Advantages of a Life Expectancy Using Life Insurance Underwriting and Life Settlement Methods in the Legal Setting

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Introduction

The advantages of a life expectancy using life insurance underwriting and life settlement methods include:

1. Accuracy. A life expectancy using life insurance underwriting and life settlement methods is very accurate, which can affect millions of dollars in judgments or awards. This addresses the inadequacy of life expectancies that are simply taken from a life table or estimated by a doctor, actuary or biostatistician. In many cases, such life expectancies are too short, too long and/or not credible.

   As an example, a plaintiff with rheumatoid arthritis filing a disability claim had been given a short life expectancy by the disability insurer. A properly done life expectancy using life insurance underwriting and life settlement methods found that this individual would live far longer than what the disability insurer said. The case settled with the plaintiff getting the proper number and amount of disability payments.

2. Provides a complete insight to the judge or jury of the individual's medical conditions and/or personal history of high-risk behaviors. A life expectancy using life insurance underwriting and life settlement methods provides a comprehensive profile of the individual's medical conditions as well as any risky behaviors. The judge or jury will be given a comprehensive view of the individual's personal health and lifestyle, which often decides the case.

   As an example, in a wrongful death case against a hospital the plaintiff died in the hospital. A life expectancy was performed for the defense on the deceased plaintiff (who was a 60-year-old male) as of the day before his final admission to that hospital. During the investigation for the life expectancy, it was discovered that 1) the plaintiff was not compliant with his diabetes medications to the point where his central nervous system was dysfunctional long before his final admission to that hospital, 2) he had suffered a stroke 4 years previously and had severe cardiovascular conditions, 3) he had chronic obstructive pulmonary disease and emphysema as a result of 45 years of cigarette

smoking, and 4) he had a host of other medical conditions ranging from depression and anxiety to degenerative disc disease, gastrointestinal esophageal reflux, cataracts and prostatic hypertrophy. All of these medical conditions were included in the life expectancy report.

All of the above medical conditions were used to determine the plaintiff's life expectancy. During trial, these medical conditions were explained to the jury and how they affected the plaintiff's life expectancy. The jury heard all of the deceased plaintiff's medical conditions that affected his life expectancy prior to his final admission to that hospital, the jury then found a complete verdict for the defense. After the trial, jury members said, "It's a good thing that he died. His wife remarried a rich man."

In another defense case, the investigation conducted for the life expectancy uncovered evidence of prescription narcotic addiction, which was the deciding factor in winning the case at trial. Evidence of medical conditions, substance abuse and risky behavior that are relied on in a life expectancy using life insurance underwriting and life settlement methods comes from medical records, motor vehicle records, criminal records and any other documentation of health and risky behavior.

3. <u>A way to admit excluded evidence using Rule 703.</u> A life expectancy report can get excluded evidence admitted. A life expectancy using life insurance underwriting and life settlement methods relies on **all** available evidence related to the mortality risk of the individual involved, including evidence that may have been previously excluded. This evidence is essential to the accuracy of the life expectancy, and this evidence is what the expert relies on to render an opinion of the life expectancy. Rule 703 enables the judge to decide if the evidence that was previously excluded (on which the expert's opinion of the life expectancy relies) is to be re-admitted.

As an example, Rule 703 was used in one case where the individual's extensive history of risky driving and hazardous motorcycle riding had been excluded from the evidence considered. This personal history of risky behavior was essential to the calculation of an accurate life expectancy. As a result, the evidence relied on to calculate the life expectancy was re-admitted, resulting in a decision that awarded plaintiff a half-million dollars instead of the requested $9 million.

Factors that Affect a Life Expectancy

A life expectancy is a statistical calculation that indicates the average length of life left until death that is expected for an individual with a known mortality risk profile. The most important factors in defining an individual's mortality risk profile are demographics (age, sex and race), personal and medical history. The more that is known about an individual's demographics, personal and medical history, the more accurate the life expectancy calculation. This information is critical to the judge or jury in understanding how, why and on what basis the life expectancy was calculated.

The investigation and use of personal and medical history in assessing mortality risk is standard practice in the life insurance and life settlement industries. Life insurers want to ensure that the premiums charged for a life insurance policy accurately reflect the mortality risk of an applicant. Life settlement providers similarly want to ensure that the calculated life expectancy accurately reflects the mortality risk of the insured seeking to settle (sell) his/her life insurance policy.

