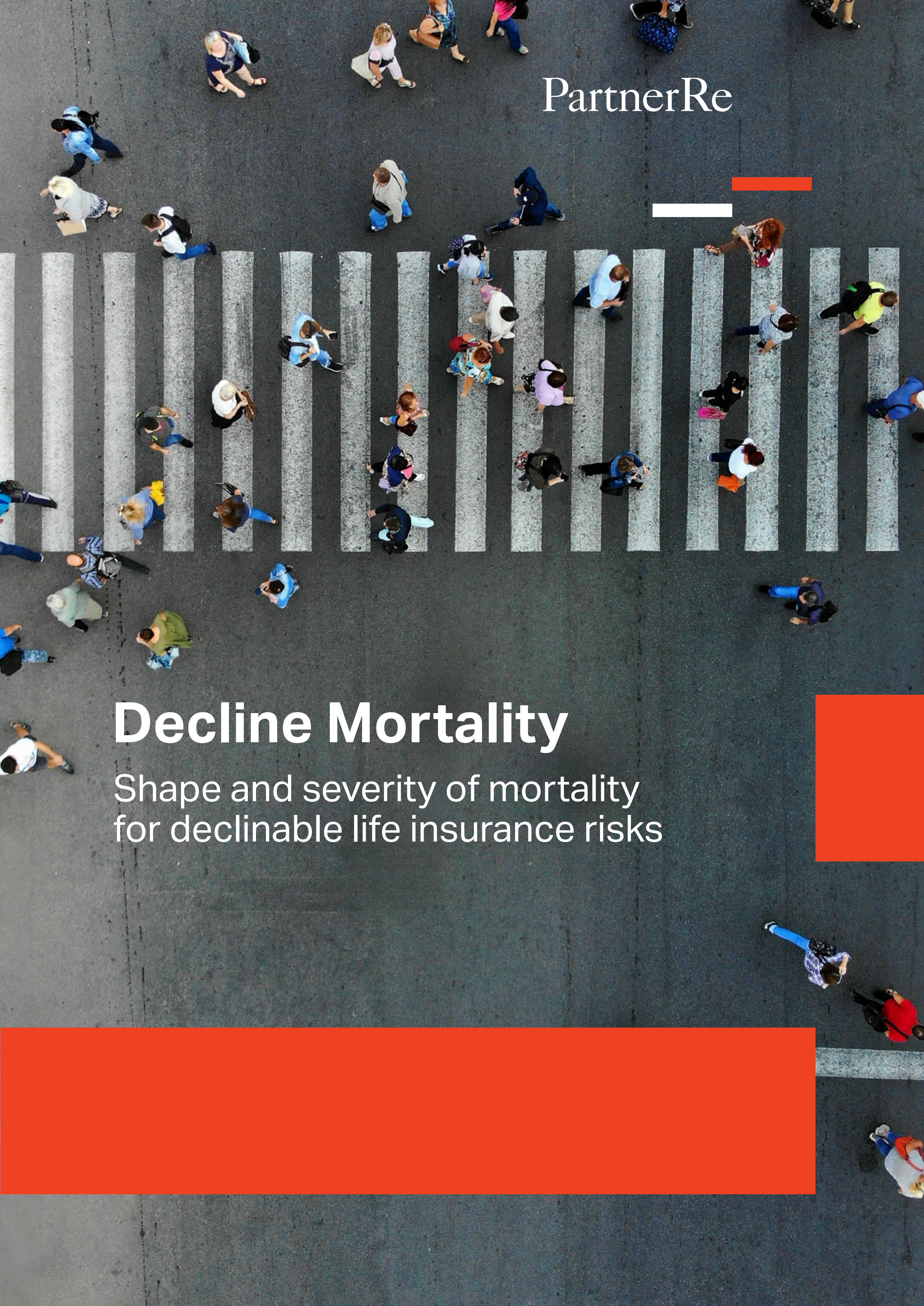


PartnerRe

Decline Mortality

Shape and severity of mortality for declinable life insurance risks

Contents

Ehren Nagel, FSA, MAAA
Head of Actuarial Innovation
PartnerRe US Life

Abstract

Without direct mortality data for individuals who have historically been declined for life insurance under fully underwritten programs, the shape and severity of the expected mortality for such individuals is not well understood. With the increase in availability of accelerated underwriting programs, which waive traditional underwriting requirements such as a physical exam, blood testing and urinalysis, there are now declinable risks being issued single-life policies and entering the insured mortality pool.

In this paper we explore the potential shape and severity of these declinable risks by utilizing a large, anonymized life insurance application data set. We attach a referent expected mortality scale based on the 2015 VBT industry table, and then quantify declinable risk A/Es as they relate to a Standard or Better risk pool.

The result of this analysis indicates that while the prevailing industry assumption of roughly 500% of aggregate non-tobacco for the relative severity of declinable risks may be appropriate for longer-horizon life insurance products, the actual declinable risk A/Es vary significantly by product length and male/female. Furthermore, the relative shape of the mortality curve is highly front-loaded, and therefore a simple, point-estimate scalar does not appropriately reflect the risk profile of declinable risks entering a life insurance pool.

Research Objective and Case for Analysis

Mortality impact of fluidless programs and the slippage due to declines

The rapid industry evolution over the last ten years for U.S. life insurance accelerated underwriting (AUW) products with fully underwritten premiums has created numerous pricing and operational challenges, not the least of which is quantifying the impacts of these new methods on expected mortality compared to traditional underwriting programs. In particular, the removal of exam and lab requirements in many programs, has created concern about the potential for misclassification, both within preferred class structures as well as between non-tobacco and tobacco categories. For example, the removal of the cotinine test detecting tobacco use was an early source of considerable concern as it was assumed to be one of the most likely candidates for anti-selective misrepresentation in fluid-less programs.

In practice, however, tobacco misclassification has often been overshadowed by significant underreporting of weight, as well as substance use, diabetes, cholesterol, and high-blood pressure, which have often been much more significant drivers of misclassification than originally expected. For companies who conducted significant retrospective studies when designing their new AUW programs, these results have been an unwelcome surprise. These contributing factors grew even more significant during the pandemic lock-downs due to the necessary expansion of these programs and the removal of face-to-face interactions between agents and insurance applicants, and these new virtual sales methods have persisted. While the change in sales methods has often been less pronounced for companies relying on affiliated agents, the reality for the industry as a whole is that policies are being sold in new ways with new underwriting requirements to new customers, and the resulting misclassifications observed through both random hold outs and post-issue audits have often been more significant than the original retro studies indicated.

Looking across a representative industry sample of the actual audit results of AUW programs that waive exam and labs, the largest contribution by misclassification category to mortality slippage comes from low frequency, high-severity declinable risks that would have been entirely excluded from traditional underwriting programs historically. The very nature of these risks makes quantification of the mortality impact challenging since these risks were simply declined within the traditional context, and the timing and severity of the mortality associated with these individuals has not been systematically tracked by the industry. The remainder of this paper is devoted to the exploration of the shape and severity of these declinable risks and a potential quantification of the associated mortality using de-identified life-insurance application data collected by Milliman.

Decline relative risk and conventional wisdom

The very fact that we make the claim in the paragraph above that declinable risks are the greatest contributing factor for mortality slippage in AUW programs points to a fundamental quandary: if we haven't tracked and quantified declinable mortality risk as an industry, then how can we define the impact of those risks on an insurance pool? And the truth of the matter is that for the contribution sited above, we used what has become conventional wisdom in the life industry for declinable risks: 500% of aggregate Standard or Better risk (in this case as defined relative to the 2015VBT Select and Ultimate table).

