

# LIFE INSURANCE UNDERWRITING IN THE UNITED STATES – YESTERDAY, TODAY AND TOMORROW

By Allen M. Klein

## ABSTRACT

Underwriting in the United States (US) life insurance marketplace has evolved tremendously over the last several decades. This paper will take a brief look at that history, from the older underwriting techniques still in use today to the introduction of smoker/nonsmoker distinctions in about 1980 to the evolution of preferred underwriting in the late 1980s and finally to a movement toward simplified issue underwriting and a new approach to older age underwriting today.

## KEYWORDS

Underwriting; Medical Underwriting; Financial Underwriting; Preferred Underwriting; Simplified Issue Underwriting; Older Age Underwriting; Tele-underwriting; Predictive Modeling; Mortality

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## 1 INTRODUCTION

1.1 This paper will describe each of the types of life insurance underwriting used in the US along with each of the tools used. It will also provide a look to what might be next on the horizon for life insurance underwriting in the US and will conclude with several methodologies to measure the impact underwriting has on mortality experience.

## 2 UNDERWRITING TYPES

2.1 The underwriting types can be split into two categories, those that have been around a very long time and are still used today, and those that have come on the scene more recently. More recently here means within the last 30 years or so. Each of the types listed in the next two paragraphs will be explained in more detail following the lists. The first category of more traditional types of underwriting include:

- Fully underwritten
- Medical / Paramedical
- Nonmedical
- Simplified Issue
- Guaranteed Issue
- Guaranteed-to-Issue

2.2 The more recent types of underwriting that will be discussed include:

- Smoker/Nonsmoker
- Preferred underwriting
- Older age underwriting
- Simplified Issue (new)
- Financial underwriting

- Policy Ownership
- Remote underwriting
- Outsourced underwriting
- Straight-through processing

2.3 Fully underwritten consists of a full application. A full application has two parts, referred to as Part 1 and Part 2. Part 1 contains general non-medical information such as:

- Name
- Address
- Phone number
- Gender
- Birth date
- Social security number
- Drivers license number for MVR (Motor Vehicle Record) check
- Citizenship
- Occupation
- Financial information, including at least income
- A question on smoking
- Plan information, including riders
- Other coverage, including whether it is going to be replaced
- Whether the applicant has ever been denied coverage
- Owner
- Beneficiary

2.4 Part 2 contains a series of medical questions (e.g., have you been told that you had, or have you consulted or been treated by a physician or licensed medical practitioner for any disease of the lungs or respiratory system, including asthma, bronchitis, emphysema, tuberculosis or shortness of breath?).

2.5 Fully underwritten may or may not also include an exam from a doctor or paramedical professional. If it does include one, blood and urine specimens are generally also obtained for analysis.

2.6 A medical or paramedical exam generally consists of the following elements:

- Height and weight measurements
- Blood pressure readings
- Pulse rate
- Blood draw – this will be described later in the report
- Urine specimen – this will be described later in the paper
- A series of medical questions

2.7 The medical exam will include the same items and may also include an examination of other things, such as the eyes, nose, throat and listening to the heart and lungs.

2.8 For nonmedical underwriting, the full application is completed, including all of the traditional medical questions; however, no medical or paramedical exam is given. Neither a blood draw nor urine specimen is completed for nonmedical underwriting either. Nonmedical underwriting is another type of fully underwritten.

2.9 Simplified issue (SI) underwriting is similar to nonmedical underwriting, however, it does not include a full set of medical questions on Part 2 of the application. For this reason, it is not considered fully underwritten. While other tests may be used, as will be explained later in the paper, SI has the following characteristics:

- Less than a full set of medical questions on Part 2 of the application
- No medical or paramedical exam and no blood or urine test

2.10 Characteristics of guaranteed issue life underwriting include:

- No or a few medical questions
- No medical / paramedical, blood or urine
- Cannot be turned down for coverage, with a few exceptions. Generally the only circumstances where one can be turned down are:
  - The proposed insured doesn't meet specific age requirements for the plan, or
  - The proposed insured currently is living in a nursing home or LTC facility
- Small face amounts
- Return of premium for death in first two years

2.11 Guaranteed-to-issue is sometimes referred to as guaranteed acceptance. This type of underwriting is similar to guaranteed issue, however, the person cannot be turned down for coverage. Instead, rating of the individual is allowed. Guaranteed-to-issue also has relatively small benefits, sometimes return of premium with interest.