The process of investigating and assessing personal and medical mortality risk factors is called "underwriting" in both the life insurance and life settlement industries.[1,2] Many of these risk factors include: adverse medical conditions, substance abuse, psychological disorders, motor vehicle violations, disabilities, adverse family medical history, tobacco use, and hazardous lifestyles, sports, avocations or occupations.[3] All of these risk factors are known and well accepted by the life insurance and life settlement industries as influencing the risk of death.[4]

Accepted practices in underwriting include the authorized collection of information regarding these risk factors, and the evaluation of this evidence for any extra mortality risk beyond that which is expected for the average individual with the same demographic status.[5] Life insurers and life settlement providers are forbidden by law to use race as a risk factor in underwriting life insurance and life settlements, so the only demographic factors allowed in their underwriting are age and sex. However, additional demographic factors are used to calculate life expectancies for litigation purposes because the U.S. general population life tables are available by age, sex and race.

The Life Expectancy Calculation Process

In a life expectancy report produced for litigation purposes, the same methods used by the life insurance and life settlement industries are employed. The process used for the life expectancy calculation is as follows:

1. Determine the individual's age, sex and race as of the date of interest (date of injury, date of onset or present day).
2. Select an appropriate life table to estimate an individual's life expectancy as if (s)he had the same overall health status as the U.S. general population for the same age, sex and race. For our purpose here, this is called the "base life table."
3. Determine from the individual's personal and medical history if there were any risk factors that might affect his/her life expectancy on the date of interest, if the death or injury had not occurred.
4. Determine which risk factors would have the most impact on that individual's life expectancy on the date of interest.
5. Obtain reasonable estimates from the medical literature of mortality risks at or close to the individual's status of his/her risk factors.
6. Extract these mortality risks as numbers that can be applied to the selected base life table. For our purpose here, these numbers are called "multipliers."
7. Calculate the adjusted life expectancy for the individual, using the selected base life table adjusted by the multipliers described in step 6.

Essentially, there are two parts to the life expectancy calculation. The first part is the underwriting assessment of the individual, which identifies from the available evidence if there are risk factors in the personal and medical history that contribute to an excess risk of mortality above average.[6] After these risk factors are identified, the second part is to quantify the excess mortality risk using multipliers that are used to adjust the base life table to reflect the increased risk in the resulting life expectancy.[7,8] The methods to perform these steps are common to both the life insurance and life settlement industries, with the exception that the life settlement underwriters produce a life expectancy; life insurance underwriters complete their work with the assignment of the multiplier (when appropriate) to be used to calculate the insurance premiums for that case. There are various terms used in life insurance underwriting and life settlements to denote such multipliers, including "rating," "debits," and "relative risk."

The life expectancy report can either be complete or abbreviated, based on the requirements and resources of the case. An abbreviated report follows all the steps necessary to calculate a life expectancy, but does not include full documentation of the evidence reviewed and evaluated. This option tailors the report when detailed documentation of the evidence is not required or resources are limited.

A complete life expectancy report documents the investigation of the individual's personal medical and history factors that can contribute an excess risk of mortality as of the date of interest. This documentation includes pertinent excerpts from all available evidence that establishes the identification and assessment of medical and nonmedical risk factors affecting the individual's mortality risk as of the date of interest.

In the legal setting, a complete insight into the individual's medical conditions and risky behaviors is often not possible to get before the judge or jury. A life expectancy using life insurance underwriting and life settlement methods now can get all of this essential insight to the judge or jury. This information, once presented to a judge or jury, strengthens the case. Most cases that benefit from getting this essential insight to the judge or jury result in reduced damages or an outright verdict for the defense.

Accuracy of a life expectancy is needed in many cases when life expectancies are estimated by a doctor, actuary or biostatistician, and are too short, too long and/or not credible. The individual will benefit by getting the proper judgment or award that sufficiently covers them into the future. As an example, in one case a life expectancy was calculated for a severely impaired 6-year-old with cerebral palsy. A biostatistician for the defense had calculated the life expectancy for this child to be 16 years, which was too short and not credible. A doctor for the plaintiff estimated the life expectancy of this child to be that of an average child, taking the life expectancy straight from the U.S. government life tables, which was too long and not credible.

