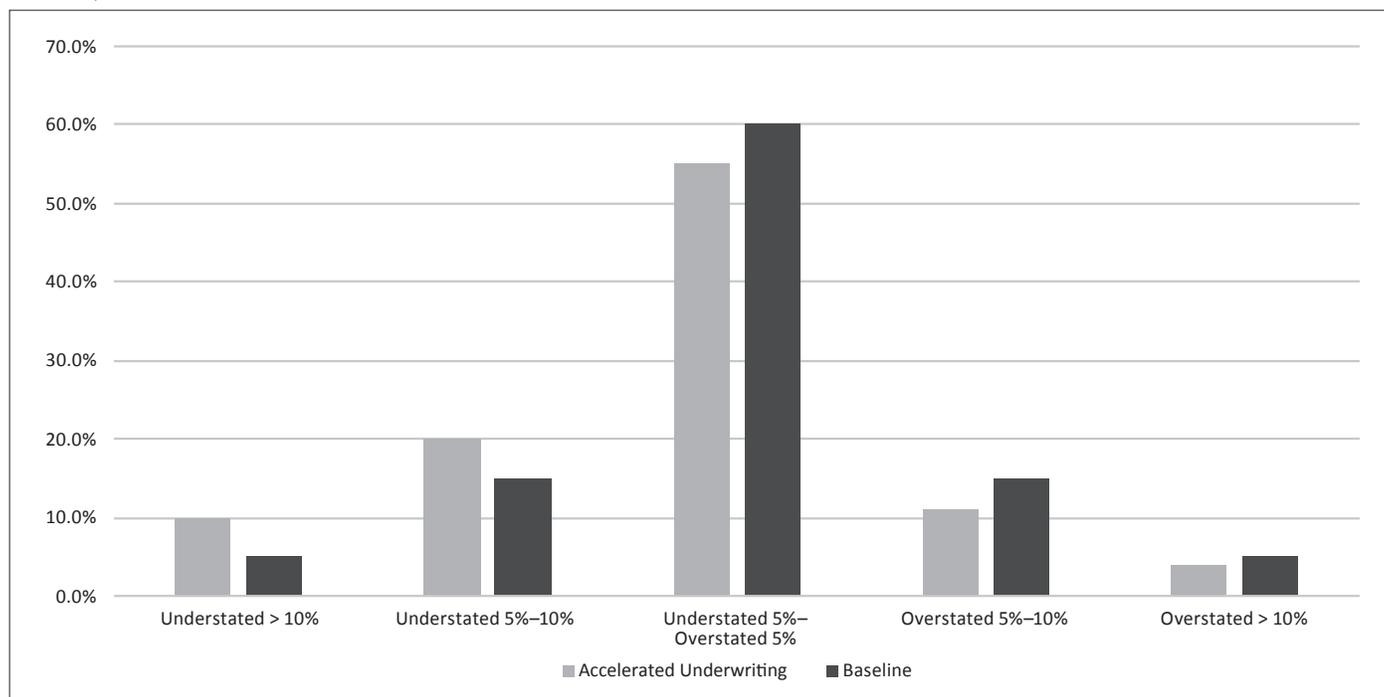


Taylor Pickett, FSA, MAAA, is an actuary in RGA's U.S. Mortality Markets division. He can be reached at jpickett@rgare.com.



Ryan LaMar Holt, FSA, is a senior assistant actuary in RGA's U.S. Mortality Markets division. He can be reached at ryan.holt@rgare.com.

Figure 3
Self-Reported Build vs. Measured Build



Product Development Section Research

By Jim Filmore

As you likely know, the Product Development Section uses its section membership dues to finance its work, such as publishing the *Product Matters!* newsletter and conducting research projects. Those membership dues are then leveraged by use of volunteers whenever possible. As I write this article, I'm impressed by how much research is being conducted by our section and what a fantastic return is being provided each year by the investment of our \$25 annual dues per member.

This column highlights research that the Product Development Section either has recently completed or is currently conducting. Some research projects are cosponsored by more than one SOA section, both to help spread the cost of the project and to ensure that the results are applicable to actuaries practicing in difference functions (such as pricing and valuation). Other research is conducted solely by the Product Development Section in conjunction with our research partners at the Society of Actuaries (SOA).

If a particular topic profiled here piques your interest, you can go to the SOA website to find more information. The final deliverable on each project is available on the website once the research has been completed. Those deliverables typically include a report regarding the scope of the project and the results. Some projects also include additional information, such as spreadsheets containing the results or tools that actuaries can use to apply the results to their business.

RECENTLY COMPLETED RESEARCH

The Product Development Section has completed three large-scale research projects over the past several months. All are available on the Product Development Section research page of the SOA website:

- **Practical Analysis of PBR Mortality Credibility for Term Insurance.** This research examines the impact of VM-20 mortality credibility requirements on life insurers and of the potential solutions for increasing credibility levels.