2.12 The smoker / nonsmoker distinction began in the US in about 1980. This was a precursor to preferred underwriting. Some companies will allow former smokers who have quit smoking to reapply for a nonsmoker rate, after a designated period of abstinence. Being a smoker is defined in different ways by companies. These include:

- No cigarettes; occasional pipe, cigar, and chewing tobacco are acceptable
- No nicotine in last year, 2 years, 3 years, etc.
- Never smoked

2.13 The smoker / nonsmoker distinction was the beginning of preferred underwriting in the US. In addition to not smoking, some companies offered a preferred discount to those who exercised regularly. In the late 1980s, with the AIDS scare, companies began to have blood drawn to test for HIV. The laboratories convinced life insurance companies that additional valuable information could be obtained from the same blood draw at a small incremental cost. Thus, preferred underwriting as it is known today, was born in the US.

2.14 The key elements of preferred underwriting are used by most companies. These have generally remained the same since preferred underwriting began. The key elements of preferred risk underwriting include:

- Alcohol and drug abuse
- Blood pressure
- Build
- Cholesterol
- Family history
- MVR
- Personal medical history
- Tobacco use
- Other – Aviation, avocations, citizenship, foreign travel, hazardous activities, residence

2.15 While the elements themselves haven't changed, what has changed over the years are the number of classes and the cutoff levels of each for the specific criteria. The number of risk classes has increased. With this increase, the cutoff levels have moved both up and down, depending on the company, product and risk class.

2.16 Another more recent change is that some companies have moved from a knockout approach to a debit/credit approach. A knockout approach is where an applicant does not qualify for a particular risk class if they do not meet one or more of the cutoff levels for the full set of criteria. A debit/credit approach is one where a point system is used for good and bad levels for the criteria. At the end, the points are summed and the point total determines which risk class into which the applicant is placed. There are also hybrid systems which include a combination of knockout and debit/credit. In fact, most debit/credit structures have some element of knockout in them.

2.17 Another development is that some companies allow exceptions to the published guidelines. These exceptions are sometimes published and sometimes kept internally to be applied to the criteria. The types of exceptions allowed vary considerably and are beyond the scope of this paper.

2.18 The Joint American Academy of Actuaries (AAA) and the Society of Actuaries (SOA) Preferred Mortality Task Force formed a group called the Underwriting Criteria Team (UCT) to develop a method to score the preferred underwriting criteria for the purposes of Principles Based Reserves. The UCT was comprised of actuaries and underwriters and met over the course of 1 ½ years to determine a method to score the various preferred risk classes. While this was done for valuation purposes, it may still be of interest to the reader. The UCT published a report on the scoring algorithm and it was republished in 2009. This report, entitled "Report of the Society of Actuaries Underwriting Criteria Team" can be found on the SOA website (soa.org). A new UCT team has been formed is currently taking a new look at the original work. Revisions are being worked on and results from this team should be published sometime in 2012.

2.19 While a number of companies have recognized the need for underwriting differently at the older ages for many years, this is a new type of underwriting for many companies. Some companies recognized this need in the late 1990s, but most of the recent adopters did so throughout the 2000s. Today, it is estimated that about half of the US life insurance companies have a special (meaning different from that used for the younger ages) older age underwriting program.

2.20 As people reach older ages (old age is defined differently company to company), a number of things change. These include:

- Routine readings on blood pressure, cholesterol, etc. may increase
- Weight may increase
- More medications may be taken
- Physical and mental abilities may diminish
- Living arrangements may change

2.21 Based on this, underwriting for the elderly should also change. Older age underwriting programs in the US may include one or more of the following:

- Cognitive testing
- Functional testing
- Changes to the traditional levels of underwriting acceptance
- Supplemental questionnaire

2.22 At a minimum a cognitive test may indicate whether the applicant has some degree of dementia. Some tests also do a good job of recognizing the precursor to dementia, Mild Cognitive Impairment (MCI). There is extra mortality associated with MCI, but certainly not to the extent of one who has dementia. With no current cure, barring death from something else, one with MCI will progress to dementia. Progression rates vary person to person.

2.23 The goal of a functional test is to determine where the applicant lies on a scale that has full functionality at one end and frailty at the other end. Depending on the degree of frailty, there can be a large increase in expected mortality from these individuals.

2.24 The changes to traditional underwriting include differences in blood pressure, cholesterol and weight readings. For example, higher blood pressure, cholesterol and weight are no longer necessarily bad. On the other hand, very low levels of cholesterol, for example, may be an indication of a potentially serious problem in the individual.