Research Objective and Case for Analysis

If we step back and look at what that translates to from a high-level underwriting classification perspective, we're assigning a rating of roughly 16 tables to a declinable risk (+25% / table). Since most carriers typically only issue fully underwritten business out to 12 tables, an expected mean of 16 tables may seem reasonably conservative. However, we are effectively assuming that the average mortality for declined risks is just beyond insurability and this has potentially serious limitations. For example, it assumes that declinable risks follow the same mortality pattern as a fully underwritten select and ultimate table and we can simply scale up that mortality slope to estimate the declinable risk. This doesn't account for how low the assumed early select mortality is compared to some of the life expectancies associated with declinable conditions.

If we do assume, for illustrative purposes, that declinable risks have roughly +400% expected mortality and we take the industry average rate of roughly 2% for misclassified declinable risks slipping into AUW programs, we can easily calculate a rough expected mortality increase of 8% for aggregate Standard or Better in AUW programs from declinable risk misclassification alone. If the actual declinable relative risk is more like +800%, then this slippage would increase to 16%, and given the thin profit margins on many AUW products (especial term products at the eligible ages and face amounts), such a mortality differential could quickly push margins into negative territory.

Potential mortality for declinable risks

While we may not have direct data available to understand declinable mortality within the fully underwritten (FUW) context, we can pause to reflect on other industry data that might inform us on what these risks could look like. The most obvious being the industry tables for Simplified Issue (SI) and Guaranteed Issue (GI) products.

Starting with the latter, there are some immediate challenges to using the GI tables. First, there is very little overlap between the GI and FUW market, both in terms of the customer need and face amounts, as well as the target age groups which skew much older for GI final expense products versus the younger age cohort associated with the push for accelerated underwriting solutions in the AUW space. Second, GI products are very expensive per 1000 of face compared with FUW products, and GI pricing assumes significantly higher levels of anti-selective lapsation than FUW, which will result in a much higher overall mortality rate by duration than we might experience even for the same cohort at a lower price point.

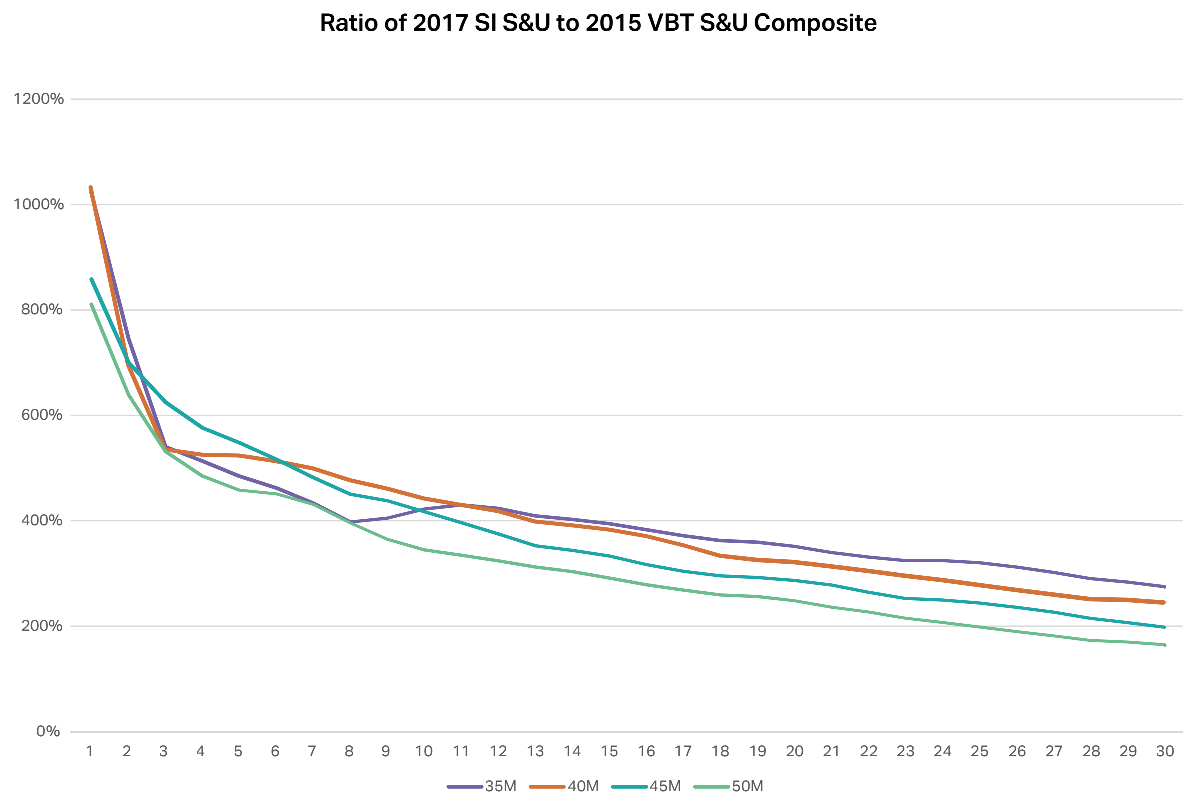
So, setting GI tables aside, the SI mortality tables have some more promising characteristics for our use case. The market rates per 1000 are more reasonable and there is more overlap between the ages and face amounts of SI and the AUW eligible space. In addition, SI products typically do not require an exam or fluids and use a short list of application questions to screen for serious medical conditions.

Research Objective and Case for Analysis

The chart below (**Figure 1**) examines the ratio of SI q_x to FUW q_x by policy duration based on the 2017 SI Male, S&U table and the 2015 VBT Male, Unismoke, S&U table for ages 35,40,45, and 50. We see the ratio of SI to FUW mortality begins near 1000%, rapidly decreases, and then stabilizes into a near linear wear off after 15 years. Ignoring differences in persistency, the average present value (discounted for deaths and 5% interest) of the mortality between these two tables for the illustrated ages is roughly 300%.

While the shape of the mortality for SI clearly differs, the results of this initial exploration may appear reassuring compared to our 500% assumption; however, a significant proportion of the individuals purchasing SI policies would still likely fall within the insurable (under table 12) range for FUW, and therefore declinable FUW risks likely have a present value of mortality well in excess of the 300% average seen here. The question is, by how much and where can we find a reasonable set of data to perform a declinable risk analysis?

Figure 1 : Comparison of the shape of SI mortality to FUW select and ultimate mortality



Milliman Data Set Overview

Given the potential impact on the mortality of AUW programs from declinable risks, a direct study of mortality for declinable FUW risks is certainly warranted for the industry; however, such a study will require significant time, coordination, and effort. Until such a study can be conducted, we have endeavored to leverage other more readily available data sources that may still help us better quantify the level of risk we are actively putting on the books.

What was provided and why

As part of their release of the **Irix® Risk Score** 3.0 models, Milliman shared an extensive data set with several reinsurance partners which included scores for nearly 27 million life insurance applicants (predominately FUW applicants, but including some SI business as well). The data included application year, male/female, age at time of application, most severe drug priority, and it had a death flag and month of death already attached. **Irix® Risk Scores** were provided for all Risk Score 3.0 combinations (Rx, RxDx, RxCr, and RxDxCr)[1] as well as the previous Risk Score 2.2 (Rx only) for reference. The intent of sharing this data was to allow independent verification of the predictive lift provided by the new 3.0 models and respective data source combinations.