- **Mortality Analysis of the 1898–1902 Birth Cohort.** The 1898–1902 birth cohort for the U.S. presents a unique opportunity to analyze the mortality of this cohort at advanced ages with a high level of confidence in the results. Advanced ages can be easily verified, as this cohort was too young to qualify for Medicare when it was first introduced, so proof of age was required when they qualified in the following year. Deaths from this cohort and subsequent cohorts at ages 65 and up should be available in governmental records, such as the Social Security Administration Death Master File.
- **Survey of Waiver of Premium/Monthly Deduction Rider Assumptions and Experience.** This report contains the results of a survey that was conducted to better understand practices regarding disability waiver of premium benefits offered on individual life products in the United States.

RESEARCH CURRENTLY UNDERWAY

Many more research projects are at varying stages of completion:

- **Canadian Predictive Analytics.** This is a survey of predictive analytics techniques being used by actuaries in Canada. The project is nearing completion, and we anticipate that the report will be posted soon to the SOA website.
- **Modeling and Forecasting Cause of Death.** This project entails evaluating data regarding mortality cause of death in the United States. The deliverable will be a research report discussing the approach and results. A second deliverable will be a tool (likely Excel) that allows users to make their own assumptions regarding the future prevalence of certain causes of death to see how that impacts mortality rates in the future. We anticipate the research will be completed and the results posted to the SOA website before the end of this year.
- **Credibility Theory in Canadian Life Insurance Industry.** This research project began as a survey of credibility approaches being used by life insurance actuaries in Canada. The research was then expanded to demonstrate the impact on results if a different approach to defining credibility was taken. The project is nearing completion, and we anticipate that the report will be posted soon to the SOA website.
- **Validation of Predictive Models for Insurance Applications.** This research is intended to be a resource for actuaries and other practitioners to address the challenges



insurers face with validating predictive models. This project is nearing completion and should be posted soon to the SOA website.

- **Life Insurance Accelerated Underwriting Survey.** This survey examines life insurance accelerated underwriting programs and practices. The survey results are currently being consolidated and analyzed.
- **A Machine Learning Approach to Incorporating Industry Mortality Table Features in Mortality Analysis.** This research will assist in the development of a method of using a machine learning approach for inputting industry mortality table features in creating predictive models.

- **Simplified Underwriting Survey.** This survey of companies is gathering data regarding simplified-issue underwriting practices on individual life products.
- **InsureTech.** This project intends to provide actuaries and insurance professionals with an introductory guide regarding history, current landscape and potential for the future. This research has just been initiated. ■



Jim Filmore, FSA, MAAA, is vice president and actuary at MunichRe. He can be reached at JFilmore@MunichRe.com.

Lifestyle-Related Behaviors and Mortality: A Comparison of Physical Inactivity and Smoking

By Julianne Callaway, Jason McKinley, Richard Russell, Kishan Bakrania and Guizhou Hu

Editor's note: This article was first published by RGA on Jan. 31, 2019, and is reprinted here, in abridged form, with permission.

Rates of diabetes, heart disease, respiratory disorders, certain cancers and other noncommunicable diseases are increasing globally, and a growing body of evidence links lifestyle behaviors, such as physical inactivity, poor nutrition and smoking, to the increase.

It should come as no surprise that spending excessive time behind a computer or on a couch, using tobacco products or eating fatty foods could have negative effects on longevity. The modern, sedentary lifestyle may be comfortable, but it contributes to a cluster of chronic and profoundly costly “sitting diseases.” Perhaps the clearest indication of this phenomenon is the dramatic and well-documented global rise in obesity rates over the past 40 years. The average adult today is three times as likely to be obese compared to the average adult in 1975.¹

A growing waistline is directly associated with a shrinking life span. In fact, the World Health Organization (WHO) estimates that rising obesity levels are responsible for the growing prevalence of a range of noncommunicable diseases, taking the lives of approximately 40 million people aged 30 to 70 annually. Worldwide the number of adults living with diabetes has almost quadrupled since 1980. In the United States, 30.3 million adults (nearly 1 in 10) have diabetes, 28.1 million have cardiovascular disease and almost 15.7 million suffer from chronic obstructive pulmonary disease (COPD).^{2,3,4} Together these conditions are responsible for more than half of all deaths globally each year.