A properly done life expectancy using life insurance underwriting and life settlement methods was done, showing that the true life expectancy of this 6-year-old child with cerebral palsy to be another 42 years. A life expectancy calculated using life insurance underwriting and life settlement methods is credible, stands up in court and passes Daubert challenges.

The Qualitative Underwriting Assessment

After all the pertinent factors and conditions related to the individual's excess mortality risk are identified, the qualitative underwriting assessment is made.[9,10] The underwriting approach is identical to that used by both the life insurance and life settlement industries. If only one factor in the personal and medical history indicates an excess mortality risk, then that is the only factor that is further investigated to determine its quantitative effect on the individual's life expectancy. However, if there are multiple factors which appear to contribute excess mortality risk, those risk factors must be evaluated to distinguish between factors that are related by their nature to each other, and those that are unrelated.

Risk factors that are unrelated to each other are straightforward to assess, while factors that are related to each other need more careful attention. A real case example of three unrelated risk factors that each contribute excess mortality risk is crack cocaine use, bipolar disorder, and smoking two packs of cigarettes a day. The life insurance and life settlement industries would evaluate the risk presented by each of these factors independently. A real case example of three related risk factors that jointly contribute excess mortality risk is hypertension, heart disease and Type 2 diabetes. These risk factors would be assessed to determine the highest likely risk that represents their combined effect, based on a reasonable degree of life insurance underwriting ("life underwriting") certainty.

The Quantitative Assessment

After the qualitative underwriting assessment is made from the available evidence, the most important risk factors which present excess risk are selected based on a reasonable degree of life underwriting certainty. The quantitative assessment then is made, which seeks the best number that represents the excess risk presented by each independent risk factor or group of related risk factors.[11,12] This "best number" is typically a multiplier that is applied to the selected base life table.

The mortality risk factor multipliers that are used in the life insurance and life settlement industries are found in underwriting manuals. These underwriting manuals are considered proprietary information critical to the competitiveness of their respective originating organizations and their clients. The contents of these manuals are the product of collaborative research among insurance professionals evaluating the most reliable available information about the mortality risk of a wide range of personal and medical history factors.

Because underwriting manuals and their risk factor multipliers are proprietary and thus not in the public domain, the multipliers for a life expectancy report must be developed specifically for each case. The same methods used by the life insurance and life settlement industries are used to investigate and derive the multipliers for a life expectancy report.[13]

Although the life insurance and life settlement industries are attuned to new information concerning the mortality risk of any personal or medical history factor, attention is paid to the most reliable available information. Accepted practices in developing risk factor multipliers include the evaluation of contemporary studies with the largest populations and longest follow-up for mortality.[14,15] For a life expectancy of a U.S. resident, a study of the U.S. population is preferable to studies of populations in other countries, unless the other country is similar in living conditions to that of the U.S. and the selected study is superior in its other qualities to those available from the U.S.

As described in Step 5 above, the medical literature is searched for the best studies that provide information about mortality risks at or close to the individual's status of his/her risk factors. The "best number" for a particular risk factor is selected from the best medical study available. If the risk factor is for a nonmedical risk, other information sources that address the mortality risk of that factor are investigated. Such information sources can include government or other institutional statistics in the public domain.

When more than one independent or interrelated group risk factor is used in calculating a life expectancy for an individual, the factor-specific multipliers are combined into one overall multiplier using accepted life insurance and life settlement methods.[16] How that overall multiplier is then used to adjust a life table to produce a life expectancy is described after basic information about life tables is discussed.

Selecting a Base Life Table

Life tables are constructed by actuaries, and are built from observed vital statistics combined with conservative statistical projections. Life tables used within the life insurance and life settlement industries are built from statistics of insured lives and deaths; they reflect the unique demographic composition, personal and medical history of the self-selected population of insureds. Life tables used within the life

insurance and life settlement industries are constructed separately by sex and smoking status; race is not allowed to be used as an underwriting risk factor.

Life tables constructed for the general population are built from information taken from vital records of births and deaths, as well as population counts from the latest national census. Life tables for the general population are available for specific sex and race combinations (white males, white females, black males, black females, Hispanic males, Hispanic females, etc.), although in addition there are life tables available that are combined by sex or race (all males, all females, all white, all black, all Hispanic, etc.).