Application years extended from 2008 to 2020 with a data extract date of March 31, 2021, and the application exposures spanned up to a 13-year timeframe with over 111 million total years of exposure and roughly 838 thousand deaths[2]. The data provided allowed us to conduct a robust experience study by Risk Score, and furthermore allowed us to utilize the risk stratification provided by those Risk Scores. We realized we could build a declinable risk proxy to explore declinable risk mortality with a very credible level of death information. We reached out to Milliman, shared our work, and came to an agreement to pursue this analysis into proxy declinable risks.

1 Prescriptions Data (Rx), Medical Data (Dx), and Credit Data (Cr) model features.

2 The methods employed by Milliman to attach deaths to the data is beyond the scope of this paper, and we relied on the death flags and month of death as they were provided. We excluded the partial 2021 exposures and deaths due to the observed lag in death reporting.

Milliman Data Set Overview

Brief exploration of the original data

Looking at the death rate (raw deaths / study exposure) by duration, decennial age groups, and male/female, we see that the data conforms to expected mortality patterns: death rate increases by duration, progresses with age at time of application, and is higher for males than for females (**Figure 2-5**).

Figure 2 : Original Data by Duration

Duration	Count	Study Exposure	Raw Deaths	Death Rate
1	26,806K	24,758K	128.7K	0.52%
2	22,312K	20,583K	121.5K	0.59%
3	18,412K	16,828K	113.5K	0.67%
4	14,936K	13,580K	103.6K	0.76%
5	11,944K	10,747K	92.3K	0.86%
6	9,284K	8,214K	79.0K	0.96%
7	6,894K	6,050K	63.6K	1.05%
8	5,032K	4,379K	49.4K	1.13%
9	3,564K	2,999K	36.9K	1.23%
10	2,243K	1,734K	24.7K	1.43%
11	1,217K	926K	14.9K	1.61%
12	588K	397K	7.4K	1.86%
13	195K	91K	2.1K	2.32%
Grand Total	26,806K	111,287K	837.5K	0.75%

Figure 3 : Original Data by Decennial Age at Time of Application Group

Dec Age Group	Count	Study Exposure	Raw Deaths	Death Rate
Under 20	871K	3,131K	1.6K	0.05%
20-30	3,643K	14,037K	13.6K	0.10%
31-40	5,739K	22,605K	33.6K	0.15%
41-50	5,663K	24,889K	86.1K	0.35%
51-60	5,695K	24,515K	197.3K	0.80%
61-70	3,857K	16,146K	266.9K	1.65%
71-80	1,198K	5,327K	192.3K	3.61%
81-90	137K	626K	44.9K	7.17%
91+	2K	11K	1.1K	10.65%
Grand Total	26,806K	111,287K	837.5K	0.75%

Milliman Data Set Overview

Figure 4 : Original Data by Male/Female

Gender	Count	Study Exposure	Raw Deaths	Death Rate
Female	13,599K	56,583K	376.6K	0.67%
Male	13,206K	54,705K	461.0K	0.84%
Grand Total	**26,806K**	**111,287K**	**837.5K**	**0.75%**

Moving on to death rate by exposure year we see very clearly the impact of the COVID-19 pandemic in year 2020, resulting in a significant jump in the death rate for that year.

Figure 5 : Original Data by Exposure Year

Exposure Year	Count	Study Exposure	Raw Deaths	Death Rate
2008	223K	223K	1.4K	0.64%
2009	660K	660K	4.4K	0.66%
2010	1,333K	1,333K	9.0K	0.68%
2011	2,412K	2,412K	15.9K	0.66%
2012	3,772K	3,772K	25.6K	0.68%
2013	5,262K	5,262K	37.0K	0.70%
2014	7,122K	7,122K	53.4K	0.75%
2015	9,474K	9,474K	68.9K	0.73%
2016	12,045K	12,045K	86.6K	0.72%
2017	14,903K	14,903K	104.1K	0.70%
2018	18,207K	18,207K	122.4K	0.67%
2019	21,895K	21,895K	156.4K	0.71%
2020	26,120K	13,982K	156.4K	1.09%
Grand Total	**26,806K**	**111,287K**	**837.5K**	**0.75%**

Filters applied to the data

The impact of the COVID-19 pandemic clearly makes the use of 2020 data problematic, and therefore we exclude that exposure year from the data for our declinable risk analysis. This does remove a significant number of deaths and total exposure years from our starting data. Fortunately, due to the size of the dataset we are still left with 685,000 deaths and roughly 97 million exposure years over 12 application durations.

Next, we filtered to only include ages 20 to 60 at time of application, since we are concerned with declinable risks within the context of AUW programs, and this covers the most common range of eligible ages for such programs. For ages 20-60 our sample is just under 271,000 deaths and 75 million exposure years.

Finally, we will be using a combination of the **Irix® Risk Score** 3.0 RxDxCr along with the red/yellow/green[3] drug priority, to create a proxy for underwriting declinable risks. We therefore excluded roughly 3% of the remaining applications where there was a no-hit for Risk Score 3.0 RxDxCr.

3 Milliman provides a color coding for prescription drugs based on the potential mortality risk, and the listed category is related to the worst risk of all prescriptions in the applicant record.

Milliman Data Set Overview

After applying these three filters, the resulting data set contains over 255,000 deaths and 72 million exposure years and continues to conform to our mortality pattern expectations by feature split (**Figure 6-8**)

Figure 6 : Filtered Data by Duration

Duration	Count	Study Exposure	Raw Deaths	Death Rate
1	16,701K	16,701K	46.6K	0.28%
2	13,789K	13,789K	41.2K	0.30%
3	11,157K	11,157K	37.3K	0.33%
4	8,889K	8,889K	33.4K	0.38%
5	6,892K	6,892K	28.5K	0.41%
6	5,112K	5,112K	22.8K	0.45%
7	3,732K	3,732K	17.4K	0.47%
8	2,656K	2,656K	12.6K	0.47%
9	1,664K	1,664K	8.1K	0.49%
10	904K	904K	4.4K	0.49%
11	438K	438K	2.4K	0.54%
12	147K	147K	0.9K	0.58%
Grand Total	16,701K	72,079K	255.6K	0.35%

Figure 7 : Filtered Data by Quinquennial Age Group

Quin Age Group	Count	Study Exposure	Raw Deaths	Death Rate
20-25	1,120K	4,547K	3.6K	0.08%
26-30	1,699K	6,883K	6.1K	0.09%
31-35	2,255K	9,170K	10.2K	0.11%
36-40	2,286K	9,625K	15.3K	0.16%
41-45	2,261K	10,238K	25.1K	0.25%
46-50	2,366K	10,822K	41.8K	0.39%
51-55	2,469K	11,072K	66.2K	0.60%
56-60	2,246K	9,723K	87.1K	0.90%
Grand Total	16,701K	72,079K	255.6K	0.35%

Figure 8 : Filtered Data by Male/Female

Gender	Count	Study Exposure	Raw Deaths	Death Rate
Female	8,418K	36,410K	107.0K	0.29%
Male	8,282K	35,670K	148.5K	0.42%
Grand Total	16,701K	72,079K	255.6K	0.35%

Experience Study Construction and Data Adjustments

Before we define our proxy declinable risks and proceed with the quantification of the relative mortality of those risks, we need a reference point and preferably one which is comparable to the FUW insured population. Therefore, we start by detailing the process of attaching an industry reference table to the Milliman data set. To calibrate this reference table, we define a "Standard or Better" reference population, and then adjust and calibrate that population using reasonable actuarial judgement to line up with the historically expected Standard or Better mortality for the industry. Without such a calibration, there is a real risk of overestimating the impact of declinable risks, and given the proxy underwriting nature of our approach, we do not want to develop or propagate an alarmist viewpoint. Therefore, we endeavor to apply prudent adjustments that err on the side of understatement of declinable risks, so that our conclusions are more likely to be reasonable and unexaggerated.