Growing awareness of the health risks associated with inactivity is fueling interest in insurance-linked wellness programs that are supported by activity evidence from wearable devices. Against a

KEY FINDINGS

- Lifestyle behaviors significantly contribute to health outcomes.
- Physical activity improves longevity.
 - People with lower daily steps and those who do not exercise have higher mortality than those who are more active.
 - Activity, especially vigorous activity, is even more important for our health as we age.
- Exercise cannot negate the negative impact of smoking.
 - Physically active smokers experience worse mortality, on average, than the least active nonsmokers.

backdrop of growing use of nontraditional evidence in underwriting and accelerated underwriting, it can be tempting for insurers to replace the costly and slow nicotine/cotinine screening required to reliably detect an applicant’s smoking status with data-driven variables reflecting physical activity. In this paper we investigate the relationship between physical activity, smoking and mortality risk using two large U.S. health data sets. We demonstrate that, while physical activity has a significant impact on longevity, no amount of exercise can negate the profoundly elevated mortality risk associated with smoking.

ASSESSING PHYSICAL ACTIVITY AND MORTALITY

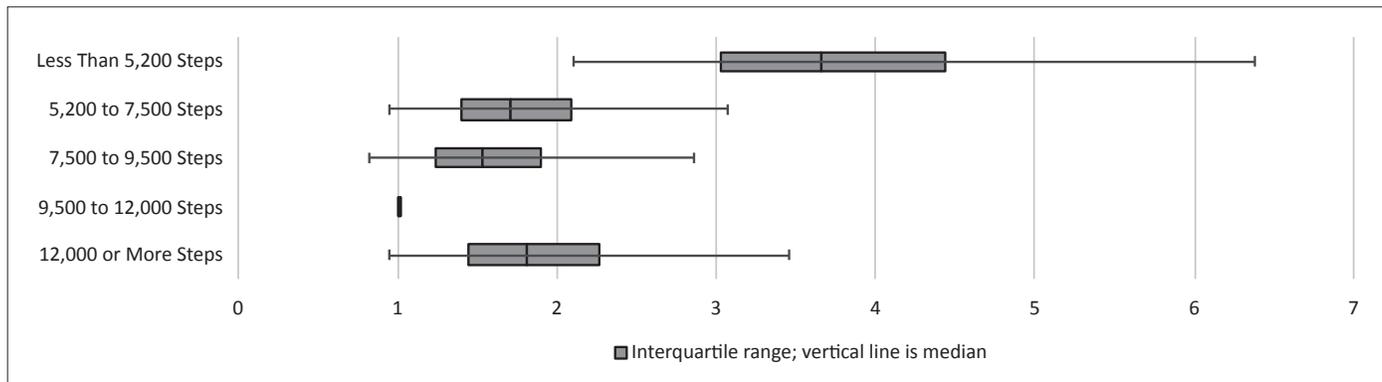
To understand the relationship between lifestyle behaviors and mortality, RGA investigated two national, health-related, mortality-linked data sets provided by the U.S. Centers for Disease Control and Prevention (CDC): The National Health and Nutrition Examination Survey (NHANES) and the National Health Interview Survey (NHIS).^{5,6} For a complete description of the research methodology, please reference the research paper, “Lifestyle-Related Behaviors and Mortality: A Comparison of Physical Inactivity and Smoking.”⁷

Steps

Step counts present an objective measure of physical activity. Additionally, step metrics have been available for many years, providing a greater amount of historical data for evaluation than some other activity metrics.

The all-cause mortality hazard ratios shown in Figure 1 segment the mortality of participants according to quintiles of measured activity with a reference category of 9,500–12,000 average daily steps. Those in the lowest quintile of steps per week—walking less than 5,200 steps—had the highest mortality. Mortality

Figure 1
All-Cause Mortality Hazard Ratios by Average Daily Step Quintile



Source: RGA analysis of 2005–2006 National Health and Nutrition Examination Survey data, paired with linked mortality followed up to 2011. Multivariate model adjusts for age, sex, smoking, disease history, health status, income and ability to walk a quarter mile.

experience declines with increasing step counts, though there may be some evidence of a slight increase in mortality for those walking 12,000 or more steps.

Although number of steps per day is certainly related to activity, it is important to note that measuring steps will not capture all elements of physical activity. For example, steps may be a reasonable activity measure for runners, but steps will not accurately capture the physical activity of swimming, cycling or even playing tennis. Wearable technology is rapidly evolving and devices are getting better at measuring other activities, but these measurements are difficult to compare against step counts. Therefore, it is important to review a host of activity metrics, not just steps, when trying to understand the relationship between physical activity and mortality.

Intensity and Age

Engagement in physical activity, particularly vigorous physical activity, becomes more important as we age. Numerous studies have concluded that regular participation in activities from moderate-intensity walking to very high-intensity sports increases accumulated daily energy expenditure and helps participants maintain muscular strength. In contrast, less active lifestyles have been linked to premature onset of cardiovascular and metabolic diseases, obesity, cognitive impairments and general frailty in the elderly.^{8,9}

RGA studied NHIS data to better measure the impact of intensity on mortality experience. Findings in Figure 2 demonstrate the mortality experience of different age groups who do not exercise relative to the mortality of members of that same age group who exercise two to six times a week. The top set of bars compares moderate exercise by age, while the second set of bars compares vigorous exercise by age. Hazard ratios for those who do not exercise increase with age for both moderate and

vigorous exercise intensity, indicating that physical activity is more important as we age.

