# Society of Actuaries in Ireland

## The Latest on United States Mortality, Lapse, and Underwriting

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# Agenda

- Milliman Industry Mortality Study and Analysis (MIMSA)

  - Mortality results

  - Lapse results

- Underwriting

  - Preferred

  - Simplified Issue

  - Older Age

  - Predictive Modeling

# MIMSA RESULTS

# MIMSA (Milliman Industry Mortality Study and Analysis)

- Why did we do this study?
  - Industry experience studies help Milliman better help its clients
  - This is first of several US studies we plan to do

- Our goals of experience studies in general
  - Provide relevant and timely information
  - Provide cutting edge information
  - Provide personalized information to each participating company
  - Handle all data confidentially

- Hope to eventually help internationally as well

# MIMSA – The Big Picture Details

- Mortality and lapse study

- 29 companies participated

- 10 study years: 2000-2009

- Could not use premium, cash value, or reinsurance data

- A number of interesting findings, some never before published!

# MIMSA – Overall Results

- Primary focus of study was standard ordinary business
  - Fully underwritten, no substandard, no term conversions
  - Fully underwritten is medical, paramedical, nonmedical underwriting
- Exposures
  - Mortality:  $27.8T in total, $23.3T for standard ordinary business
  - Lapse:       $26.8T in total, $22.8T for standard ordinary business
- Terminations
  - Death:  1.6M in total, 1.3M for standard ordinary business
  - Lapse:  8.1M in total, 6.3M for standard ordinary business
  - Other:   1.3M in total
- Standard ordinary results
  - Mortality:  87% of SOA 2008 VBT by amount, 97% by count
  - Lapse:     Lapse rate of 5.5% by amount, 4.5% by count

**Underwriting Types - Distribution by Exposure**
**All Data, Excluding Substandard and Term Conversions**
**Total Exposures ($ Millions) = 26,139,248**
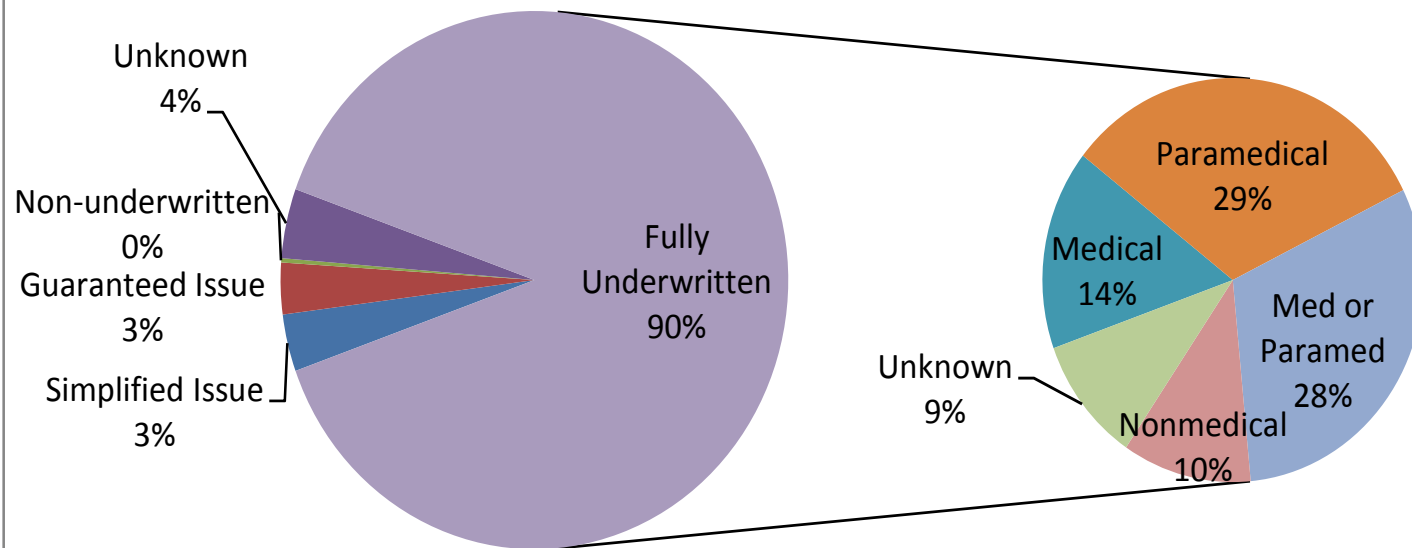
# MORTALITY