Potential differences from comparable 2015VBT data set

To conduct an experience study, we attached an appropriate industry mortality table (in this case the 2015VBT unismoke, ALB) to the Risk Score data set given the provided record features; however, it should be noted that the data provided by Milliman was for a total applicant pool which differs from the placed policy pool forming the basis of the 2015 VBT tables. There are two main population differences to keep in mind: first the total applicant pool may include individuals who never completed all requirements needed to receive an underwriting decision, and second even after a decision is rendered, they may withdraw or decide not to take the policy. We will take this into account as part of a standardization adjustment later in the calibration process.

Attaching the 2015VBT unismoke select table

Since the life applicant data does not include any tobacco use indicator, the most appropriate industry table to attach is the 2015 VBT unismoke table. We are, therefore, implicitly assuming a similar mix of tobacco and non-tobacco within the total applicant and placed populations. Data was provided on an ALB basis, so that is the basis that was used, and we are ultimately trying to evaluate the relative risk of a declinable risk compared with a fully underwritten aggregate Standard or Better risk; therefore, we attached the select table values.

Adjustment for MI

The 2015 VBT is centered at the midpoint of 2015 for mortality improvement/dis-improvement purposes, and for simplicity and consistency with regulatory assumptions we elected to use the 2023 published SOA Individual Life Insurance Mortality Improvement Scale (ILIMIS2023) – for Use with AG38/VM20[4] applied to adjust the 2015 VBT expecteds for the 2008-2019 exposure years in question. Note that the ILIMIS2023 scale averaged MI over the years 2012-2021; however, we are comfortable extending the resulting scalars to exposure years 2008-2011 in this study since MI rates should remain relative consistent over those timeframes. In aggregate, the impact of this MI adjustment was minimal, however, we included the adjustment both for completeness and to address any differences within subsets of the data.

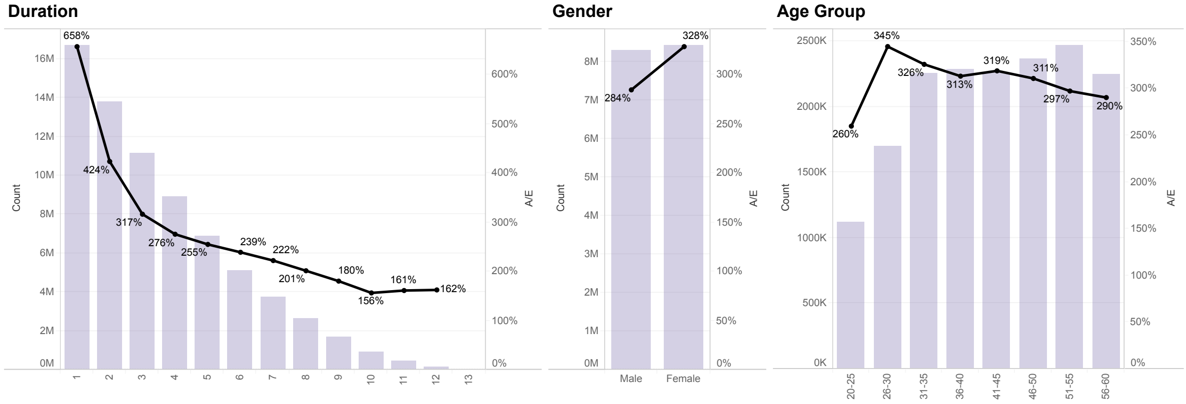
Exploration of A/E vs 2015 vbt and Definition of Standard or Better

The resulting aggregate Milliman applicant pool A/E vs. the unadjusted 2015 VBT was 298%, and the MI adjusted 2015 VBT A/E was 301%. If we examine the count breakdown of unique applicants by duration (**Figure 9**), male/female, and applicant age, we can see that there is a highly anti-selective spike in the early duration A/E's. However, this shouldn't be surprising given that this is a total applicant view. There is also a significant differential between males and females (which we will explore later).

4 Individual Life Insurance Mortality Improvement Scale – for Use with AG38/VM20 - 2023 | SOA

Experience Study Construction and Data Adjustments

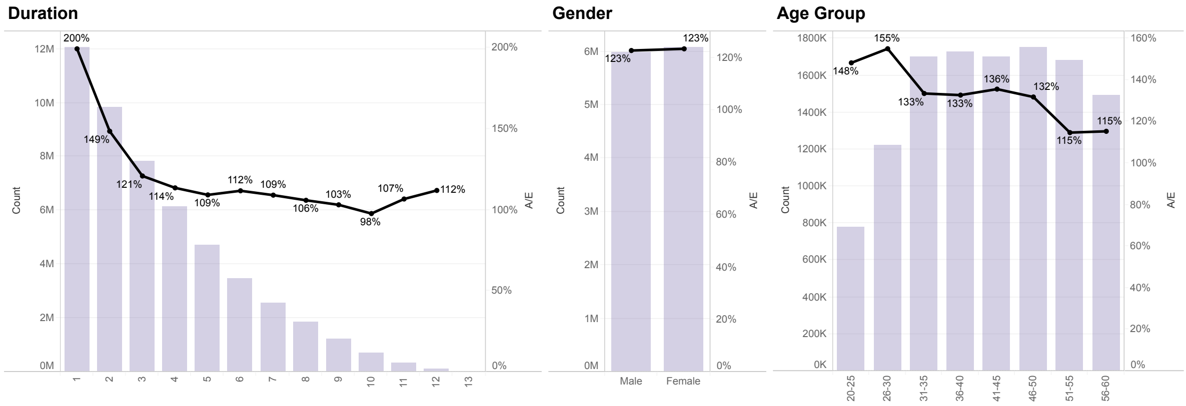
Figure 9 : A/E vs 2015 VBT, MI Adjusted, All Risk Scores



We can now use the Risk Scores themselves to define a population that has more parity with a placed policy pool. Risk Scores in the range (0,1] are considered to roughly represent Standard or Better risks within the traditional underwriting context. Some companies would define an even more restricted range for their book of business; however, if we adopt this wider definition of Standard or Better, then after standardization we will err on the side of slightly understating the declinable relative risk, which aligns with our stated prudent approach above.

If we follow this logic and use this range of scores as a representative Standard or Better population, there are just over 12 million (72%) applicants with Risk Scores from (0,1], which is a reasonable proportion for Standard or Better risks within an applicant pool when considering the historical breakdown of traditional underwriting decisions for many companies. The resulting aggregate A/E vs. the 2015 VBT is 123% for this group, and we see that it is equal by male/female (as expected based on reported model calibration of the **Irix® Risk Score** 3.0 models) and has a slight downward trend by age (**Figure 10**). The durational A/E's, however, are still elevated in the early durations, and leads to consideration of a need to adjust early claims for application screening and the contestability period.