2.25 Supplemental questionnaires vary considerably company to company among those that use one. Some of the items that may be asked about include:

- Living arrangements
- Ability to perform Activities of Daily Living (ADLs), Instrumental ADLs and Advanced ADLs
- Social activities
- Physical activities
- Mental activities
- Travel

2.26 The purpose of asking about living arrangements is to determine where the applicant lives (e.g., home, apartment, assisted living facility, nursing home). It is also to determine whether they live with someone or alone (in which case, where help might come from if they need it). Yet another item to consider here is whether the home is safe (i.e., are there items strewn across the floor which may cause the applicant to trip and hurt themselves?). Falls, even ones that seem relatively small, can sometimes turn deadly for the elderly.

2.27 ADLs include bathing, dressing, eating, toileting, transferring and continence. Instrumental ADLs include housework, managing money, meal preparation, shopping, taking medications, taking transportation, telephone use. Advanced ADLs include things such as caring for others and driving. As a person ages, advanced ADLs go first, then Instrumental ADLs and finally ADLs.

2.28 Social, physical and mental activities are all necessary to maintain ones health in the older ages. Social activities can include going out with friends, religious activities, and other social gatherings. Physical activities may consist of a regular walk or gardening; a heavy physical workout at the gym is not necessary for the elderly to stay fit. Mental activities can include things such as the crossword puzzle and Sudoku's. Travel is sometimes asked about because those not physically fit to travel sometimes stop doing so.

2.29 Beginning in the mid to late 2000s, there has been a renewed interest in simplified issue (SI) underwriting/coverage in the US. The reason for this interest is the desire for faster and cheaper underwriting. With the somewhat reduced level of underwriting with SI, companies look for ways to get as much out of the underwriting process as they can with the goal of still keeping it simple. While SI, by definition, is less than a full set of medical questions, many companies are stretching this and asking some very good medical and non-medical questions to gain as much knowledge from the applicant as possible.

2.30 In addition, some of these companies are collecting as much other information as possible upon which to base the underwriting decision. There is generally enough information collected on these SI plans to allow preferred risk classifications, although the number of risk classes is typically less than that on a fully underwritten plan. In collecting this additional information, the main consideration is the speed in which the information can be obtained. This eliminates blood, urine, and the APS (Attending Physician Statement), all of which take a number of days to receive. Some of the additional items that companies collect (tools they use for SI underwriting) include:

- MIB (Medical Information Bureau)
- MVR
- Rx (Pharmaceutical database)
- Oral fluid
- Tele-underwriting

2.31 Each of these will be explained in more detail later in this paper. One additional item that is very new is fraud protection and this can take several forms. What is collected varies company to company as do the underwriting questions and the preferred risk class structure. SI is continuing to evolve in the US.

2.32 Financial underwriting has been done for years, primarily when a business was involved. However, with the larger incomes today, more emphasis has been placed on financial underwriting. Financial underwriting is primarily done to make sure that the income and net worth are consistent with the amount of insurance in force and applied for. For business owners, the anticipated growth of the business is also an important consideration.

2.33 Over the last decade or so, stranger owned life insurance has become popular. This is business written without the fundamental principal of insurable interest. While not preventable without regulation, companies try to look for and stop this type of business from being written in the first place. Mortality and lapse results can vary greatly on this business from traditional business.

2.34 Remote underwriting is where the underwriter works from home. With technology, cases and results can easily and quickly be transferred back and forth, no matter how far away the underwriter lives from the home office.

2.35 Outsourced underwriting is becoming more popular, primarily to accommodate times of peak work flow. This allows companies to get the work done during these busier times without having to add to staff. It also keeps companies from needing to reduce staff during non-peak times. Some smaller companies prefer not to have their own underwriting staffs and fully utilize a company that provides underwriting services.

2.36 With straight-through processing the underwriter is able to take advantage of the technology available today. Rules are pre-programmed into the software. If the proposed insured meets the pre-determined guidelines, they are not only approved for coverage. In some cases, the policy is also issued immediately upon a favorable system review. Depending on the rules, 30%-70% of policies are typically approved by the system as just described. An advantage of this approach is that it allows the underwriter to spend more time on more difficult cases.

### 3 UNDERWRITING TOOLS

3.1 The following is a list of underwriting tools that could be used in the life underwriting process. Each of the tools will be explained following the list.

- Application
- Blood test
- Urine specimen
- Oral fluid
- MIB
- APS
- MVR
- Tele-underwriting
- Pharmaceutical database
- Inspection report
- EKG (electrocardiogram), Treadmill
- Chest x-ray

3.2 The information collected on an application usually includes both non-medical and medical information. Many of the specific items were discussed above. In addition, approval for collecting other information about the applicant (e.g., MIB, APS, Rx) is generally also requested.

