PartnerRe

Surprise Findings

Mortality Patterns in Life Insurance Applicants with Declinable Lab Results

Contents

Abstract

Accelerated underwriting has altered the pool of insured risks for life insurance carriers by including some lives which would have previously been declined under full underwriting. By waiving traditional requirements such as physical exams, blood testing, and urinalysis, these programs reduce barriers to issuance and introduce risks that the industry has not historically been able to study, since insurance companies have not had these lives on the books to track their experience.

This paper addresses this gap by examining laboratory results from life insurance applicants presenting with declinable values and evaluating their associated mortality using a referent expected mortality framework based on the 2015 VBT industry table. Through this analysis, we evaluate the mortality experience of these applicants and how mortality varies across specific univariate declinable lab results.

Our findings show that declinable risks exist along a spectrum, with distinct mortality implications. We quantify relative mortality across these declinable lab ranges and demonstrate aggregate mortality patterns that are consistent with results found in previous PartnerRe research on declinable mortality. These results help clarify the mortality impact associated with previously declinable risks slipping into accelerated underwriting programs, providing practical context for both underwriting and risk management decisions.

Research Objective and Case for Analysis

The recent rise in popularity of accelerated underwriting programs has led to significant changes from the traditional underwriting process. This results in an insured population containing individuals with inherently different risk profiles from the post-lab panel insurance population established in the 1990s. This shift in composition is notable as it causes a fundamental discrepancy between historically based pricing assumptions and the actual issued business. The reality is that we are many years away from credible, direct measurements of AUW mortality experience, and until then we will need to measure AUW mortality indirectly by comparing AUW decisions to their traditional underwriting alternatives with known mortality outcomes. The additional mortality experienced in accelerated blocks compared to their traditionally underwritten counterparts is known as ***mortality slippage***.

As carriers funnel more business through accelerated programs, it becomes increasingly necessary to accurately estimate the resulting mortality slippage. Life insurance companies have been developing mortality estimates of the lives they issue for as long as they've existed, but unfortunately, estimates of mortality for lives historically declined from life insurance are not readily available. In fact, barely any data exists for these groups because insurers do not track declined policies.

This presents a key challenge in developing estimates for mortality slippage as there is no frame of reference around the mortality of a declinable risk. This is why over the last several years, PartnerRe has dedicated research into the mortality of declinable risks. Our 2024 white paper[1] presented severity findings for a generic declinable risk using aggregate mortality risk scoring thresholds. The result was a 550% general estimate of a declinable risk which aligned with previous industry estimates but left the door open for further analysis into the distribution of these declinable risks. Our 2025 article[2] on the distribution of declinable mortality indicated declinable risks feature a heavy right tail, increasing the mean compared to the median mortality impact. The volatility resulting from this distribution presents a case for further research into how different sample sizes are affected by declinable risks.

With each step, we have come closer to unearthing the impact of issuing previously declinable risks as new business, and we now have a working understanding of generic declinable risk mortality. However, not every previously declined policy is being issued, and we need to understand ***which*** declinable risks are being admitted and the impact from that specific subset of risks.

1 Decline Mortality: Shape and Severity of Mortality for Declinable Life Insurance Risks

2 Hidden Volatility: Implications of the Distribution of Declinable Mortality Relative Risk

ExamOne® Data Set Overview

ExamOne Background

Through our partnership with ExamOne, one of the two largest life insurance lab and exam providers, we have access to a proprietary dataset allowing us to evaluate the severity of declinable lab measurements. ExamOne has administered labs and exams for insurance companies for over 30 years and has a robust collection of historical lab measurements for life insurance applicants. By pairing these metrics with third party mortality outcomes, we achieve both the explanatory and response variable for a thorough mortality study. In fact, the data supporting this research includes a substantial volume of cases in the extreme lab outcome ranges where even published medical research has little experience data, providing new insight into mortality in these impaired cohorts.

Data Contents

ExamOne provided data from 60 lab/exam measurements, with separate datasets for each measurement. Each dataset contained a maximum of 500k lives per year from 2001-2024, for a maximum of 11.5 million lives and 100 million life years per file[3]. ExamOne appended mortality data from the Social Security Administration Death Master File (DMF) to the dataset, including survivorship (in quarters) and a death indicator. Due to a diminishing signal from the DMF and 2020 and later COVID experience, we cut off the experience at 2018.