Figure 10 : A/E vs 2015 VBT, MI Adjusted, Scores <=1.0



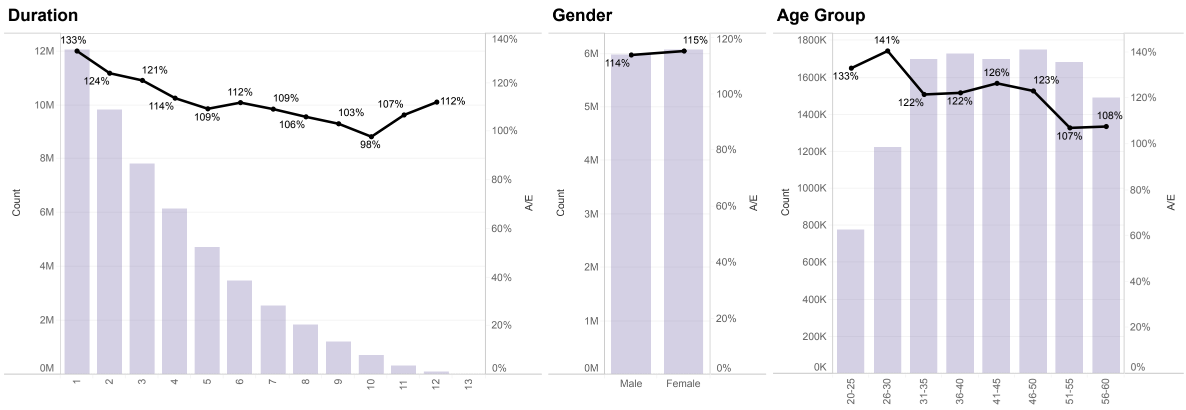
Experience Study Construction and Data Adjustments

Adjustment for underwriting and contestable claims

Now we turn to the disproportionately high A/E's in durations one and two. We will focus on two of the reasons why experience for a placed block of FUW business would have lower claims during these durations. First, our definition of Standard or Better has only relied on the **Irix® Risk Score** to categorize risk. In practice the score is combined with application questions that will disqualify individuals with acute conditions or pending results for medical tests; therefore, some of these early deaths will be excluded from a placed pool due to self-disclosure. Secondly, if an acute condition is not disclosed on the application and results in death within the first two years, the insurance company can contest the claim. While such an action is often only taken when the non-disclosure was clearly intentional, and carriers approach rescissions and contestable claims differently based on their business model, they can still certainly have a significant impact on early claims experience.

To make an adjustment we must apply some level of prudent actuarial judgement. If an individual has reached the application process and intends to answer all questions honestly, they must believe they have a chance of receiving coverage, therefore we shouldn't assume too many deaths will be removed due to application question knock outs, so let's say 1/6 of deaths in duration one are self-disclosed knockouts from acute medical conditions. Next, while early claims can in theory be contested, the burden to prove misrepresentation can be high and even getting accurate cause of death information is a challenge; therefore, let's assume that another 1/6 of duration-one claims can be successfully contested giving us a total reduction of 1/3 of recorded deaths in duration one. It's reasonable to assume that both screening and contestability effectiveness decreases with time, so let's assume that we can remove half as many deaths in duration two, or 1/6 of recorded deaths. Applying these durational adjustments to the set of applications in the Standard or Better range of (0,1] we see the trendline for A/E's becomes much more consistent with the slope seen for durations 3-10 (**Figure 11**).

Figure 11 : A/E vs 2015 VBT, MI and Duration Adjusted, UW/Contestability Adjusted, Scores <=1.0



Experience Study Construction and Data Adjustments

The aggregate A/E for (0,1] Risk Scores comes down to 114%, and total A/E for all applicants is reduced to roughly 275%. There are still over 1,200 deaths for this Standard or Better cohort in duration 11, so the A/E's remain very credible over this durational view.

Note we apply this same underwriting and contestable claims adjustment to the entire application data set, including the declinable risk cohort identified later in this paper. Since we will see that declinable risks are even more front-loaded the impact of this adjustment is greater for that cohort. Without this adjustment, our estimation of declinable relative risk would be materially higher.

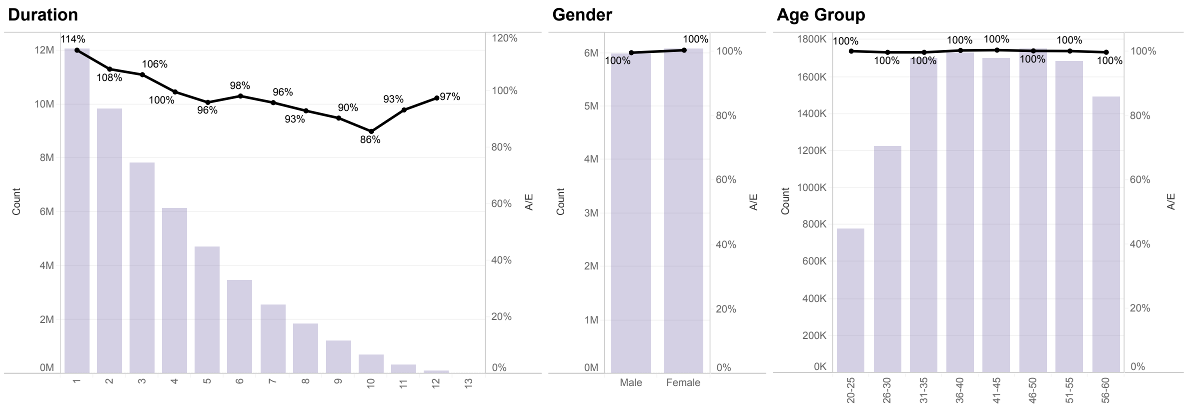
Standardization for Fully Underwritten, placed business

We have now attached our referent industry table, adjusted for mortality improvement, and applied a reasonable early claims adjustment for application and contestable claims business practice; however, the resulting A/E for our defined Standard or Better cohort remains higher than expected at 114%. However, if we examine the pattern of A/E's by age (see **Figure 11**), we see that we have come close to matching the 2015 VBT expected for ages 51-60.

Since we have defined our Standard or Better cohort using only the Risk Score, we can speculate that the gap in the A/E's compared with our FUW referent table could be closed by the addition of other underwriting evidence collection, such as MIB, MVR, the application questions, and traditional exam and lab requirements. This is particularly true at younger ages where non-medical risk factors like MVR and substance abuse are larger proportional contributing factors to mortality risk. We can also speculate that the pattern by age observed (see **Figure 11**), may correspond to the availability of the digital medical and behavioral components utilized by the Risk Score 3.0 RxDxCr model, and it can be argued that such a digital footprint will be more limited for younger age applicants leading to less predictive lift for the model at younger ages.

To account for this difference by age, and to bring our relative starting point for the declinable risk analysis directly in line with the 2015 VBT table, we adjust the expecteds for each quinquennial age group by dividing by its respective A/E in order to center the Standard or Better applicants at exactly 100% of the 2015 VBT (**Figure 12**).