3.3 The life insurance blood test screens include a variety of tests. The blood test provides the most current medical information on an applicant, except for possibly an APS. A good source of information on the tests listed below is available on the MEG Financial website (MEG Financial, 2012). The Clinical Reference Laboratory provides a more detailed description of AGP (Clinical Reference Laboratory, 2005). The items typically screened for and their corresponding tests include:

- Diabetes screen
  - Glucose – Measures blood sugar levels and is an indicator of diabetes
  - AGP (Advance Glycation Product) – Tests for abnormal blood sugar levels; is indicator of diabetes
- Kidney screen
  - BUN (Blood Urea Nitrogen) – Test for kidney disease and dehydration
  - Creatinine – Test for kidney disorder and dehydration
- Lipid screen
  - Cholesterol – Risk factor in heart disease
  - HDL (High Density Lipoprotein) and LDL (Low Density Lipoprotein) – Components of cholesterol that are risk factors in heart disease
  - Triglycerides – Risk factor in heart disease
- Liver screen
  - Alkaline Phosphatase – Test for liver and bone disease
  - Bilirubin – Test for liver and blood disease
  - AST and SGOT (Aspartate Aminotransferase) – Test for liver and muscle disorders
  - ALT and SGPT (Alanine Aminotransferase) – Test for liver disease
  - GGT (Gamma Glutamyltransferase) – Tests for liver disorder, alcohol, drugs
  - Total protein includes Albumin and Globulin
    - Albumin – Test for advanced liver disease and malnutrition
    - Globulin – Test for immune disorders, infections and allergic reactions
- HIV screen
- PSA (Prostate Specific Antigen) for men ages 50+

3.4 A urine specimen can provide information on:

- Cotinine (metabolite for smoking)
- Cocaine and other drugs
- Medicines

3.5 An oral fluid sample can provide information on:

- HIV
- Cotinine
- Cocaine
- Hepatitis (used in Canada, not currently approved for use in the US by the Federal Drug Administration)

3.6 The oral fluid test is less invasive than a blood test. It can also be collected by agent so a paramedical or medical examiner is not needed.

3.7 The MIB was formed in 1890 by 15 medical directors to help protect insurance companies from fraud, according to information on the group's website (MIB Group, Inc., 2012). Member companies submit a request for information on an applicant. MIB provides information on whether the applicant was found to have an impairment by another member company when they applied for insurance with this other company. MIB will also indicate what the impairment was.

3.8 No rating can be attributed to the applicant based solely on the MIB finding without further research to confirm the impairment. When underwriting has been completed, the company sends their decision back to MIB using special MIB codes for MIB to add to their database. MIB retains information for 7 years after which it may no longer be passed along to companies.

3.9 In recent years, MIB has added additional services for member companies. One is called the Insurance Activity Index (IAI). The IAI provides companies with information on whether the applicant has applied for other coverage. It does not provide information on the outcome of that other application. This information can be used to identify possible other coverage or possible denial of coverage not admitted by the applicant.

3.10 When the extent of a disease or impairment is not known, an underwriter often requests an APS to get a clearer picture of the situation. The advantage of an APS is that it generally provides the underwriter with the additional information needed to make a rating decision on the applicant. The disadvantage of ordering an APS is that it generally takes at least 7-10 days to receive.

3.11 The MVR varies state by state, but all states generally provide information on the driving record of the individual. As there are many motor vehicle deaths and many accidental deaths are alcohol related, this information is important for the underwriting process. Included in the MVR is a history of:

- Moving violations
- DUI (Driving Under the Influence) and DWI (Driving While Intoxicated) citations
- Reckless driving incidences

3.12 There are a number of different types of tele-underwriting, which will be explained below. This is where someone calls the applicant to either confirm information provided on the application or to the medical / paramedical examiner. The call may also be used to find out more information from the applicant. It is always done by phone. The caller can be from the insurance company or from an outside vendor who completes these

types of calls. The caller is usually knowledgeable about medical conditions and knows how to deal with customers. Through my experience with tele-underwriting, I have found that more honest answers are gained from the tele-underwriting interview than other sources. This seems logical in that the applicant would feel more comfortable discussing medical issues with someone who has a medical background and with someone over the phone rather than face-to-face, as in the typical agent situation.

3.13 When additional questions are asked of the applicant, there is usually a script and pre-programmed questions that pop up on the caller's screen, depending on how the previous question was answered. These are called drill-down questions and are designed to determine the extent of the impairment that was mentioned on the application.

3.14 To compile the pharmaceutical database, information is collected by the vendors from Pharmacy Benefit Managers. While the prescription history is not perfect, as people sometimes purchase prescriptions outside of the covered network, the data is generally very good.