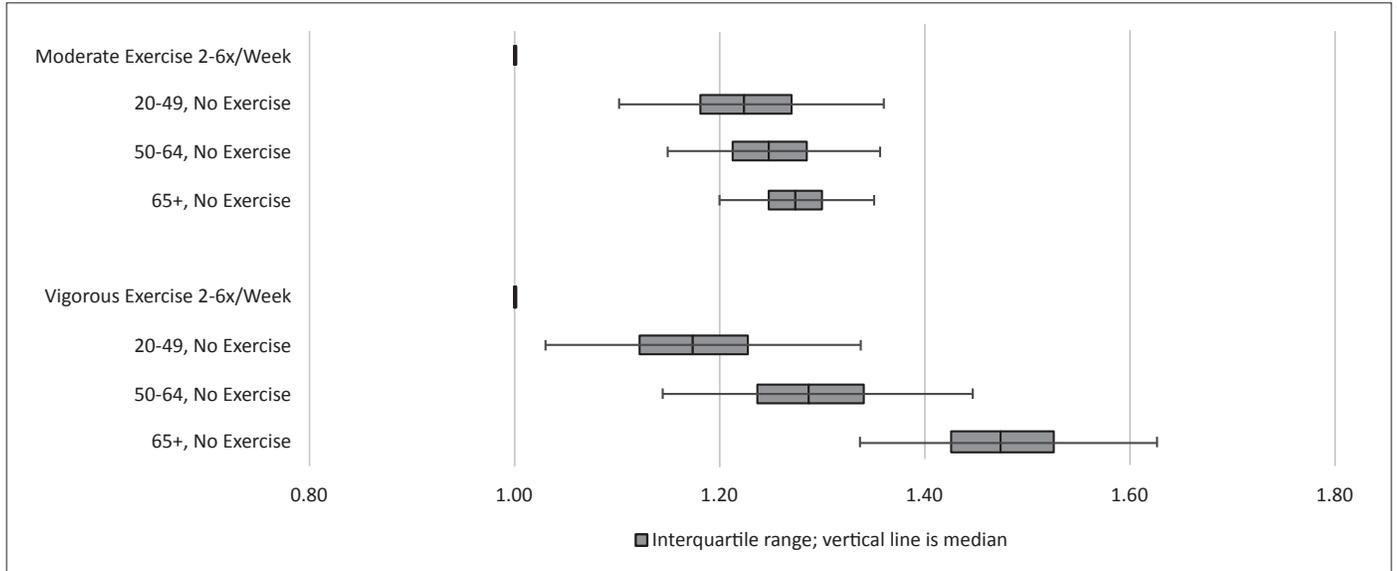
PHYSICAL ACTIVITY AND SMOKING

Physical inactivity is pervasive—and continues to drive worrying levels of noncommunicable disease. So it is understandable to compare against another leading cause of mortality: tobacco use. In fact, such comparisons have led researchers and reporters alike to boldly declare that *sitting is the new smoking*. In other words, they claim physical inactivity is at least as detrimental to health as smoking. RGA set out to evaluate this claim by comparing mortality levels associated with both behaviors and determining the implications for insurers. The conclusion is clear: Although a sedentary lifestyle is clearly linked to higher mortality risks, smoking remains far more deadly.

To study this, survey participants were grouped by both smoking status and physical activity. The measure of physical activity in this analysis was the perceived level of physical activity compared