Each file included information on:

- The given lab measurement
- Gender
- Age at time of application
- Cotinine smoking indicator

Since lives in the files were not identifiable across other datasets, we were unable to assess the impacts of comorbidities and had to analyze labs independently. Therefore, our research focuses on the most unhealthy lab ranges, where the decision to decline could be determined without considering other factors.

3 Some labs were only collected on age or gender basis and therefore have less than 500,000 lives per year.

All datasets contain a slightly different combination of lives; however, in Table 1 below, the following statistics from one example analyte are representative of most experience from 2001-2018.

Table 1: Data summary by issue year

Collection Year	Lives (Thousands)	Exposure Years (Millions)	Deaths
2001	500	8.9	11,309
2002	500	8.4	9,890
2003	500	7.9	8,931
2004	500	7.4	7,615
2005	500	7.0	6,472
2006	500	6.5	5,317
2007	500	6.0	4,665
2008	500	5.5	3,949
2009	500	5.0	3,425
2010	500	4.5	2,918
2011	500	4.0	2,280
2012	500	3.5	1,665
2013	500	3.0	1,238
2014	500	2.5	822
2015	500	2.0	537
2016	500	1.5	356
2017	500	1.0	190
2018	500	0.5	68
Total	**9,000**	**85.0**	**71,647**

A notable trend in the data is the reduction in death counts by collection year which is driven not just by the shape of mortality, but by the limitations of the DMF and was a primary focus of our data validation process, described in the section below. Through this process, we confirmed that the loss of mortality signal from DMF incompleteness did not exhibit material bias across age, gender, or smoking status that would significantly skew results.

With the total counts established above, the following tables are presented as percentages of the total observations.

Table 2: Data breakdown by gender

Gender	Lives	Exposure Years	Deaths
Male	55%	55%	66%
Female	45%	45%	34%

Table 3: Data breakdown by issue age

Issue Age	Lives	Exposure Years	Deaths
18-29	18%	19%	5%
30-39	30%	31%	12%
40-49	25%	26%	21%
50-59	18%	16%	29%
60-70	9%	7%	33%

Table 4: Data breakdown by cotinine test status

Nicotine Test (Cotinine)	Lives	Exposure Years	Deaths
Negative	76%	72%	58%
Positive	7%	8%	20%
Unknown	17%	20%	22%

Experience Study Construction and Limitations

Univariate Data and Comorbidities

As previously mentioned, the data used for this project was provided on a univariate basis, so it was not possible to link variables together to identify comorbidities. Comorbidities can represent a portion of the observed elevated mortality on lives with a declinable lab value. While it may be difficult to assess the ultimate single impact of specific lab values in the presence of comorbidities, the lab ranges at which our research is based are declinable just on the merit of the studied lab value alone. The greatest effect of comorbidities on declinable risks would be edge cases where a lab value is not declinable on its own but would be declined in the presence of a comorbidity.

Death Master File

The Social Security Administration Death Master File once provided accurate and complete information on which Americans were alive and which were not. However, the completeness of the data has deteriorated over the last two decades. When appending DMF data to our dataset, this results in a significant level of death underreporting. We conducted thorough analysis to determine the usability of the DMF for our purposes and ultimately decided this data was valid for research in a relative mortality context.

Relative A/E Analysis Methods

In order to address the underreported DMF data, we developed a normalized relative mortality scale for our analysis. As a first step we attached the 2015 VBT Smoker Distinct or Unismoke Select/Ultimate Tables to establish an age, gender and smoking status adjusted mortality expectation for the provided applicants. Then for each section of this analysis, we established a baseline group to represent a "standard-or-better" risk and used this baseline reference for relative mortality calculations. Thus, each relative mortality figure shown in the analysis that follows is defined as the ratio of the 2015 VBT A/E of that cohort relative to the 2015 VBT reference A/E.

The reference group for the standard-or-better risk was determined using underwriting guidelines for a standard risk in each lab category. By definition, the relative mortality of this reference group is always scaled to 100%, which aligns with the commonly understood A/E of a standard-or-better risk. Other groups are measured as multiples of this reference group, analogous to the A/E of a substandard risk.