3.15 The process is that a company will send a request on a particular individual to the vendor, providing the name, social security number and date of birth. The vendor attempts to match the individual in their database and then returns one of three responses:

- The prescription history if there is one,
- That the proposed insured is in the database, but no prescriptions found, or
- That the person was not found

3.16 The first two responses are considered "hits" and the company is charged for this service. They are not charged in third instance where there wasn't a hit.

3.17 The prescription history that is provided includes:

- The drug prescribed
- The date it was prescribed
- The dosage prescribed
- How long the prescription covers
- The doctor who made the prescription
- The relative importance or seriousness of the drug in a red, yellow, green format, with red drugs being the most serious and green drugs being ones that are generally not a concern, like cold medication. Note that green drugs usually become more of a concern when there are multiple ones.

3.18 Companies can use the red, yellow, green coding of the vendor or can customize the rankings based on their own research and criteria. Besides, the red, yellow, green information, companies can use this information to find nondisclosure of medications, doctors that may not have been disclosed, and whether they are taking their medications as prescribed. It may also disclose that the person has an impairment not previously mentioned on the application or to the examiner. This information is determined by knowledge of what each drug is used for. Note that a company must be careful about drawing conclusions here as many drugs can be used for multiple conditions.

3.19 The reason "individual" and "person" was used here instead of "applicant" is because some companies utilize this information at the time of claim rather than at time of application. However, most companies that currently utilize the pharmacy database do check on applicants.

3.20 The inspection report is typically where a third party vendor calls the applicant to check application information. This is similar to the simplest form of tele-underwriting. In the past, the inspection report involved a private investigator asking family and friends about the individual applicant regarding personal habits (such as smoking), finances and any criminal behavior. This more in-depth interview is rarely done today, however, it may be used on the largest amounts of coverage.

3.21 An EKG (or ECG) is an electrocardiogram or a resting test of the heart. The treadmill test is a stress test to determine whether there are any irregular heart patterns. These are typically performed on older applicants and those applying for large amounts of coverage. There is some concern that an applicant could drop dead from the stress test. A few companies have replaced these tests by blood tests, such as NT-pro BNP. These blood tests provide an indicator of cardiac events, however, the EKG and treadmill test are still relatively common.

3.22 The chest x-ray is less commonly used in underwriting today, but is still used for very large amounts of coverage by some companies. The chest x-ray makes images of the heart, lungs, airways, blood vessels, and bones of the spine and chest. It can find issues related to shortness of breath, chest pain, chronic cough and fever.

#### 4 POSSIBLE NEW APPROACHES TO LIFE UNDERWRITING IN THE US

4.1 Before discussing possible new approaches to life underwriting in the US, it would be good to discuss what might be driving the changes. There are a number of potential drivers. These include:

- Need for speed – Many companies have the desire to issue policies more quickly. This has created the new interest in SI and this strong interest will likely continue into the foreseeable future.
- Age based underwriting – This concept has been around for some time, but very few companies have done much about it to date, other than those who have implemented special older age underwriting programs. The concept here is that there are unique characteristics between the young, middle age and older age applicants. For example, the young are more prone to death from auto accidents than cardiovascular disease.
- Holistic approach – The current knockout approach to preferred underwriting does not provide an accurate classification of all risks. While the debit/credit approach is better in this regard, it still doesn't go far enough to accurately assess each individual risk.
- New work realities – Remote underwriting is a reality at many companies and is growing in popularity. This growth is likely to continue.
- Regulatory – It is unknown what changes may occur, necessitating change. Healthcare reform may have some impact. Future changes are likely to be consumer driven, especially with the new types of underwriting being considered.
- Is there a better way? – This is probably the biggest driver of change as most companies are interested in gaining a competitive advantage.

4.2 The new approaches to underwriting are split into the following categories and will be explained in the order listed below.

- Laboratories
- Other vendors
- New medical markers
- Predictive modeling
- Other considerations

4.3 The three major laboratories in the US (Clinical Reference Laboratory Inc., Heritage Labs Inc. and Quest Diagnostics Inc./ExamOne) have been collecting data on individual applicants for many years. While some of the earlier data had been purged, there is still much data available. Note that while the instrumentation that measures the results of the tests has changed some since the early days, it has been consistent during the period where the labs have data. Each of the labs has taken advantage of this data, analyzed it and created a scoring system based on the analysis.

4.4 The data used for the scoring was based on applicant rather than insured lives because the labs don't know which business actually gets placed. Deaths are determined from the Social Security Death Master file. While not perfect, this source is generally fairly reliable.

4.5 The premise behind this work is that there is a better way to assess each individual applicant, that current methods give too much weight to certain combinations of variables and not enough weight to others. Certain variables have been shown to have strong statistical correlations and others don't and this has not been considered with the traditional preferred risk underwriting approaches today.