The U.S. government publishes its official life tables through the National Center for Health Statistics (http://www.cdc.gov/nchs/products/life_tables.htm). For a life expectancy calculation done for litigation purposes, a general population life table is more appropriate to use as the selected base table than a life table built from insured lives. The base table for the individual's sex and race is typically selected from the life tables available from the U.S. National Center for Health Statistics, if the individual has resided in the U.S. long enough to experience the same mortality risks that are documented by the U.S. life tables.

If the individual is still alive, the most recent available general population life table is selected as the base table. If the individual is deceased, the general population life table most contemporaneous with the date of interest is selected. If the individual resided in another country sufficiently long enough so that the mortality risk contributed by that individual's demographics reflects the mortality patterns of that country, then the selected base life table should be taken from that country's vital statistics agency.

How Life Tables Work

In the U.S. general population life tables published by the U.S. National Center for Health Statistics, a hypothetical population of 100,000 is followed progressively from birth through each successive year of age, with deaths expected for that population removed each year as the ages increase. Each row of the life table lists the year of age evaluated for that row, along with:

- the number of the original hypothetical 100,000 entering into that year,
- the number of deaths expected for that year,
- the mortality rate attributable to that year (simply, the number of deaths divided by the total number alive),

- the combined years of life left for the remaining population in that life table for that year, and
- the life expectancy at that year of age.

The mortality rates in a general population life table start out very low in young ages, and progressively rise with older age. Currently, all U.S. general population life tables end at age 100 years, although this may change in the future as the number of centenarians in the U.S. grows larger over time.

Life expectancies reflect the average number of years of life left at each age in a life table. Simply, the total number of years of life left for each of the hypothetical 100,000 population are summed, and then divided by the number of lives counted within each age. For example, the life table for the U.S. white male population for the year 2007[17] shows the average life expectancy at birth (listed as 'age 0-1') is 75.9 years. This means that on average, a U.S. white male resident can expect a life expectancy of 75.9 years at the time of birth. At age 50 (listed as 'age 50-51') the life expectancy is 29.2 years, which reflects the 92,547 people left from the original hypothetical population, and the 2,712,517 combined years of life left for these people. The result of 2,712,517 years of life left divided by 92,547 people is the average life expectancy of 29.2 years, as listed in the table. There is some truncation of mortality rates in published U.S. life tables, so some rounding differences occur.

The probability of dying between one age and the next one is the mortality rate, discussed previously. The higher the mortality rate, the faster the hypothetical population dies, resulting in a lower life expectancy. The lower the mortality rate, the slower the hypothetical population dies, resulting in a higher life expectancy.

Adjusting a Life Table with a Multiplier

The multiplier that reflects an individual's overall excess mortality risk is entered into an Excel spreadsheet that duplicates the calculation of the selected base table, except with an additional column for the multiplier. The purpose of adding the multiplier to the life expectancy calculation worksheet is to increase the mortality rate (through multiplication), starting at the age of the individual on the date of interest.

This multiplier can be used for all successive ages in the life table, if the overall excess mortality risk is known to follow a constant pattern. The value of the multiplier also can change as age increases in the

life table, according to the underlying pattern developed during the quantitative assessment investigation. Each individual will have a unique set of risk factors that have an expected mortality risk pattern; the overall multiplier consistent with this pattern will be entered into the spreadsheet to adjust the selected base table appropriately.

After the selected base life table has been adjusted with the multiplier, the Excel spreadsheet will show the new adjusted life expectancy numbers. The adjusted life expectancy to be used in the life expectancy report is associated with the age of the individual as of the date of interest.

Hypothetical Case Example of Getting Excluded Evidence Re-admitted

A hypothetical example based on a real case in which hazardous motorcycle riding was excluded as evidence and then was re-admitted with the use of a life expectancy will illustrate the process of calculating a life expectancy and the evidence necessary to complete it. On October 4, 2011, John Doe was riding his Harley motorcycle on a rural Pennsylvania county road at a high rate of speed when he crashed into a county maintenance vehicle that was making a left turn into his path. Mr. Doe died at the scene of the accident; his estate brought action against the county for wrongful death. Mr. Doe was a white male born on June 22, 1963, which made him age 48 at the time of his death. If Mr. Doe had the same mortality risk as the average U.S. white male as of the morning of October 4, 2011, his life expectancy using the latest available U.S. life table at the time of case investigation would have been 31.0 years.[17]