This methodology is not perfect as some lives may be included in this standard-or-better reference group that would be considered substandard for reasons besides the lab measurement studied. However, since our declinable lab mortality is quantified as a multiple of this reference category, we believe any error introduced by this univariate approach would result in an understatement rather than an overstatement of decline mortality.

Lab Selection

This report intends to highlight the impact of several common insurance labs spanning a variety of declinable conditions seen in underwriting. We used a combination of data and underwriting expertise to select a relevant subset of lab results for this analysis.

These labs were selected based on the following considerations[4]:

- Data sufficiency
- Underwriting value
- Minimal correlation to other studied labs
- Potential for declinable cases to slip through an AUW program

The labs selected for this study were[5]:

- **GGT** (Gamma-Glutamyl Transferase): ***Enzyme related to liver function and bile ducts***
- **eGFR** (estimated Glomerular Filtration Rate): ***Formulaic measure of kidney health derived from several biomarkers***
- **BMI** (Body Mass Index): ***Formulaic measure of build calculated with height and weight***
- **A1c** (Hemoglobin A1c): ***Measures long-term blood sugar, used to monitor diabetes***
- **NT-ProBNP** (N-Terminal Pro B-type Natriuretic Peptide): ***A protein indicating heart strain***
- **PSA** (Prostate Specific Antigen): ***Detects prostate inflammation, enlargement or cancer***

4 Details from this process were described in Cracking the Code on Declinable Labs: How Cross-Team Collaboration Elevates Risk Assessment

5 Only the results for GGT and BMI are explicitly shared in this paper. If you are interested in seeing the mortality risk findings associated with declinable levels of eGFR, A1c, NT-ProBNP or PSA, please reach out to the PartnerRe team.

Relative Mortality Analysis

For the sake of brevity, we detail the results for GGT (Figure 1) and BMI (Figure 2), as they exhibit patterns that can be generalized to the other analytes. We then tie the results for all 6 lab measurements to our previous declinable risk findings. Below, we show the frequency and relative mortality for GGT and BMI.

Figure 1: Frequency and relative mortality by GGT range. Reference category for relative mortality: GGT 0-60.