# MIMSA Mortality Findings

- Used SOA 2008 VBT as expected basis for mortality
  - Analysis based on Actual to Expected (A/E) ratios by amount
  - Age last and age nearest birthday based on individual company
- Range of individual company A/E ratios more than double between best and worst
- Spike in duration 3 mortality due to end of contestable period
- Older age mortality rates were close to, but generally less than those of the 2008 VBT between attained ages 90 and 100
- Found increase in mortality for $1M+ policies on level term and Variable Life coming from extra accidents, suicides and homicides
- Indication of wearing off of preferred for nonsmoker two class structure

# MIMSA Mortality Findings (cont'd)

- There was a large increase in mortality at the end of level term period, generally consistent with recent SOA research project

- Overall A/E ratio on term and permanent was same

- UL with Secondary Guarantees and Current Assumption UL experience favorable, but Cash Accumulation UL experience unfavorable

- Simplified Issue experience unfavorable, but a little better in more recent years

- Mortality improvement analysis produced inconclusive results

- Compared results of medical and paramedical underwriting

- The ratio of smoker to nonsmoker mortality rates generally ranged from 150-300%, varying by age and duration

# MIMSA Mortality Findings (cont'd)

- Mortality experience by distribution channel consistent with target market sold to

- Overall substandard business was favorable
  - On average, just over 150% of standard (including preferred)
  - Also favorable relative to priced for
  - Only permanent flat extra business was unfavorable

- Term and group conversion experience was unfavorable
  - Very large A/E ratios for at least two years following conversion
  - Then grades off, but never reaches standard even by ultimate period (duration 26+)

- Cardiovascular disease, cancer and respiratory disease were the top three leading causes of death
  - Mental and nervous deaths grew by almost 200% over 10 study years

# LAPSE

# Lapse Findings

- Focus on lapse rates by count
  - Also lapse rates by amount where appropriate

- Policies issued prior to about 1980, were mostly permanent and the more recent business was term
  - Oldest duration lapse rates on permanent leveled out at just under 2%
  - Good information on term only available through about duration 16

- While overall rates by gender were close, there was a variance in gender lapse rates by age

- Lapse rates generally decreased with increasing policy size

- Duration 1 lapse rates generally high, except for largest policies

- The better the risk class rank the lower the lapses
  - Biggest difference in first two durations

# Lapse Findings (cont'd)

- Shock lapse experience for the end of the level term period

- Lapse rates were high on Return of Premium Term and low on UL with Secondary Guarantees

- Direct marketing / Internet had the lowest lapse experience among the distribution channels

- Lapse rates began to rise overall in 2006, but not for all companies

  - This study was based on 16 companies that contributed in all 10 study years to avoid distortion of companies entering and leaving