The county requested a report for Mr. Doe that would contain a life expectancy calculated for Mr. Doe as of the morning of October 4, 2011. Mr. Doe's risk factors for death must be investigated and evaluated from all available evidence of his personal and medical history to produce an accurate life expectancy report. As is generally accepted in life insurance and life settlement underwriting of medical risk factors for mortality, the evaluation of Mr. Doe's medical risks of death should include the investigation of his medical history, diagnoses, treatment, testing, rehabilitation, follow-up and prognosis. As is generally accepted in life insurance underwriting of nonmedical risk factors for mortality, the evaluation of Mr. Doe's nonmedical risks of death should include the investigation of his adverse driving history, hazardous lifestyles, sports, avocations, occupations and criminal history.

To complete Mr. Doe's life expectancy calculation and report, records from Mr. Doe's physicians, clinic and hospital stays, ambulance, emergency room, police, employers, car and motorcycle insurers, disability and workman's comp benefit providers, motor vehicle registries, military service, and physical rehabilitation providers were obtained and reviewed. From these records, it was determined that as of the morning of October 4, 2011, Mr. Doe was married with four adult children, had three grandchildren that reside in the family home, did not complete high school, and spent 4 years in the Army starting at age 18.

After being honorably discharged from the Army, Mr. Doe had worked at a number of blue-collar occupations until 1999, when he became a self-employed floor installer. Because Mr. Doe had a contract with a local school district to install flooring in a new elementary school in 2001, he obtained workman's comp insurance. Since 2001, Mr. Doe had several instances of disability from worksite injuries that each lasted about 4 to 6 months and required some rehabilitation. Mr. Doe wore glasses, was diagnosed in October 2010 with recurrent hernia, and smoked one pack of Newport cigarettes per day from 1981 to 2003. The only family history of note was a paternal grandmother who died from breast cancer at age 65. At the time of his death, his medications included Prilosec for heartburn and Minipress for mild hypertension. Mr. Doe was 5'7" tall and weighed 175 pounds, indicating a body mass index of 27.4; this means that Mr. Doe was overweight but not obese.

Mr. Doe was an avid motorcycle rider. He was a member of his local Harley Davidson club in Pennsylvania, and took long trips every summer across the country. Mr. Doe had 12 ticketed speeding violations in both Pennsylvania and New Jersey between 2001 and 2011, the last 5 being on his Harley. Mr. Doe had a history of motorcycle accidents, and had a long history of multiple bone fractures associated with these accidents, dating to before 2001. In 2005 he was treated in an emergency room for concussion associated with an accident. He was cited by law enforcement in that accident for driving under the influence of alcohol; a blood test indicated that his alcohol level was above the legal threshold. Mr. Doe was also cited in 2007 for riding a motorcycle without a helmet.

From his police records, Mr. Doe had two arrests for simple possession of methamphetamine, each time at a traffic stop during a summer cross-country motorcycle trip. Mr. Doe was arrested in California in 2002 with 3.7 grams of methamphetamine, and in Nevada in 2006 with 2.1 grams of methamphetamine.

For each arrest, the charges were dismissed. No other indication of Mr. Doe's criminal activities or use of methamphetamine was evident in any of his medical or nonmedical records.

After the qualitative underwriting assessment of Mr. Doe's available medical and nonmedical records, Mr. Doe was found to have an increased risk of death above that which would have been expected for an average U.S. white male. The mortality risks attributable to Mr. Doe's bouts of occupational disability, his 8-year span of having quit smoking, hernias, mild hypertension and overweight were not primary factors for Mr. Doe's increased risk of death on the morning of October 4, 2011. What was distinctive about Mr. Doe from the average U.S. white male was his risky motorcycle riding (speeding, DUI, lack of helmet), associated history of motorcycle accidents, his criminal history of methamphetamine possession, and his implied personal use of methamphetamines.