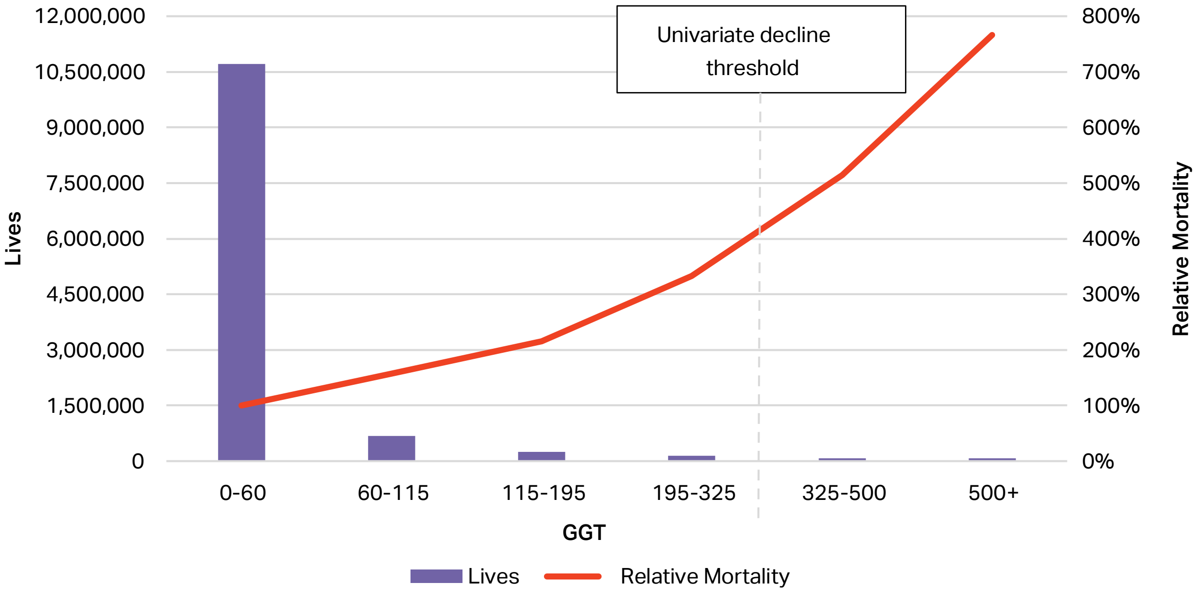
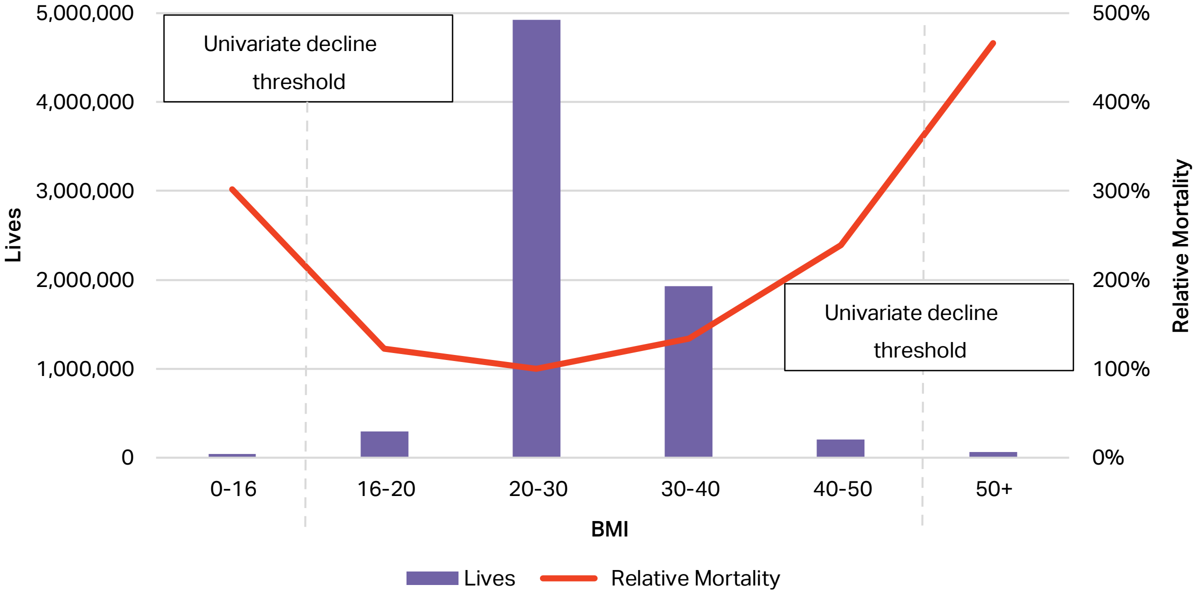


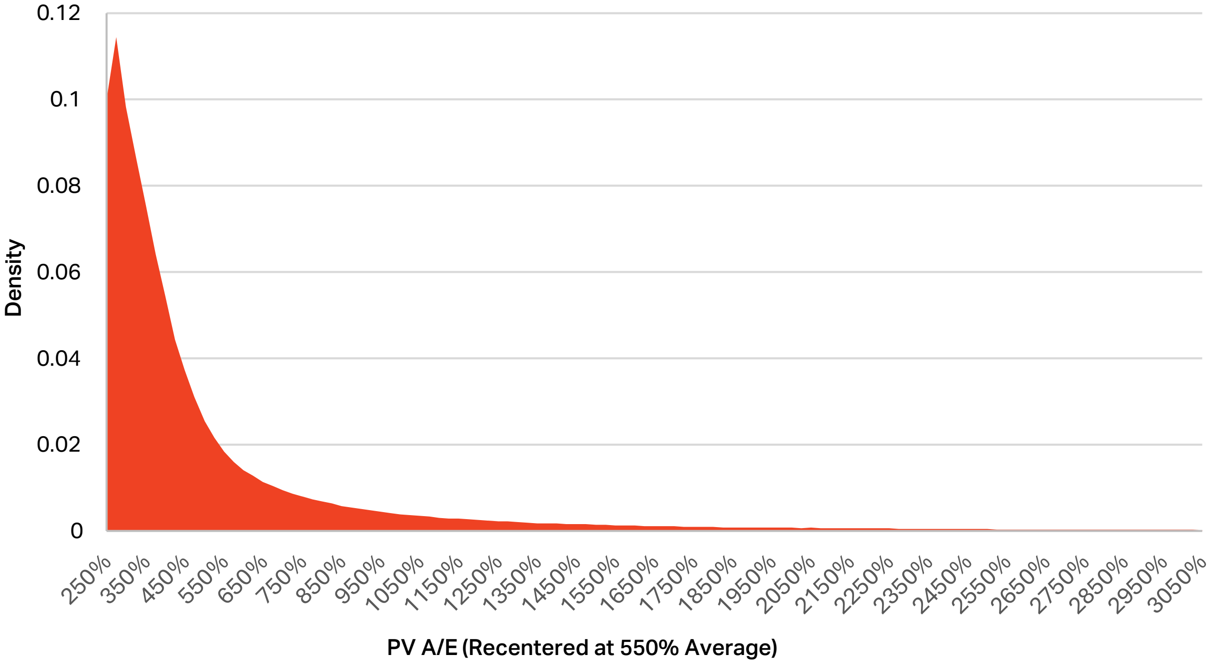
Figure 2: Frequency and relative mortality by BMI range. Reference category for relative mortality: BMI 20-30.