4.6 This type of scoring is very new, but the testing and preliminary findings are very positive. The labs are just beginning to market this scoring technique to the industry. It could be expected for this scoring to become popular in the near future.

4.7 There are other vendors that have also looked at similar issues, clinical literature and developed models that appear to better predict mortality outcomes than the traditional methodologies. There are also vendors that have automated the underwriting process, utilizing some of this research. While some companies are already using some of these resources, we anticipate there will be additional growth in these areas as well.

4.8 The SOA hired Milliman, Inc. to complete a study on potential new medical markers that could be used in the underwriting process. The report is entitled "New Medical Markers in Life Insurance Underwriting" and will be published on the SOA website in early 2012. The markers studied were provided by the laboratories and independent research was completed to determine the cost and benefit of each of these markers. Specific references used in this research can be found in the paper.

4.9 The 11 markers studied were:

- Apolipoprotein A and B – Lipid test that can be used instead of cholesterol
- CBC (Complete Blood Count) – Specifically within the CBC, Red Cell Distribution width was studied. Wider variation in widths implies higher mortality.
- Cystatin C – Renal (kidney) function
- Hemoglobin – Anemia and other physiological diseases
- Hemoglobin A1c – Metabolism of glucose
- Microalbumin – Early renal disease related to Diabetes
- NT-proBNP – Congestive heart failure
- Oxidized LDL – Early detection of plaque and MI (myocardial infarction) risk
- Phospholipase A2 – Used to predict cardiac event or stroke
- TNF(Tumor Necrosis Factor) alpha - Cancer
- Troponin I and T – Determines if damage to heart

4.10 There are potential markers from other research. One is a study of telomere length as it relates to life expectancy. This work was done by a company called Telomere Health. Much work has also been done regarding Alzheimer's disease. However, there are too many studies to try to list them all in this paper.

4.11 The term “predictive modeling” means different things to different people. For the purposes of this report, it is to be considered what is known as “life-style based analytics” or the use of consumer information in the underwriting process. Predictive modeling has been used more in health insurance, however, several companies have begun to use it for life insurance and more are expected to use it in the future. Many in the industry oppose use of this.

4.12 A very large amount of consumer data (thousands of pieces of information on each individual) can be obtained at a very low cost. Every time a card is swiped or a survey is filled out data is received and stored, generally without the knowledge of the individual it is happening to. The data available has been studied and analyzed. Some consistent patterns have emerged and conclusions drawn. For example, from the data below, someone could potentially and rightfully conclude that the first person would be healthier and live longer than the second:

1. Just bought new running shoes and subscribes to several healthy living magazines
2. Commutes 75 minutes each way to/from work and just bought a new television and a new reclining chair

4.13 Currently, insurance companies using this data only reward the better risks and don’t penalize the poor risks. The “reward” might be less underwriting requirements because the proposed insured received a favorable score based on all of their consumer data. The use of this data is expected to continue and to evolve, unless there is consumer backlash and/or unfavorable regulatory rulings due to privacy concerns or for other reasons.

4.14 There are a number of other things that may be considered in the underwriting process in the future. Some of these are listed below along with one or more recent articles on the topic. Most, but not all, of the articles are based on US data.

- Environment
  - Pollutants linked to diabetes, per a study by Lee et al. (Lee, 2011)<sup>i</sup>
  - Age of onset of puberty predicts adult osteoporosis, as demonstrated in a study led by Gilsanz (Gilsanz, 2011)<sup>ii</sup>
- Geographical location
  - Wide difference in life expectancy by region in US, per a study by Kulkarni et al. (Kulkarni, 2011)<sup>iii</sup>
- Poverty, low levels of education and other social factors, as illustrated in a study by Galea et al. (Galea, 2011)<sup>iv</sup>
  - 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
- Obesity
  - Overweight more harmful to liver than alcohol in middle-aged men, per a study by Kaczynski et al. (Kaczynski, 2011)<sup>v</sup>
  - Obesity is a killer in its own right, irrespective of other risk factors, as illustrated in a study by Logue and colleagues (Logue, 2011)<sup>vi</sup>
  - Dementia link to middle-age obesity, per a study by Anstey et al. (Anstey, 2011)<sup>vii</sup>
- Diet
  - Diets for elderly after hospitalization decreased mortality rates, as shown in a study by Shahar and colleagues (Shahar, 2011)<sup>viii</sup>
  - Eating purple fruit could fend off Alzheimer’s Disease and Multiple Sclerosis, per a study by Kell (Kell, 2010)<sup>ix</sup>
- Exercise

4.14 The pollutants, chemicals and hormones found in the environment are growing. These same toxins are found in increasing volume in individuals. It might make sense to screen for this in the underwriting process.