  - Increase in lapse rates appeared to be due to increase in production

Lapse Rates by Count - Study Year
16 Companies with 10 Years of Lapse Data
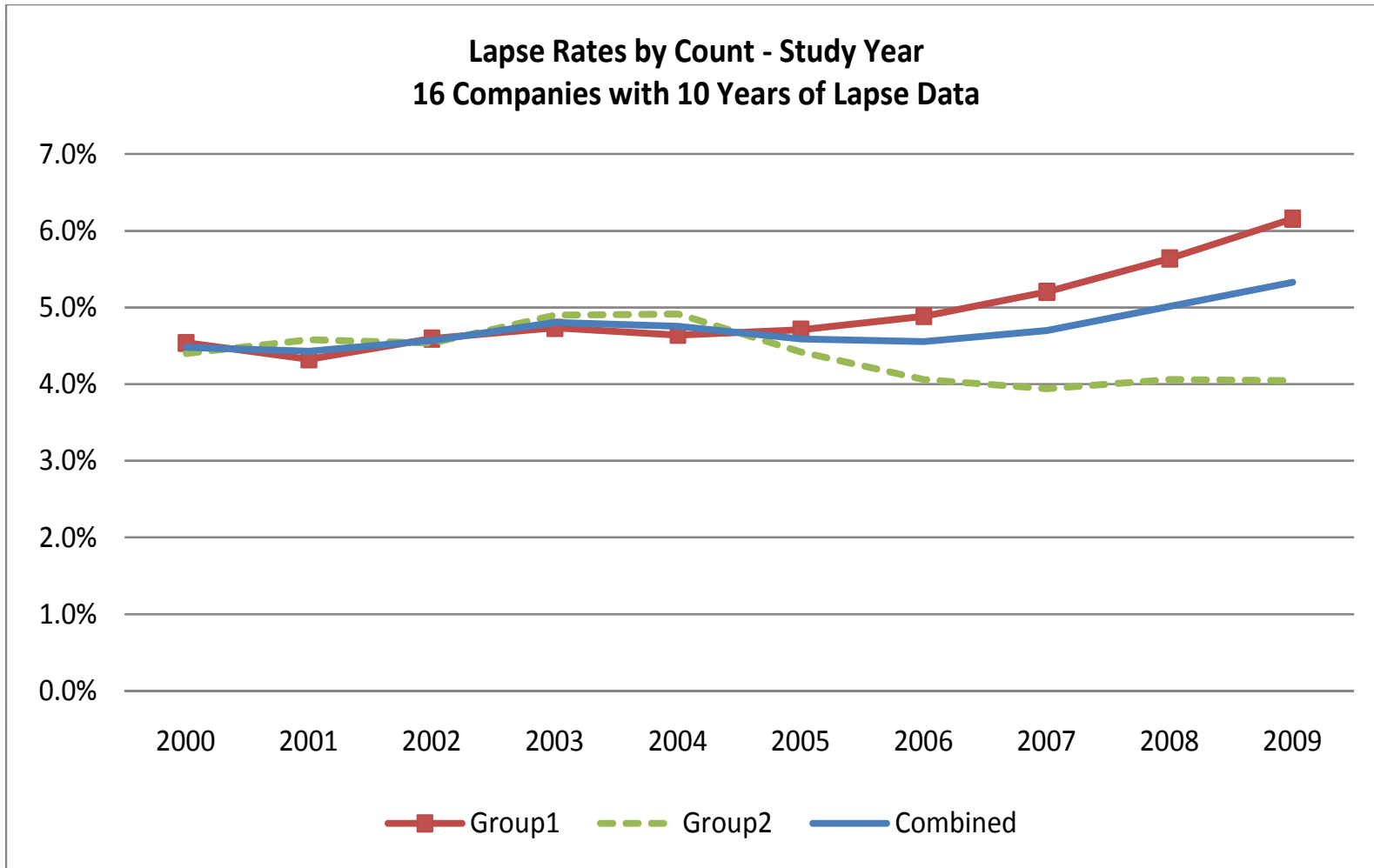
# UNDERWRITING

# PREFERRED UNDERWRITING

# Preferred Underwriting in the US

- Began in late 1980s with AIDS scare
- Common elements of preferred underwriting in the US
  - Alcohol and drug abuse
  - Blood pressure
  - Build
  - Cholesterol
  - Family history
  - Motor Vehicle Record (MVR)
  - Personal medical history
  - Tobacco use
  - Other – Aviation, avocations, citizenship, foreign travel, hazardous activities, residence

# Preferred Underwriting (cont'd)

- Evolution over the years
  - More risk classes
  - Move by some companies from the original knockout approach to a debit/credit approach
  - Exceptions vs. business decisions
  - Scoring of criteria for Principles Based Reserves

# SIMPLIFIED ISSUE

# What is Simplified Issue?

- Many definitions

- Somewhere between fully underwritten and guaranteed issue

- Some general statements
  - Generally no medical or paramedical exam
  - Typically no bodily fluids collected, but sometimes oral fluid
  - Generally medical questions and a question on tobacco use
  - Generally allow some substandard business, but also have some knockout questions
  - No consistency in policy size

# Why is there interest in SI?

- Quicker issue

- Less intrusive

- Method to enter certain markets
  - Middle income
  - Juvenile
  - Mortgage
  - Banks
  - Direct marketing
  - Internet

# What underwriting tools provide protective value?

- Application questions
  - Medical
  - Financial
  - Lifestyle

- MIB (Medical Information Bureau)

- Motor Vehicle Record (MVR)

- Tele-underwriting
  - Verification or drill down
  - All ages or limited
  - Can incorporate cognitive testing for older ages

# What underwriting tools provide protective value? (cont'd)

- Prescription database

- Oral fluid

- Predictive modeling

- Personal History Interview (PHI)

# Setting a Mortality Assumption

- Two approaches
  - Start with the 2008 VBT Limited Underwriting Table
  - Start with current company mortality table

- Make appropriate adjustments
  - Must understand underlying table
  - Adjustments may be in both directions

- Considerations
  - Is the new product single premium or premium paying?
  - Underwriting, target market, distribution channel, etc.