Univariate decline thresholds were determined by PartnerRe underwriters to be the value at which an applicant would be declined solely from displaying that lab result. As expected, there is an observable pattern of increasing mortality as lab values approach the declinable range for both analytes. GGT shows a greater slope of increasing mortality than BMI, and this steep increase is also evident in the declinable ranges for eGFR, PSA and NT-ProBNP. Like BMI, A1c shows a significant but less severe mortality increase in the historically declinable ranges.

The industry standard for mortality of a decline has historically been a flat estimate of roughly 500%. In our 2025 publication ***Hidden Volatility: Implications of the Distribution of Declinable Mortality Relative Risk***, we developed the distribution of declinable risks, showing a distribution centered at 550% and with a right skewed shape, as seen in Figure 3.

Figure 3: Declinable Relative Risk Probability Distribution. Mortality distribution of historically declinable risks, Hidden Volatility: Implications of the Distribution of Declinable Mortality Relative Risk



The mortality in declinable ranges of GGT, BMI and the other studied labs corroborate these findings, with mortality values ranging above and below 550%.

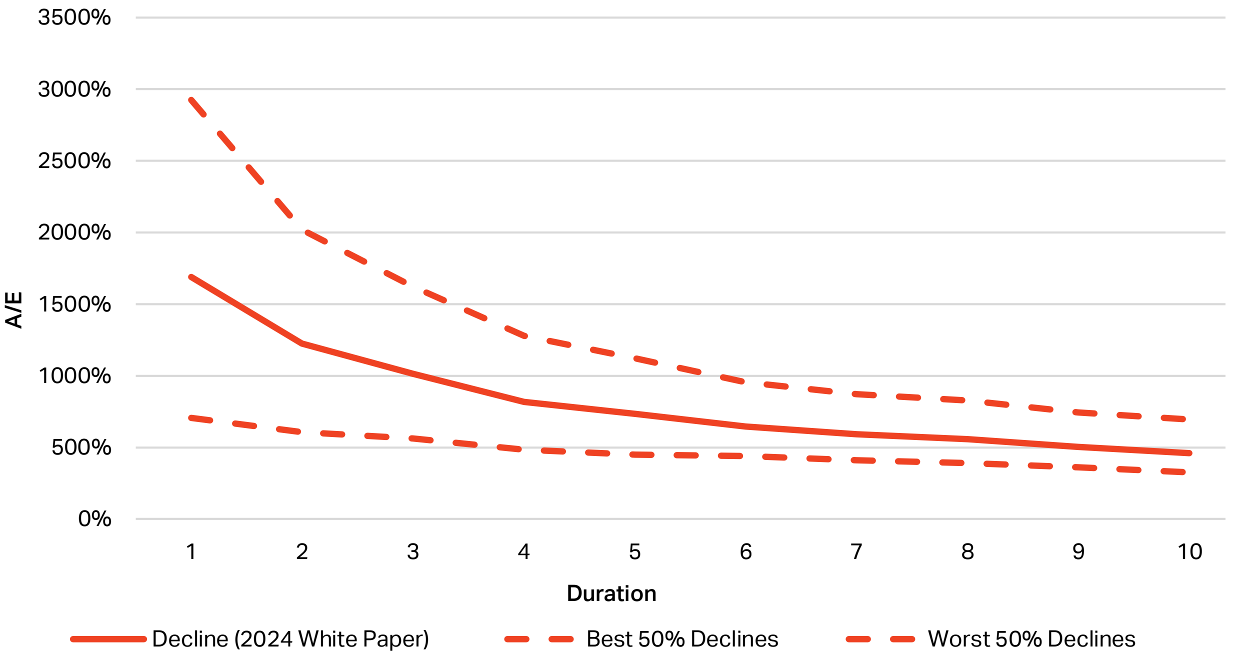
This distribution of declinable risks illustrates that low frequency, high severity events can emerge in many patterns, and not always close to the best estimate mortality, especially in small sample sizes[6].