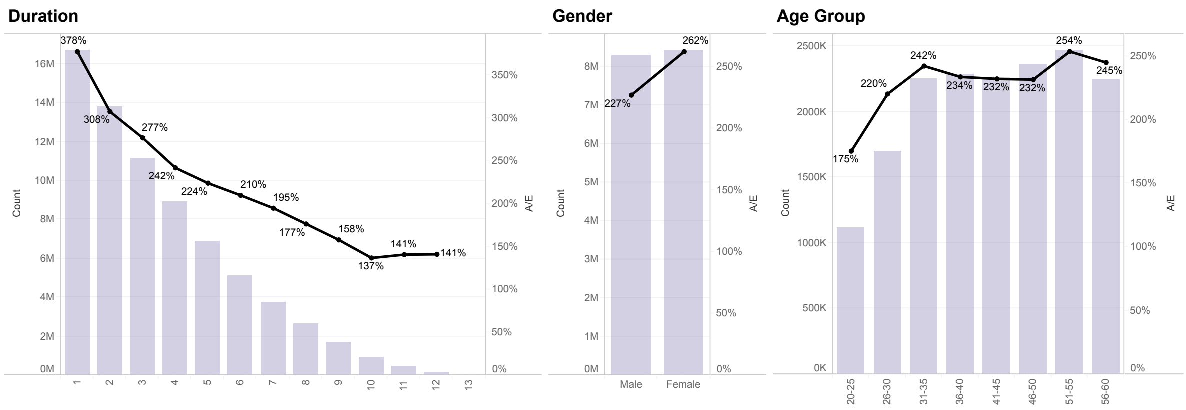
Figure 12 : A/E vs. the 2015 VBT, MI and Duration Adjusted, UW/Contestability Adjusted, Standardized, Scores <=1.0



Proxy for Traditional Decline Underwriting

With our referent experience study basis for Standard or Better in place and calibrated to 100% of the 2015 VBT, we can turn now to an analysis of declinable risks. We start with the aggregate A/E after calibration for the entire applicant pool (**Figure 13**) which is now 241%, with a more linear slope by duration and a more level pattern by age group.

Figure 13 : A/E vs. the 2015 VBT, MI and Duration Adjusted, UW/Contestability Adjusted, Standardized, All Risk Scores



We continue to use the Risk Score model as a proxy for traditional underwriting and now define a range of scores for declinable risks. Let's start by examining the A/E's by Risk Score groupings based on our experience study (**Figure 14**).

Figure 14 : A/E by Risk Score group (combining all scores >3)

Risk Score 3.0 RxDxCr	Running % Count	A/E
0.25	13.5%	41%
0.5	45.1%	74%
0.75	61.3%	129%
1	70.8%	185%
1.25	76.9%	235%
1.5	81.1%	284%
1.75	84.3%	333%
2	86.9%	377%
2.25	88.9%	423%
2.5	90.5%	468%
2.75	91.9%	506%
3	93.1%	539%
>3	100.0%	1205%

Proxy for Traditional Decline Underwriting

As can be seen in **Figure 14,** scores of 2 and above correspond to risks of roughly Table 11 (375%) and beyond. This is near the edge of insurability for typical FUW risks for most direct carriers. Based on the running total of applicants, this would put roughly 16% of applicants beyond the FUW range for insurability. While this is certainly a higher rate of declinable risks than what has been observed by most FUW carriers in practice, we should keep in mind that the data set represents all applicants, and within a traditional process many of these individuals may self-select to withdraw from the process when it becomes clear that approval is unlikely based on the exam and fluid requirements. Now that most accelerated programs have removed those requirements, these individuals may be proceeding through the underwriting process.

Combination of score and drug priority

Based on the table above, it seems reasonable to define declinable risks to be scores of roughly 2 and above; however, rather than setting a hard and fast cut point at a score of 2, we elected to also leverage the green/yellow/red drug classification information provided as well, recognizing that in practice an underwriter will be looking at multiple factors when determining a decline: for borderline scores the presence of a red drug might be necessary for decline, for higher scores a red or yellow would push it over the edge, and after a certain point the score alone indicates the risk is too great. Therefore, we defined declinable risks as follows (**Figure 15**):

Figure 15 : Definition of Declinable Risks

Declinable Risks	
Irix Risk Score Range	Rx Category
2.0-2.39	Red
2.4-2.69	Yellow, Red
2.7+	Any

Using this definition, we categorize 2.19M applicants (roughly 13%) as declinable risks, with just over 120k deaths (contestability period adjusted) for an aggregate A/E of 845%.

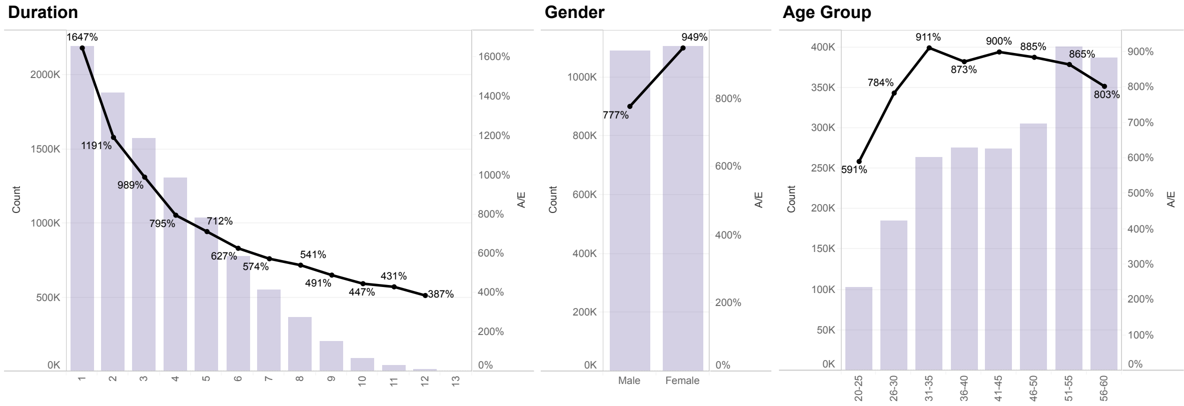
This leaves the remaining 14.51M as insurable risks with an aggregate total A/E of 137%. Using our Risk Score definition for Standard or Better from (0,1], this means that of the insurable risks 83% are Standard or Better and 17% are Sub-Standard, which we consider to be a reasonable breakdown of risk based on industry underwriting experience.

We have now effectively performed a proxy underwriting process with the application of actuarial judgement to break the total application pool into reasonable Standard or Better, Sub-Standard, and Decline cohorts.

Decline Cohort Exploration

We can now examine the declinable risk cohort by duration, male/female, and age in (**Figure 16**).

Figure 16 : Declinable Risk A/E vs. the 2015 VBT, MI and Duration Adjusted, UW/Contestability Adjusted, Standardized



There are two noticeable patterns in the declinable risk data. First, even after our adjustments for early duration contestable claims, there is a steep A/E curve in early durations (with some similarities to the SI mortality we examined earlier). Secondly, the aggregate A/E is much higher for females than for males. The A/E's across ages are relatively stable, excluding the very youngest ages which do not have a credible level of deaths.

To better understand the drivers behind these patterns and to ensure that we haven't produced counter-intuitive relationships by duration or male/female through our definition of declinable risk, let's look at the underlying declinable risk death rates[5] for males and females compared with the underlying expected death rates for the 2015 VBT[6] and 2017 SI tables:

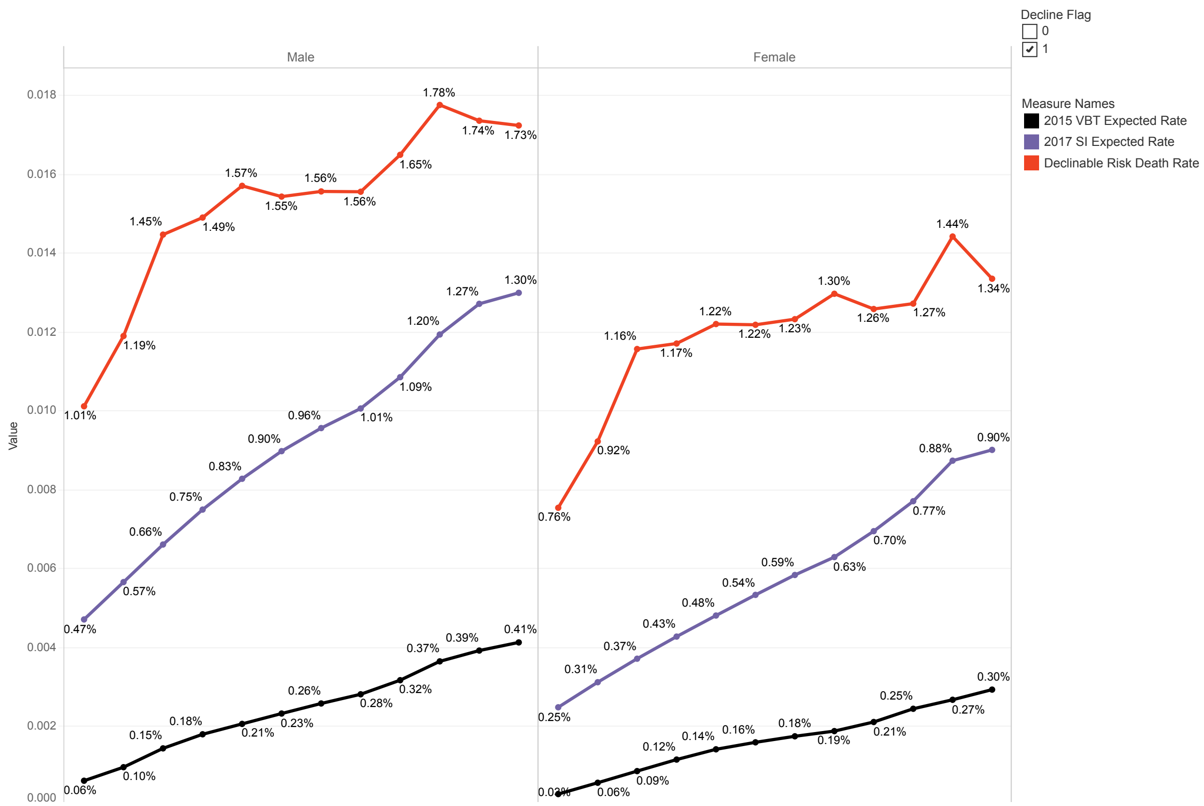
5 Adjusted for underwriting and contestable claims.

6 Adjusted for MI and Standardized

Decline Cohort Exploration

Figure 17 : Declinable Risk Death Rate vs. 2017 SI and 2015 VBT

Death Rates by Duration



As can be seen above (**Figure 17**), the underlying death rates (red lines) for female declinable risks remains significantly below males; however, the relative risk compared with the 2015 VBT expected rates (black lines) for female A/E's are higher especially in early durations. Therefore, the relationship between male and female declines fits our expectations, with male declinable mortality higher than female mortality, and the observed A/E's for female declinable risks vs the 2015VBT is driven by lower relative expecteds.

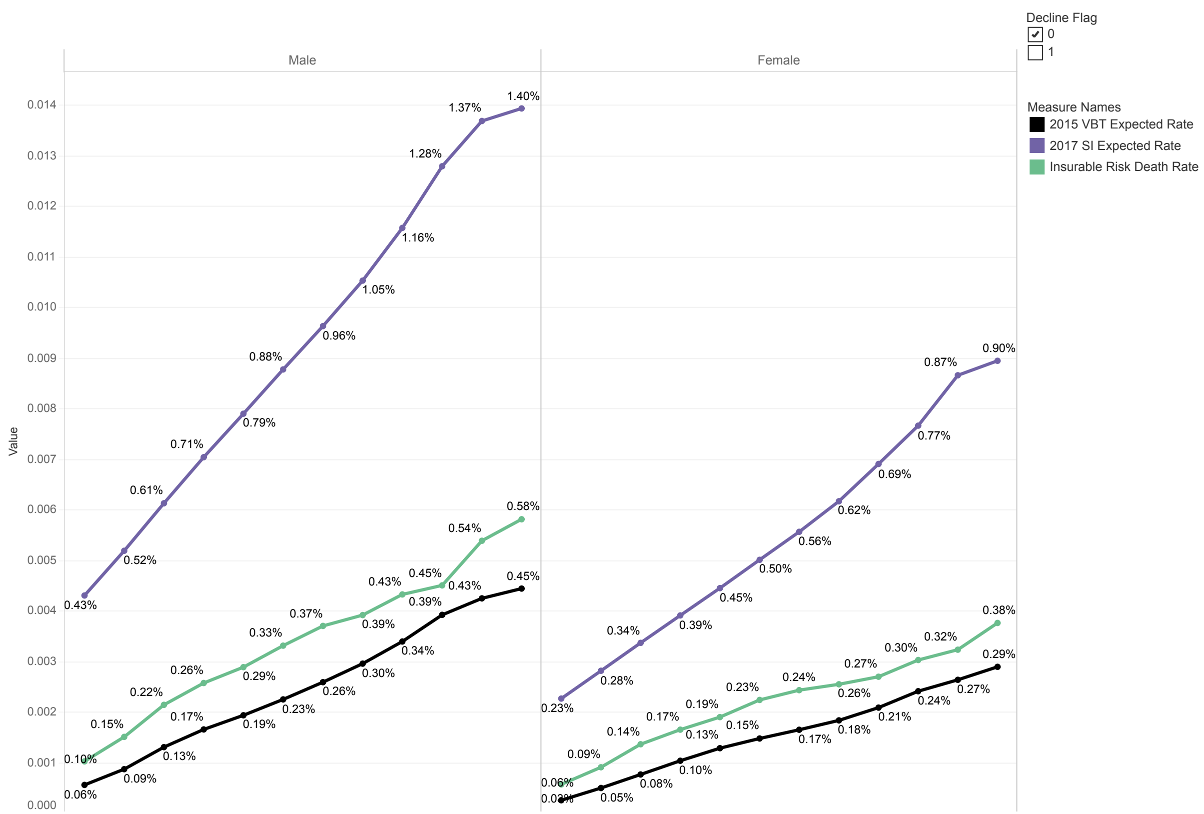
Comparing the declinable risk rates to the 2017 SI, we see that especially after adjusting durations one and two for contestable claims, the pattern is similar, though higher and somewhat flatter. This lines up with our earlier speculation that declinable risk would have similar characteristics to SI but would have worse mortality than an SI block. The difference in slope may reflect the steep select wear off in the 2017 SI table due to greater anti-selective lapsation in those products.

Decline Cohort Exploration

We can also look at the cohort of insurable applicants as we've now defined them. We can see below (**Figure 18**) that the insurable mortality curve is highly consistent with the 2015 VBT S&U table, which should come as no surprise based on our earlier results, however, it is helpful to see internal consistency in the construction of our declinable and insurable risk cohort assumptions.

Figure 18 : Insurable Risk Death Rate vs. 2017 SI and 2015 VBT

Death Rates by Duration



Decline Severity by Product Duration

Now let's turn to the shape of declinable mortality, which differs significantly from FUW select mortality and is much more heavily weighted towards early durations. This has implications for how we measure the impact of declinable risks when pricing by different product durations, and it points to an overall need to think about the relative declinable mortality risk on a present value basis rather than a simple aggregate A/E.

Since there is a significant difference between the relative severity of declinable risks between males and females compared to our expected basis by male/female, let's start by examining the declinable pattern of A/E's by male/female and duration splits. The below show the declinable risk A/E in black and the ratio of the 2017 SI vs. 2015 VBT in orange for reference (**Figure 19-20**).