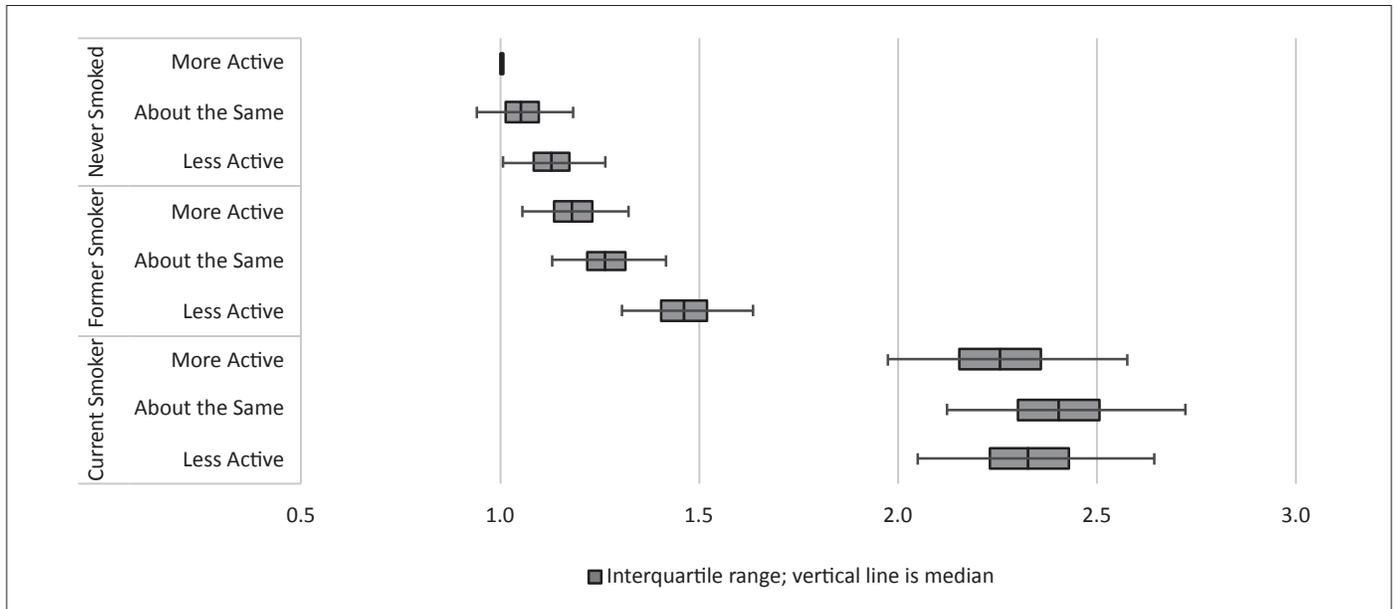


Figure 2
All-Cause Mortality Hazard Ratios by Intensity Level



Source: RGA analysis of National Health Interview Survey data, 1987–2015. Multivariate model adjusts for age, sex, smoking, disease history, health status and income.

Figure 3
All-Cause Mortality Hazard Ratios by Smoker Status and Physical Activity Relative to Peers



Source: RGA analysis of National Health Interview Survey data, 1987–2015. Multivariate model adjusts for age, sex, disease history, health status and income.

to people of the same age (peers). The top three bars in Figure 3 represent hazard ratios for people who have never smoked by activity relative to peers, the middle bars show experience of former smokers, and the bottom bars show the experience of current smokers by varying levels of self-reported activity compared to peers. Every group's result is set relative to people who never smoked and who consider themselves more active than their peers. While mortality experience improves with more activity, even the more physically active smokers experience worse mortality than less active nonsmokers.

CONCLUSION

Lifestyle choices, including physical activity and smoking, significantly impact longevity. There are many challenges to researching the impact of lifestyle on mortality. As a consequence, it is critical that insurers view counterintuitive and sometimes conflicting reports with skepticism and ground risk assessment in statistically significant, reproducible analysis.

The evidence to date points to one conclusion: Exercise is still not a better predictor of mortality outcomes than tobacco use, even though exercise improves mortality experience and activity becomes more important as we age. A person cannot exercise away the damaging effects of smoking, but they can smoke away the benefits of exercise. ■



Julianne Callaway, FSA, is a vice president and actuary of Strategic Research in RGA's Global Research and Data Analytics division. She can be reached at jcallaway@rgare.com.



Jason McKinley, FSA, is an actuary in RGA's Global Research and Data Analytics division. He can be reached at jmckinley@rgare.com.



Richard Russell, Ph.D., is lead health data scientist in RGA's Global Research and Data Analytics division. He can be reached at rrussell@rgare.com.



Kishan Bakrania, Ph.D., is a health data scientist in RGA's Global Research and Data Analytics division. He can be reached at Kishan.Bakrania@rgare.com.



Guizhou Hu, M.D., Ph.D., is a vice president and head of risk analytics in RGA's Global Research and Data Analytics division. He can be reached at guizhou.hu@rgare.com.