6 For more on the significance of sample sizes when analyzing mortality slippage, see The Volatility Effect of Declinable Labs in Small Sample Sizes

Durational Relative Mortality Analysis

In 2024, PartnerRe explored the shape of declinable risk mortality in the white paper, ***Decline Mortality: Shape and Severity of Mortality for Declinable Life Insurance Risks.*** For the first time, mortality of declinable risks was plotted over time.

Figure 4: Decline Mortality by Duration. Durational mortality shape of historically declinable risks,
Decline Mortality: Shape and Severity of Mortality for Declinable Life Insurance Risks



The observed mortality is highest at issue, with the elevated mortality wearing off over several years. We see this same trend when examining declines uniquely identifiable by adverse lab results.

In Figures 5 and 6 below, we find there are two major contrasting patterns, where the cohorts presenting severe GGT exhibit frontloaded and steeply sloped mortality. This indicates a severe condition with near-term mortality consequences; however, if survived initially, mortality may return to a less elevated level, though still significantly above standard risk. Comparatively, BMI 50+ shows a more constantly elevated risk, indicating a chronic health condition where a flat scalar may be more appropriate.

Figure 5: Relative Mortality by GGT Range & Duration. Durational mortality shape of applicant risk stratified by GGT. Reference category for relative mortality: GGT 0-60.