Figure 19 : Female Declinable Risk A/E by Duration

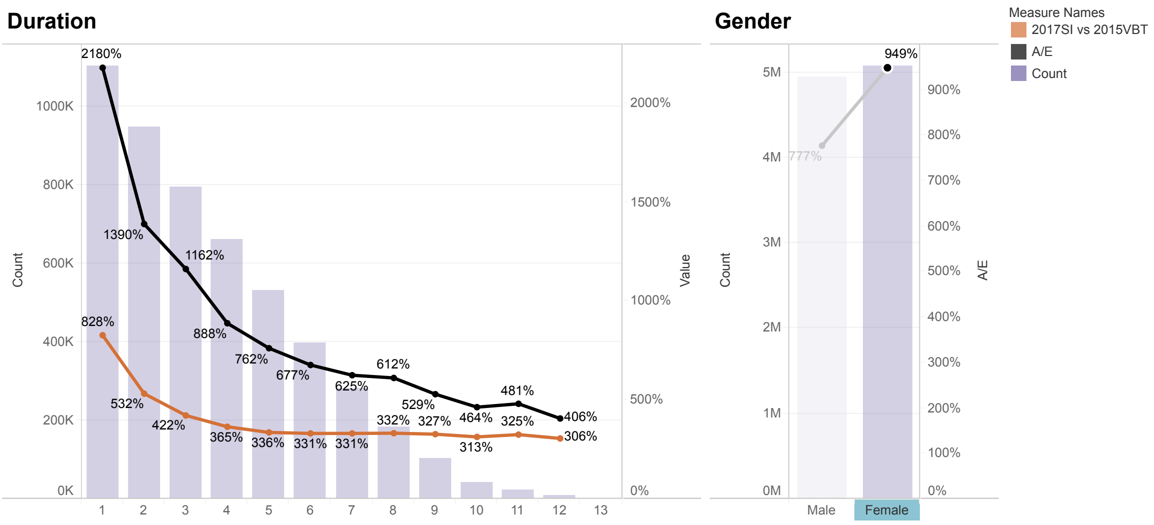
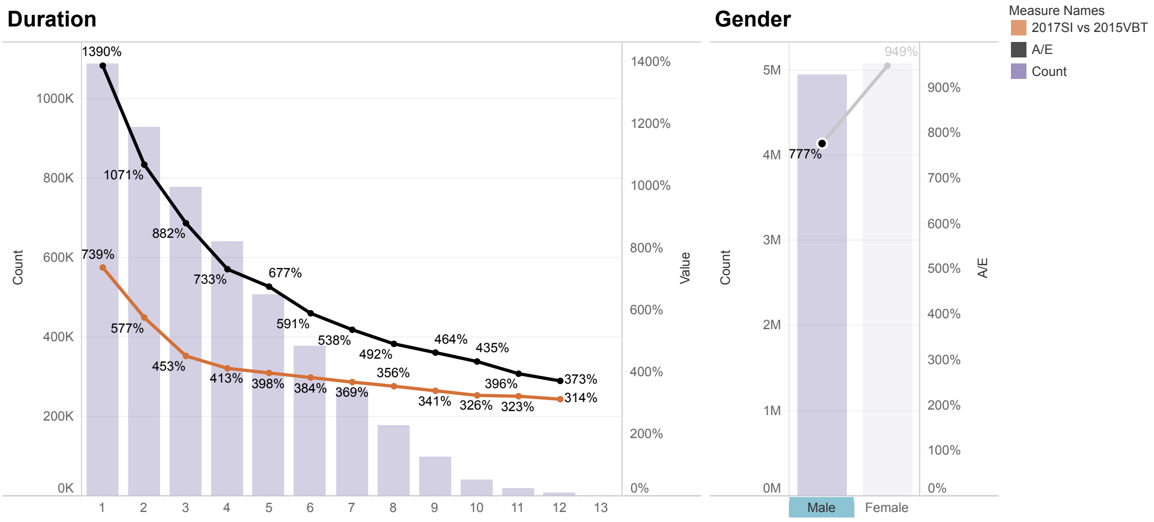


Figure 20 : Male Declinable Risk A/E by Duration



Decline Severity by Product Duration

While the relative risk for female declinable risks starts out much higher in early durations, both male and female A/E's drop off rapidly and begin to stabilize into a steady slope in later durations. The credibility in durations 11 and 12 becomes thin, so for simplicity let's assume that the declinable risk A/E's in durations 11+ run off using the same pattern as the SI vs. 2015 VBT ratios in later durations. Using this A/E wear off assumption we can now calculate the present value of the cost of insurance for representative Standard or Better 2015 VBT risks and Declinable risks (i.e. the ratio of $A_{x\ DEC}$ to $A_{x\ STD}$ respectively[7]) based on different product durations (**Figure 21**).

Figure 21 : Example of Declinable Risk A/E's by male/female and product duration based on Age 45 Standard 2015VBT PV of insurance.

PV of Declinable Mortality	Male Age 45	Female Age 45
10 Year Product	702%	837%
15 Year Product	590%	682%
20 Year Product	521%	585%
30 Year Product	432%	466%

The figure above indicates that the impact of declinable risks should be modeled as more than a single point estimate scalar, and PV of mortality impact can range from at least 400%-850%, so the pricing impact of declinable risks slipping into AUW programs should be carefully considered based on male/female and product duration. On the other hand, after calculating the PV impact of mortality in this way, the conventional wisdom estimates of 500% of Standard or Better for declinable risks appears in-line with the results for longer duration products, so while the timing of mortality may differ significantly from this simple pricing scalar approach, the long-term mortality impact may still line up with our previous pricing assumptions for these longer product durations.

The wear-off of the impact of early duration declinable risks may be welcome news for those monitoring higher than expected early claims experience within their accelerated underwriting pools; however, the experience and reserving implications, especially under PBR may lead to significant capital friction for accelerated products, since early claims experience will drive mortality ratios for years to come.

7 Note we use a flat 5% interest rate, a flat 4% lapse rate for Standard risks, and a flat 2% lapse rate for Declinable risks taking into account the likely anti-selective persistency of declinable risks with issued policies who are otherwise uninsurable.

Limitations and Next Steps

The analysis of declinable risks detailed above should serve as a starting point for a more in-depth study of the mortality shape and severity of historically declined individuals entering the insured AUW risk pools, however, as we noted earlier, our analysis is limited by the lack of direct decline risk data, and our conclusions are based only on proxy approximations of traditional underwriting decisions.

Application of the PV of declinable risk mortality is further complicated by the fact that many AUW programs incorporate the use of the **Irix® Risk Score** in determining eligibility for acceleration; therefore, many of the declinable risks analyzed here may already be excluded within the AUW context, and therefore more questions remain about declinable risks that otherwise fall into the range of better Risk Scores. For this reason and based on different target markets and distribution channels, it is likely that average declinable risk severity can vary significantly company to company. We do think, however, that the implied durational shape of declinable risks demonstrated in our analysis above is a logical, defining characteristic of these risks with clear implications for pricing by product duration.

Given the potential long-term impact on life mortality experience and AUW product profitability, we believe there is a strong argument for an industry sponsored study of the actual declinable risk pool. Such a study is both necessary for carriers and reinsurers as well as in the interest of the consumer who benefits from the increased access to insurance and improved customer experience associated with AUW programs in the market. Research into declinable risks is necessary for the long-term sustainability of such programs and the continued improvement of life insurance distribution and the customer journey.

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