- Monitor results
  - Be able to react quickly if results don't come in as expected

# OLDER AGE

# Why is having an Older Age Underwriting program important in the US?

- Proportion of business on the elderly is high and growing
  - Larger premiums and sometimes face amounts on this business
- There is often a big difference in the health and life expectancy between two elderly individuals of the same age
- Growth in cognitive impairment
  - Older age population growing
  - Approximately doubles every 5 years (age, not calendar time)
- Other companies have implemented programs
- Sentinel effect

# How prevalent is dementia?

| 2005 Alzheimer's Disease International (ADI) Estimates of the prevalence of dementia (%) By World Health Organization (WHO) region and age group | | | | | | |
|---|---|---|---|---|---|---|
| WHO Region Description | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85+ |
| Western Europe | 0.9 | 1.5 | 3.6 | 6.0 | 12.2 | 24.8 |
| Eastern Europe (B) | 0.9 | 1.3 | 3.2 | 5.8 | 12.2 | 24.7 |
| Eastern Europe (C) | 0.9 | 1.3 | 3.2 | 5.8 | 11.8 | 24.5 |
| North America | 0.8 | 1.7 | 3.3 | 6.5 | 12.8 | 30.1 |
| South America (D) | 0.8 | 1.7 | 3.4 | 7.6 | 14.8 | 33.2 |
| South America (E) | 0.7 | 1.5 | 2.8 | 6.2 | 11.1 | 28.1 |
| Middle East | 0.9 | 1.8 | 3.5 | 6.6 | 13.6 | 25.5 |
| North Africa, Middle East | 1.2 | 1.9 | 3.9 | 6.6 | 13.9 | 23.5 |
| Japan, Australia, New Zealand | 0.6 | 1.4 | 2.6 | 4.7 | 10.4 | 22.1 |
| China and neighbors | 0.6 | 1.7 | 3.7 | 7.0 | 14.4 | 26.2 |
| Indonesia, Sri Lanka, Thailand | 1.0 | 1.7 | 3.4 | 5.7 | 10.8 | 17.6 |
| Inda and neighbors | 0.4 | 0.9 | 1.8 | 3.7 | 7.2 | 14.4 |
| Sub-Saharan Africa (D) | 0.3 | 0.6 | 1.3 | 2.3 | 4.3 | 9.7 |
| Sub-Saharan Africa (E) | 0.5 | 1.0 | 1.9 | 3.8 | 7.0 | 14.9 |

# Components of an Older Age Underwriting Program

- Four components to a successful program:
  - Cognitive testing
  - Functional testing
  - Supplemental questionnaire
  - Changes to traditional underwriting

# Best Indicators of Mortality

- A July 2007 Society of Actuaries survey on older age underwriting practices asked respondents to rank the five most important indicators of mortality (see table on next slide)
  - 5 of the top 6 indicators were related to cognitive or functional testing
  - All but 3 of the indicators relate to non-traditional testing or questions needed for older age underwriting