4.15 Geographical location can produce different mortality rates for a variety of reasons. If these differences are evident, should the underwriting process consider this? Should it also consider income levels and net worth, education levels, and social support, each of which has been shown to exhibit differences in mortality experience?

4.16 What about diet and exercise? If a healthy diet and regular exercise are two things that keep people healthy and lack of them causes potential health issues, why shouldn't these items be considered in the underwriting process? Why not reward someone for eating well since they should be expected to live longer? Exercise was the first preferred criterion, but was dropped because it was difficult to prove. With the technology available today, the frequency of health club visits is now generally available. This could be used in a positive way in the underwriting process.

## 5 MEASURING THE IMPACT ON MORTALITY EXPERIENCE

5.1 There are a number of methods to measure the mortality of a given underwriting type, tool, test or marker. These methods will be split between those for evaluating new tools and those for evaluating existing tools. For new underwriting tools, two methods will be described:

- Testing and validation
- Protective Value Study

5.2 For established underwriting tools, one method will be described:

- Actual-to-Expected Study

5.3 Testing and Validation is one process for determining whether to move forward with a new underwriting test or tool. Note that it is often difficult to segment the mortality impact of a particular tool or test relative to the impact from other sources. However, the process is described below.

5.4 Mortality data is collected from clinical data, a company's own studies, or another source. Testing of the new tool should be done to make sure mortality results are consistent with the values received from the tool. For example, if higher scores are indicative of higher mortality and some of the high scores have the lowest mortality results, there is either a problem with the tool or an explanation for this anomaly is needed. The anomaly could be explained, for example, by a lack of data in that portion of the study. This would not necessarily mean that the test was not a good one if the rest of the data proved reliable.

5.5 Validation is an important part of this process. In order to validate the data, it is generally split into two segments, with the second (smaller) set of data saved for the validation. Tests are performed on the first set of data and results are attained. The same tests are run on the second set of data and results are hopefully confirmed. Results won't be exact. However, if they are reasonably close they can be considered validated.

5.6 A Protective Value Study is also known as a cost / benefit analysis. Here the cost and benefit are estimated and compared. Does the cost justify the benefit? Determining both the cost and benefit can sometimes be difficult due to the elements involved in each. The following describes the elements and some of the related issues.

5.7 Elements of the cost include:

- Cost of the test itself
- Time spent by underwriter and other personnel on upfront training, evaluating the applicant during the underwriting process for this test, ordering additional information due to this test, and evaluating this additional information when it is received
- Cost for ordering an APS or another test to verify information from this test
- Time spent explaining to applicant why they were declined due to this new test

5.8 Depending on the complexity of the test, a more or less seasoned underwriter may be required. Although not specifically stated above, the medical director's time may also be needed.

5.9 The benefit may be even more difficult to quantify. Elements of the benefit (savings) include:

- Mortality savings due to this test / technique – This is typically measured by both the prevalence (how often the disease or impairment will be found) and impact of the findings (the total savings that will be achieved)
- Mortality savings due to needing to order an APS or other test and discovering something else, completely different, that wasn't caught before
- If the new test replaces an existing test, cost of the eliminated test

5.10 In terms of evaluating the mortality savings, the biggest challenge may be to determine how much savings was due to the introduction of this new test, that wouldn't be caught through the other underwriting tests/tools. For example, how much savings would the pharmaceutical database provide if the applicant already mentioned the drug or if it was found in an already ordered APS – possibly very little or none! The savings often vary by age and gender.

5.11 The sentinel effect may reduce the impact of the savings. That is, if someone knows a company is testing for something specific and they have it, it is likely they will go to another insurance carrier. This reduces the prevalence of the disease or impairment being tested for and should be factored into the savings.

5.12 After the cost and benefit are determined, they are compared and it can be determined at what ages and face amounts the new test would be cost-justified. Note that protective value studies can be and are done both to determine whether to use a particular test and after the test is already being used to make sure it is providing the value originally anticipated.

5.13 Actual-to-Expected (A/E) studies are generally performed after a test has been used for a period of time. This type of study can provide a simple analysis of the mortality experience on the test or marker.

5.14 "Actual" is the actual mortality experience and "Expected" is the expected mortality. The expected mortality assumption is usually either the pricing assumption or an assumption based on a standard industry table. The actual results are divided by the expected results to create a ratio, the A/E ratio. If actual results were identical to expected results, the ratio would be 100%. Ratios below 100% indicate results which are better than expected and ratios above 100% indicate results worse than expected. The A/E ratio is not a perfect comparison as other factors beyond underwriting come into play, but it is a relatively easy approach to determine the effectiveness of the underwriting that has already been done.