ENDNOTES

- 1 NCD Risk Factor Collaboration. 2016. Trends in Adult Body-Mass Index in 200 Countries From 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *The Lancet* 387, no. 10026:1377–1396. <https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2816%2930054-X/fulltext> (accessed June 10, 2019).
- 2 Centers for Disease Control and Prevention. 2017. *National Diabetes Statistics Report, 2017*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. <https://www.cdc.gov/diabetes/data/statistics/statistics-report.html> (accessed June 10, 2019).
- 3 Centers for Disease Control and Prevention. 2017. *Summary Health Statistics Tables for U.S. Adults: National Health Interview Survey, 2016, Table A-1*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. <https://www.cdc.gov/nchs/fastats/heart-disease.htm> (accessed June 10, 2019).
- 4 Wheaton, A. G., T. J. Cunningham, E. S. Ford, and J. B. Croft. 2015. Employment and Activity Limitations Among Adults With Chronic Obstructive Pulmonary Disease—United States, 2013. *Morbidity and Mortality Weekly Report* 64, no. 11:290–295.
- 5 Centers for Disease Control and Prevention, National Center for Health Statistics. *National Health and Nutrition Examination Survey*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. <https://www.cdc.gov/nchs/nhanes/Default.aspx> (accessed June 10, 2019).
- 6 Centers for Disease Control and Prevention, National Center for Health Statistics. *National Health Interview Survey, 1987–2015*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. <https://www.cdc.gov/nchs/nhis/index.htm> (accessed June 10, 2019).
- 7 Callaway, J., J. McKinley, R. Russell, G. Hu, and K. Bakrania. 2019. *Lifestyle-Related Behaviors and Mortality: A Comparison of Physical Inactivity and Smoking*. St. Louis, MO: RGA Reinsurance Company. <https://www.rgare.com/knowledge-center/media/research/lifestyle-related-behaviors-and-mortality-a-comparison-of-physical-inactivity-and-smoking> (accessed June 10, 2019).
- 8 L. DiPietro. 2001. Physical Activity in Aging: Changes in patterns and their relationship to health and function. *The Journals of Gerontology. Series A*, 56, no. 2:13–22. DOI: 10.1093/gerona/56.suppl_2.13.
- 9 McPhee, J. S., D. P. French, D. Jackson, J. Nazroo, N. Pendleton, and H. Degens. 2016. Physical Activity in Older Age: Perspectives for healthy ageing and frailty. *Biogerontology* 17, no. 3:567–580. DOI: 10.1007/s10522-016-9641-0.

Post-Level Term Mortality Expectations per Dukes-MacDonald

By Michael Parker

Life insurance companies have taken a new look at setting premium rates on their term products during the so-called post-level term (PLT) period. This is because new theories have emerged that suggest setting PLT premiums at lower levels might in fact drive higher profitability as a result of more favorable persistency.

To quantify this phenomenon, many companies have adopted the Dukes-MacDonald (DMD) method, a calculation that predicts how anti-selective lapsation affects expected mortality.

In this article, I compare first PLT year mortality levels predicted by the DMD method to the mortality experience realized according to the SOA-sponsored publication *Report on the Lapse and Mortality Experience of Post-Level Premium Period Plans (2014)*. This comparison leads to several important observations about the use of Dukes-MacDonald (Figure 1, next page).

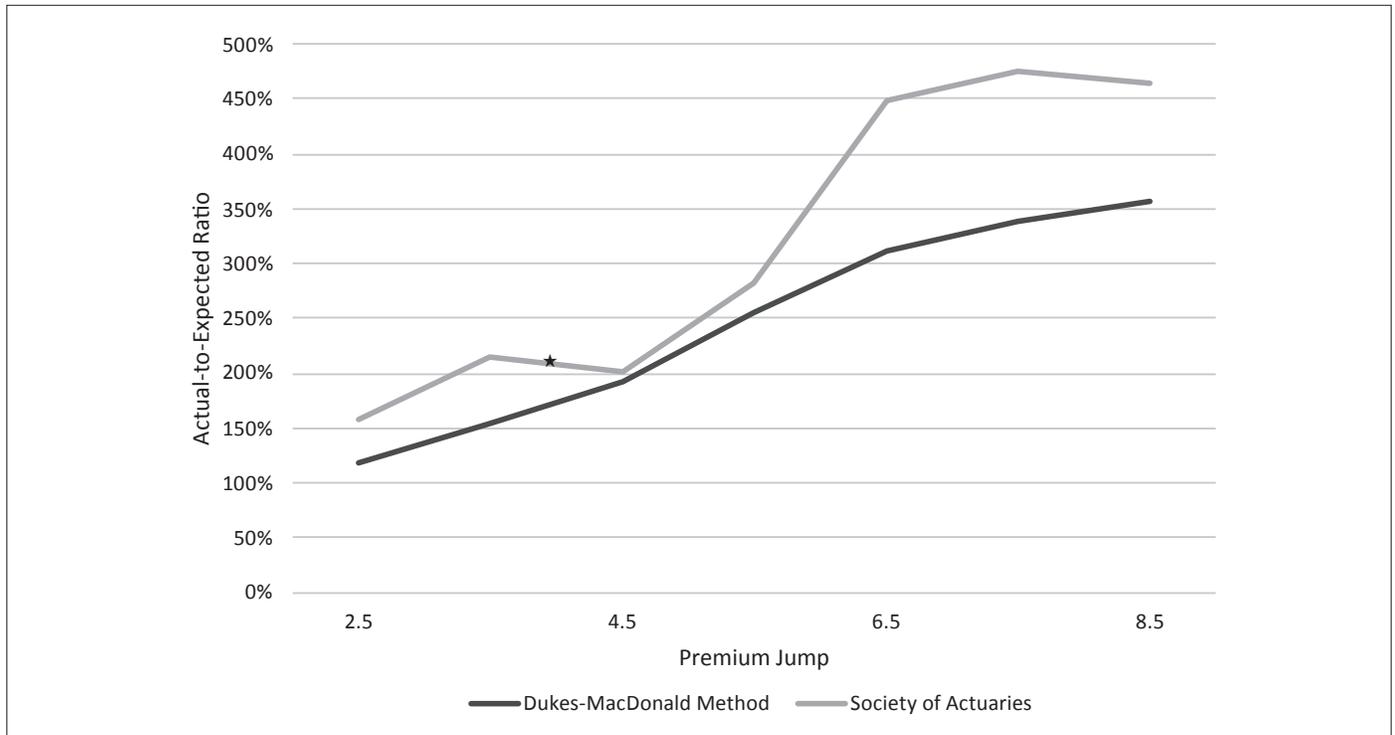
Of course, the results shown in Figure 1 reflect certain choices regarding the DMD calculation (95 percent efficiency, 10 percent base lapse rate, DMD Option II—excess efficiency deaths spread across persisting block and “inefficient” lapsed). But understand that these choices were made in an attempt to generate an *ordinary* scenario, one that is representative of a typical insured and reasonable implementation of DMD. Also note that the calculation was executed in accordance with ALFA, one of the industry’s most commonly used pricing software packages.