# Best Indicators of Mortality (cont'd)

| Factors that Affect Mortality - Shown by Number of Respondents * | | Rank | | | | | | Component of Older Age |
|---|---|:---:|:---:|:---:|:---:|:---:|:---:|---|
| | Risk Factor | 1 | 2 | 3 | 4 | 5 | Total | Underwriting Program |
| 1 | Current health condition | 13 | 3 | 4 | 0 | 2 | 22 | Traditional |
| 2 | Cognitive function | 2 | 9 | 3 | 5 | 1 | 20 | Cognitive |
| 3 | Frailty | 8 | 2 | 4 | 2 | 2 | 18 | Functional |
| 4 | ADLs (Activities of Daily Living) | 2 | 4 | 2 | 4 | 2 | 14 | Functional |
| 5 | Current mental health | 0 | 4 | 3 | 2 | 1 | 10 | Cognitive |
| 6 | IADLs (Instrumental ADLs) | 1 | 1 | 2 | 4 | 0 | 8 | Functional |
| 7 | Active lifestyle | 0 | 2 | 0 | 0 | 6 | 8 | Supplemental Questionnaire |
| 8 | History of heart disease | 1 | 3 | 2 | 0 | 1 | 7 | Traditional |
| 9 | Social condition | 0 | 0 | 1 | 1 | 5 | 7 | Supplemental Questionnaire |
| 10 | Mobility | 1 | 0 | 1 | 4 | 0 | 6 | Functional |
| 11 | Financial condition | 0 | 1 | 1 | 2 | 2 | 6 | Traditional / SQ |
| 12 | Living arrangements | 0 | 0 | 1 | 1 | 4 | 6 | Supplemental Questionnaire |
| 13 | History of cancer | 1 | 0 | 1 | 1 | 2 | 5 | Traditional |
| 14 | Self-perceived health | 0 | 1 | 1 | 0 | 2 | 4 | Supplemental Questionnaire |
| 15 | Support structure | 0 | 0 | 2 | 1 | 1 | 4 | Supplemental Questionnaire |

\* Excerpt from Table 16.1: Factors that Affect Mortality - Ranked by Number of Respondents
from the Society of Actuaries July 2007 report on Older Age Underwriting Practices

# PREDICTIVE MODELING

# *Laboratories*

- Have been collecting data for many years and now using it to score individual applicants

- Information on applicants rather than insureds

- Collected death information from Social Security Death Master file

- Performed statistical analytics to determine score, considered correlations

# Other Vendors

- Re-evaluate same information but in different ways
  - Research provides different values, weightings
  - Utilize individual company data for research
  - Preliminary results show better accuracy in predicting mortality

- Automated underwriting
  - Can be simple use of company parameters or more sophisticated analysis of data

# New Medical Markers

- Sponsored by SOA
  - Studied 11 potential tests
    - Apolipoprotein A and B – Lipid test that can be used instead of cholesterol
    - CBC (Red Cell Distribution width) – Wider variation in widths implies higher mortality
    - Cystatin C – Renal (kidney) function
    - Hemoglobin – Anemia and other physiological diseases
    - Hemoglobin A1c – Metabolism of glucose
    - Microalbumin - Diabetes
    - NT-proBNP – Congestive heart failure
    - Oxidized LDL – Heart disease
    - Phospholipase A2 – Used to predict cardiac event or stroke
    - TNF alpha - Cancer
    - Troponin I and T – Determines if damage to heart
  - Report quantifies mortality savings and cost of test
    - Available on SOA website

# New Medical Markers (cont'd)

- Marker to predict life expectancy
  - Blood test to measure telomere length

- Markers to predict Alzheimer's disease
  - Protein in spinal fluid (1)
  - Measure of increase in DHEA (dehydroepiandrosterone) when blood oxidized (no increase in DHEA in Alzheimer's patients) (2)

# Life-Style Based Analytics

- Used more in health insurance, but some beginning to use in life insurance

- Uses consumer data to evaluate applicant, example of two individuals:
  - First just bought new running shoes and subscribes to several healthy living magazines, 10 minute bicycle ride to work each day
  - Second just bought new television and couch and drives 40 miles to back and forth to work each day

- Currently can only use positive information

- Potential privacy issues

# Other New Underwriting / Mortality Improvement Considerations

- Recent studies listed generally, but not always from US

- Environment
  - Pollutants linked to diabetes (3)
  - Age of onset of puberty predicts adult osteoporosis (4)

- Geographical location
  - Wide difference in life expectancy by region in US (5)

- Poverty, low levels of education and other social factors (6)
  - US study showed following extra deaths in 2000
    - 245,000 due to lower education
    - 162,000 due to low social support
    - 133,000 due to individual-level poverty

# *Other New Underwriting / Mortality Improvement Considerations (cont'd)*

- Obesity
  - Overweight more harmful to liver than alcohol in middle-aged men (7)
  - Obesity is a killer in its own right, irrespective of other risk factors (8)
  - Dementia link to middle-age obesity (9)

- Diet
  - Diets for elderly after hospitalization decreased mortality rates (10)
  - Eating purple fruit could fend off Alzheimer's Disease and Multiple Sclerosis (11)

- Exercise

# Questions?

# References

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Thank you!