5.15 A/E ratios can be studied by any of the following:

- Study year
- Issue year
- Age
- Duration
- Gender
- Risk class / smoking status
- Policy Size
- Product
- Distribution channel / agent
- Target market
- Underwriter
- Other

5.16 A cause of death study can also be useful in determining the effectiveness of an underwriting tool that is supposed to identify those with a specific impairment or disease.

## 6 CONCLUSION

6.1 The purpose of this paper was to document the types of life insurance underwriting and underwriting tools used in the United States, past and present. It is hoped by the author that professionals in other countries can put together similar papers so that life underwriters and other life insurance professionals around the world can have a better understanding of the life insurance underwriting practices used today and how they differ from country to country. It is also hoped by the author that this knowledge will help to lead to new innovations in life underwriting, possibly from the borrowing of ideas from other countries.

## REFERENCES

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- Anstey, K.J., Cherbuin, N., Budge, M., Young, J. Body mass index in midlife and late-life as a risk factor for dementia: a meta-analysis of prospective studies. *Obesity Reviews*, Volume 12, Issue 5, pages e426–e437, May 2011.
- Clinical Reference Laboratory. New Development in Diabetic Testing: AGP (Advance Glycation Product). *The Scoop*, 2005. Accessed February 10, 2012, at <http://www.crlcorp.com/insurance/NewsViews/NewDevelopmentinDiabeticTestingAGP.cfm>.
- Galea, S., Tracy, M., Hoggatt, K.J., DiMaggio, C., Karpati, A. Estimated Deaths Attributable to Social Factors in the United States. *American Journal of Public Health*, August 2011, Vol. 101, No. 8, pp. 1456-1465.
- Gilsanz, J.M.; B.S. Zemel, H.J. Kalkwarf, V. Lappe, S. Oberfield, J.A. Shepherd, M.M. Frederick, X. Huang, M. Lu, S. Mahboubi, T. Hangartner, K.K. Winer, "Revised reference curves for bone mineral content and areal bone mineral density according to age and sex for black and non-black children: results of the bone mineral density in childhood study," *The Journal of Clinical Endocrinology & Metabolism*, October 2011.
- Kaczynski, J., Schult, A., Eriksson, H., Wallerstedt, S. Overweight and hypertriglyceridemia are risk factors for liver cirrhosis in middle-aged Swedish men. *Scandinavian Journal of Gastroenterology*, June 2011, Vol. 46, No. 6, Pages 738-744.
- Kell, D.B. Towards a unifying, systems biology understanding of large-scale cellular death and destruction caused by poorly liganded iron: Parkinson's, Huntington's, Alzheimer's, prions, bactericides, chemical toxicology and others as examples. *Archives of Toxicology*, Volume 84, Number 11, pages 825-889. Published online August 17, 2010.
- Kulkarni, S.C., Levin-Rector, A., Ezzati, M., J. Murray, C.J.L. Falling behind: life expectancy in US counties from 2000 to 2007 in an international context. *Population Health Metrics*, June 15, 2011.
- Lee, D.-H., Lind, P.M., Jacobs Jr., D.R., Salihovic, S., van Bavel, B., Lind, L. Polychlorinated Biphenyls and Organochlorine Pesticides in Plasma Predict Development of Type 2 Diabetes in the Elderly: The Prospective Investigation of the Vasculature in Uppsala Seniors (PIVUS) Study, *Diabetes Care*, June 2011.
- Logue, J., Murray, H.M., Welsh, P., Shepherd, J., Packard, C., Macfarlane, P., Cobbe, S., Ford, I., Sattar, N. Obesity is associated with fatal coronary heart disease independently of traditional risk factors and deprivation. *Heart*, February 2011.
- MEG Financial. Life Insurance Medical Requirements: Lab Finding and Results Defined. Accessed February 6, 2012, at [http://www.termland.com/life\\_insurance/lab\\_results\\_and\\_blood\\_tests.html](http://www.termland.com/life_insurance/lab_results_and_blood_tests.html)
- MIB Group, Inc. website. Accessed February 6, 2012, at [http://www.mib.com/html/mib\\_history.html](http://www.mib.com/html/mib_history.html)

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Shahar, D.R., Feldblum, I., German, L., Castel, H., Harman-Boehm, I. Individualized Nutritional Intervention During and After Hospitalization: The Nutrition Intervention Study Clinical Trial. *Journal of the American Geriatrics Society*, January 2011, Volume 59, Issue 1, pages 10-17.