This comparison leads to several key observations:

- Companies using DMD calculations and parameters like those used in this article may underpredict first-year PLT mortality compared with industry experience, potentially by a significant margin. Note that for some premium jump sizes in our example, experienced mortality was more than 40 percent higher than that predicted by Dukes-MacDonald.
- To forecast appropriate mortality levels, the key DMD parameters need to be chosen deliberately to generate an intended mortality level. A passive reliance on “reasonable” assumptions could lead to material mortality misstatement.
- DMD parameters that correctly forecast mortality for one premium jump size may not correctly forecast mortality at other premium jump sizes. This makes intuitive sense because DMD fundamentally hinges on an assumption about the “selectness” of lapsing lives, and it is *not* possible



Figure 1
 Comparison of First-Year Post-Level Term Mortality Forecast by the Dukes-MacDonald Method* and Industry Experience for a Representative Case**



* 10 percent base lapse rate. 95 percent efficiency. Excess “efficiency” deaths spread across persisting block and “inefficient” lapsers. Shock lapse rates by premium jump size come from Society of Actuaries, *Report on the Lapse and Mortality Experience of Post-Level Premium Period Plans (2014)* (2.5–30.6 percent, 3.5–52.4 percent, 4.5–65.1 percent, 5.5–76.4 percent, 6.5–82 percent, 7.5–84 percent, 8.5–85.2 percent).

** 10-year term policy, male nonsmoker, age 45 preferred. Point-in-scale $q = 1.50/1,000$. Select $q = 0.50/1,000$.

★ Note the decline in the SOA mortality actual-to-expected ratio circa a jump of 4.5–5.5 times the premium. This feature of the data may correctly reflect the relative inefficiency of incremental policyholders reacting to premium increases of this midrange size. It could make sense that policies that lapse in reaction to small premium increases will be very healthy and therefore very efficient regarding their decision to lapse, while persisting policies at the opposite end of the spectrum *not* lapsing in the face of very large premium jumps will be very *unhealthy* and therefore will also be very efficient. It is the policies in between that will be more uncertain of their health and therefore less efficient.