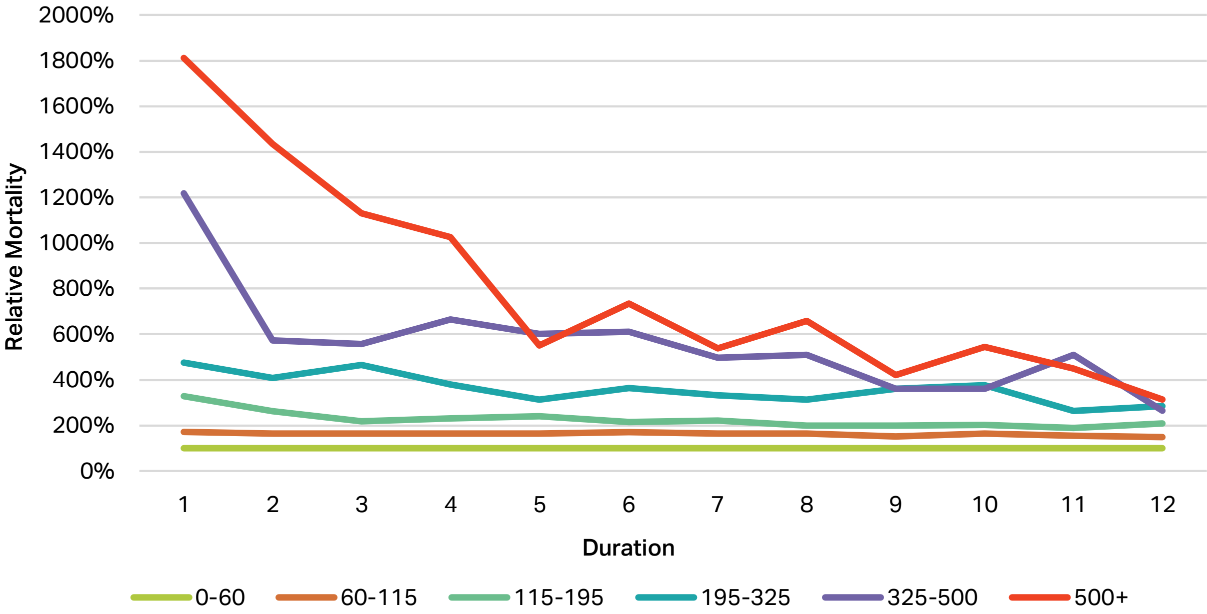
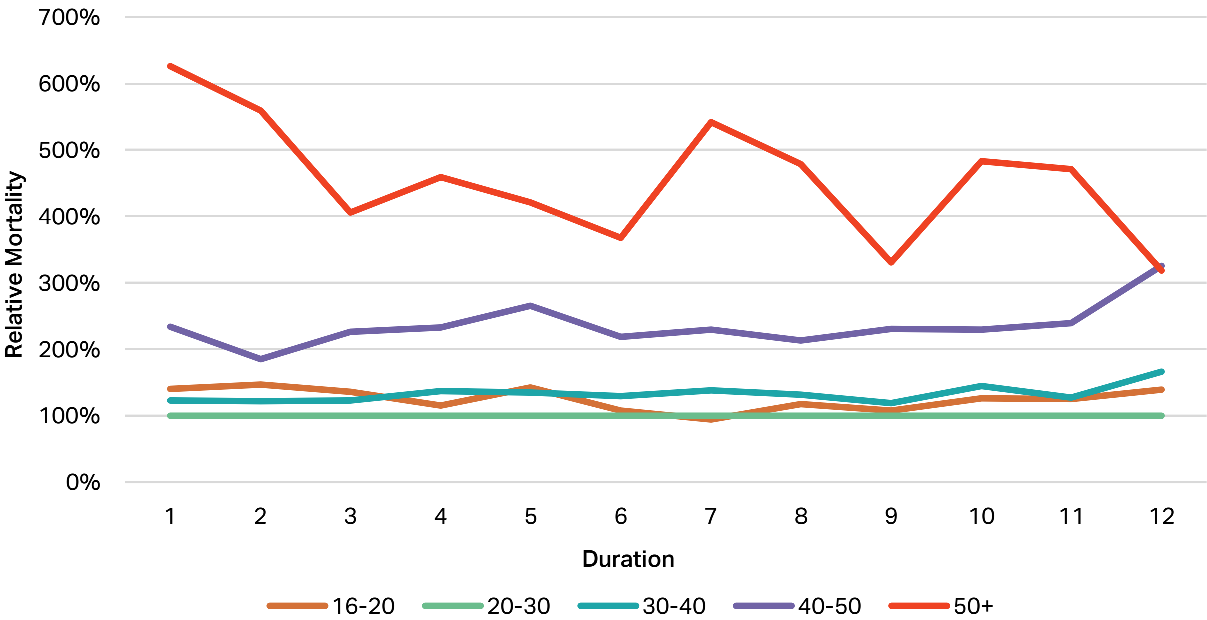


Figure 6: Relative Mortality by BMI Range & Duration. Durational mortality shape of applicant risk stratified by BMI[7]. Reference category for relative mortality: BMI 20-30.