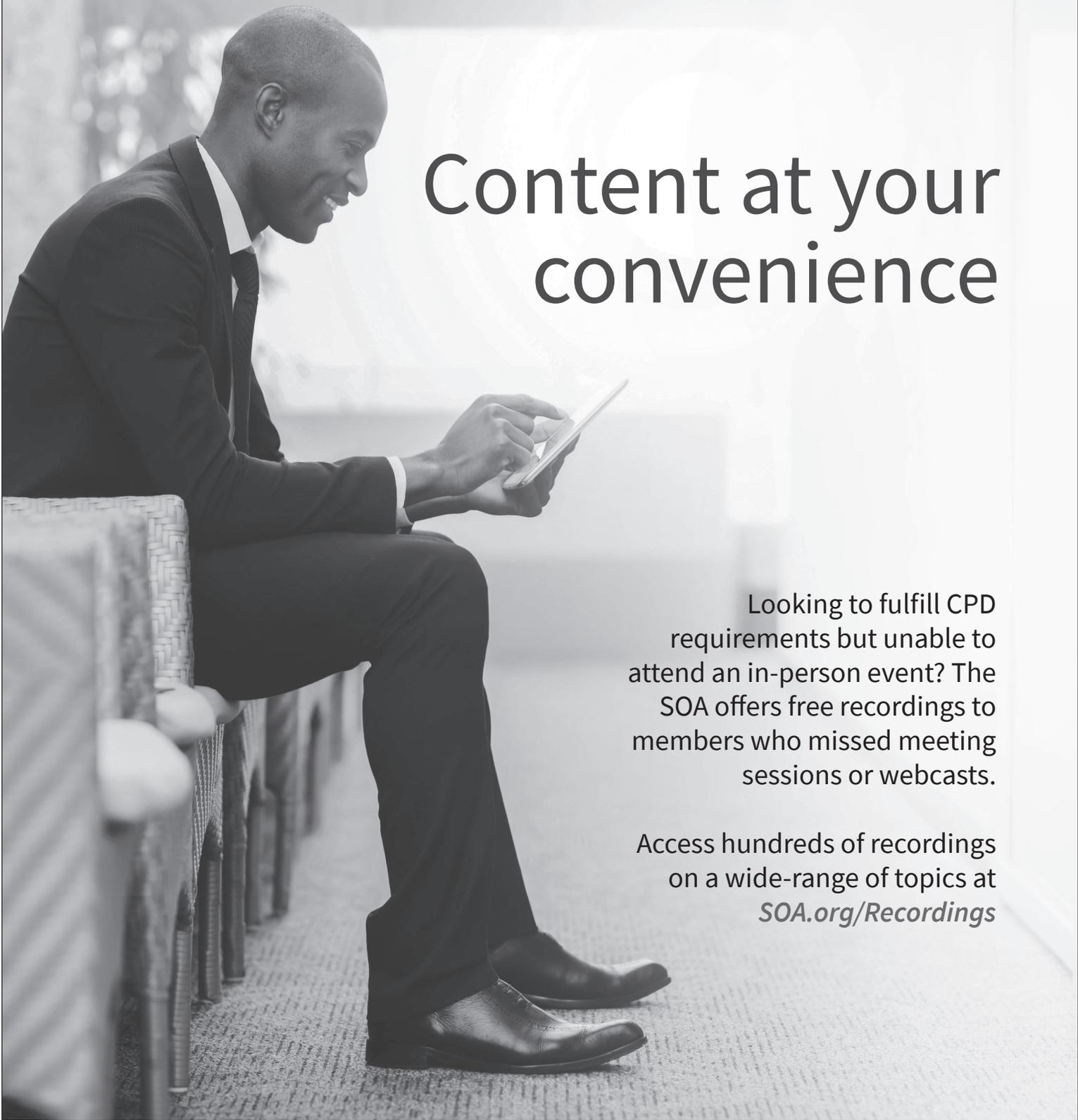
that lapsing lives could have the same mortality expectation regardless of how large the lapsing block is. This seemingly obvious assertion leads to an interesting conclusion: that DMD parameters, particularly the efficiency rate, should be viewed as *variables* across premium jump level sizes, not constants.

This final observation will be particularly important in circumstances in which different-sized premium jumps are being considered—for example, in an instance where a single product includes a variety of different premium jump sizes for different ages, classes, sexes and so on, or during a PLT rate-setting exercise in which a variety of different premium jump strategies are being considered.

In conclusion, Dukes-MacDonald is an excellent tool for predicting anti-selective mortality, but it needs to be used carefully. Its parameters should be calibrated so that DMD produces results that match experience data, whether industry data or company data. And if a broad variety of premium jump sizes are being considered, the parameters may need to be conceived as variables rather than constants so that they will yield valid results across a broad range of scenarios. ■



Michael Parker, FSA, MAAA, has spent most of his 20-year actuarial career practicing in the area of life insurance product development and consults for several major insurance companies. He can be reached at michael.parker@optimaactuarial.com.

A black and white photograph of a man in a dark suit and tie, sitting on a light-colored wicker chair. He is looking down at a tablet computer he is holding in his hands. The background is a bright, out-of-focus interior space with large windows.

Content at your convenience

Looking to fulfill CPD requirements but unable to attend an in-person event? The SOA offers free recordings to members who missed meeting sessions or webcasts.

Access hundreds of recordings on a wide-range of topics at [SOA.org/Recordings](https://www.soa.org/Recordings)



**SOCIETY OF
ACTUARIES®**

2019 ANNUAL MEETING & EXHIBIT



EVOLVE

with today's disruptive technology.

EMPOWER

yourself through innovation.

ELEVATE

the actuarial profession.

October 27-30

Toronto, Canada

It all begins at the **2019 SOA Annual Meeting & Exhibit**, where you'll 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. Embrace change today to create a stronger tomorrow for the actuarial profession.

Register Now at SOA.org/2019AnnualMeeting



SOCIETY OF ACTUARIES®

475 N. Martingale Road, Suite 600
Schaumburg, Illinois 60173
p: 847.706.3500 f: 847.706.3599
w: www.soa.org

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
SAINT JOSEPH, MI
PERMIT NO. 263