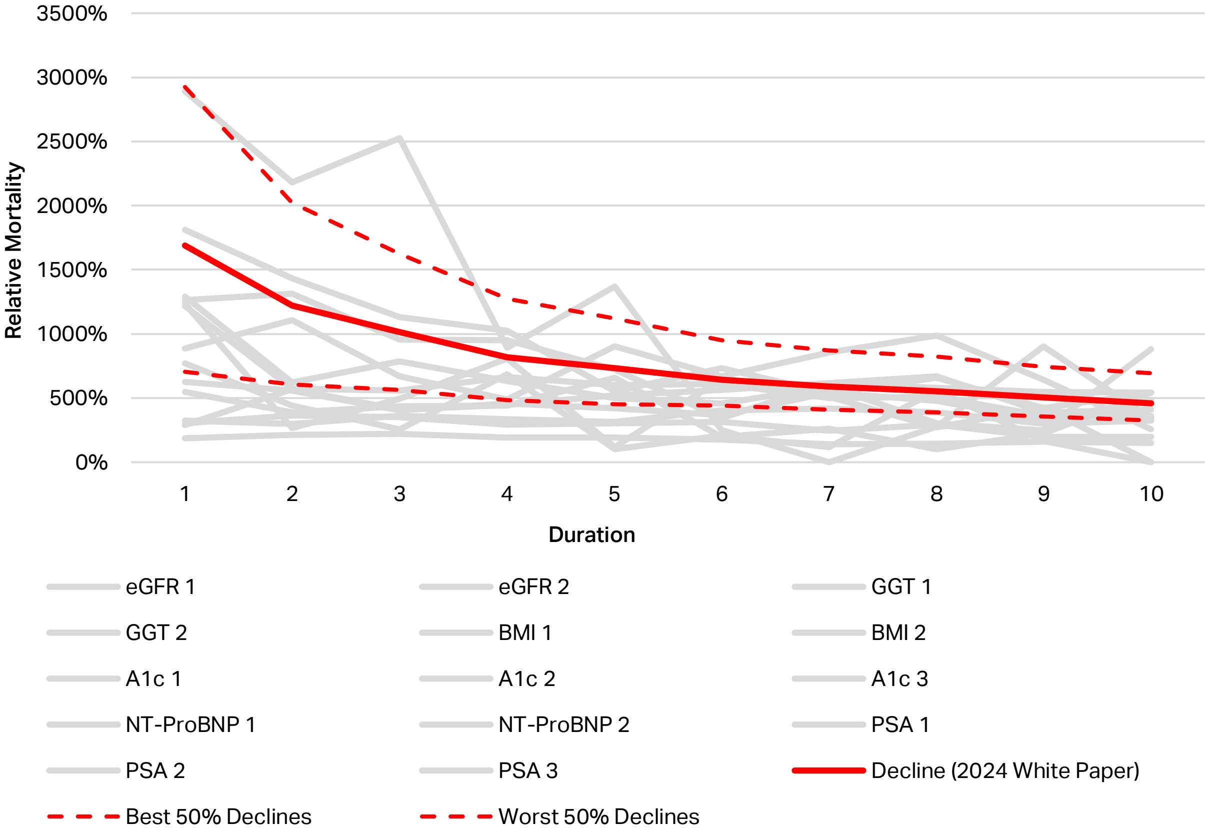


These contrasting examples display a trend that appears in the mortality behavior of the other analytes as well. When examining all 6 labs studied, the declinable ranges for each lab fell into either the steeply front-loaded or the constant elevation category of risk.

7 BMI 0-16 omitted from chart due to low data volume in most durations.

These distinct flavors of declinable risk show variety in the behavior of declines – not all declines are created equal – but taken together, these declines fit to the overall pattern of declines observed in the 2024 whitepaper, as can be seen in Figure 7.

Figure 7: Relative Mortality of Declinable Lab Ranges. Durational mortality shape of historically declinable risks and applicants with declinable lab outcomes



The shape of declines from extreme lab results corroborates the research into general declines. While this chart compiles mortality profiles from different lab declines, the group of labs shown is not intended to display a comprehensive set of all issued declines resulting from the removal of labs and exams.

Although the current dataset does not allow for explicit quantification of this effect, it is likely that additional stratification by comorbidities would reveal subcohorts with higher mortality that approach the worst segment of overall declines. Similarly, the conservative approach of taking mortality relative to a standard group whose true A/E may reside well above 100% likely pulls lab declines to lower mortality ranges, understating the severity we might otherwise observe.

We view the alignment between these declinable lab mortality patterns and previous research as strong, and we expect that incorporating multivariate analysis with comorbidity data would further refine these mortality estimates and reveal additional insights.

Conclusion

Placing declinable labs on a continuum of declinable risks confirms that the previously declinable lives now entering AUW programs generally align with prior estimates of decline mortality, but it also underscores that not all declines carry the same risk implications. Declinable impairments span a wide range of severities, making it essential to understand not only the volume of newly admitted risks but their underlying composition.

As AUW programs continue to expand, it becomes increasingly important to quantify these impacts and actively manage them. Implementing a robust post-issue monitoring program would help ensure life insurance carriers maintain a sustainable balance between customer experience and risk selection over time.

Limitations

Our analysis is limited by univariate datasets, which prevented us from analyzing the effect of comorbidities. We focused our research on the severe ranges of singular lab measurements, minimizing the need for insights into comorbidities. Even so, there are likely to still be confounding effects – which could only be quantified with multivariate datasets.

Additionally, as previously mentioned, death data from the DMF suffers from incompleteness. We took steps to work around this including verification of unbiased signal and using relative A/Es to preserve mortality relationships. However, results may still be impacted by missing data.

Acknowledgments:

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