Mr. Doe's evidence of criminal history and implied methamphetamine use is documented as part of the life expectancy report to the county, because this information is relevant to the evaluation of Mr. Doe's mortality risk using generally accepted life underwriting practices. Based on a reasonable degree of life underwriting certainty, because it was unclear what Mr. Doe's criminal activity status or methamphetamine use was as of October 4, 2011, this evidence was not sufficient to reliably assist in the quantitative calculation of his life expectancy. Generally accepted practices in life insurance underwriting take careful note of criminal history and investigate thoroughly when possible.[18] Generally accepted practices in life insurance underwriting take careful note of any substance abuse, with the understanding that it increases mortality risk.[19]

Based on a reasonable degree of life underwriting certainty, Mr. Doe's primary risk of death was from risky motorcycle riding and its associated risk of fatal motorcycle accidents. There is certainty that Mr. Doe's criminal history and implied use of methamphetamine also were primary risks of death for Mr. Doe on the morning of October 4, 2011, but there was insufficient evidence to quantify their influence on his life expectancy. Mr. Doe's mortality risk profile was different than the average U.S. white male because of his extensively documented risky motorcycle riding, so that is the risk factor that must be quantified in order to calculate his adjusted life expectancy from the base table life expectancy of the average U.S. white male.

Life Expectancy Calculation for the Hypothetical Case

The steps previously outlined for calculating a life expectancy can now be completed for Mr. Doe, as follows:

1. *Determine the individual's age, sex and race as of the date of interest (date of death or injury).* On October 4, 2011, John Doe was age 48. He was a white male.
2. *Select an appropriate life table to estimate individual's life expectancy as if (s)he had the same overall health status as the U.S. general population for the same age, sex and race.* Based on a reasonable degree of life settlement certainty, the appropriate base life table to estimate Mr. Doe's life expectancy on October 4, 2011 (as if he had the same overall health status as the U.S. general white male population) is the 2007 U.S. general population life table for white males.[17] This was the most contemporaneous U.S. general population life table available at the time of the case investigation.
3. *Determine from the individual's personal and medical history records if there were any risk factors that would affect his/her life expectancy on the date of interest, if the death or injury had not occurred.* Mr. Doe's personal history of occupational disability, his 8-year span of having quit smoking, hernias, mild hypertension, overweight, riding a motorcycle while intoxicated, riding a motorcycle without a helmet, large number of speed violations, motorcycle accidents associated with broken bones, and two arrests for simple possession of methamphetamine was evaluated using generally accepted practices in life underwriting.
4. *Determine which risk factors would have the most impact on that individual's life expectancy on the date of interest.* Based on a reasonable degree of life underwriting certainty, Mr. Doe's primary risk of death was from risky motorcycle riding and its associated risk of fatal motorcycle accidents. There was insufficient information to determine the influence of Mr. Doe's history of two arrests for simple possession of methamphetamine as Mr. Doe's primary risk of death on the date of interest.
5. *Obtain reasonable estimates from the medical literature of mortality risks at or close to the individual's status of his/her risk factors.* A search was conducted using the National Library of Medicine's PubMed facility (http://www.ncbi.nlm.nih.gov/sites/entrez) for articles in the peer-reviewed medical literature on risky motorcycle riding and fatal motorcycle accidents that would provide the best study to represent Mr. Doe's excess risk. Criteria for selection of these articles were based on generally accepted practices in the life insurance industry for developing underwriting manuals.[14] None of the literature sources used in the life expectancy calculation indicates the specific risk of an individual with Mr. Doe's precise characteristics. The mortality risk estimates closest to

Mr. Doe's risk factor status were selected from the medical literature based on a reasonable degree of life underwriting certainty. The article that was selected to help best estimate Mr. Doe's mortality risk from risky motorcycle riding and fatal motorcycle accidents was a study performed by the Centers for Disease Control that looks at U.S. traffic exposure data from 1999 to 2003 for fatal injury rates per 100 million person-trips, by age and mode of travel ("Beck, et al.").[20]

6. *Extract these mortality risks as multipliers that can be applied to the selected base life table*. From Table 2 in the Beck, et al. article, the annualized fatal injury rates per 100 million person-trips were compared for motorcycle riders between ages 25 and 64 years, and all individuals between ages 25 and 64 years. The fatal injury rate for motorcycle riders is 517.0 per 100 million person-trips (95% confidence interval 397.5 and 636.6) and the fatal injury rate for all individuals is 9.6 (95% confidence interval 9.5 and 9.8). A motorcycle rider's relative risk for mortality from fatal injuries is thus 517.0 divided by 9.6, or **53.8**, with 95 confidence intervals of **41.8** (lower limit) and **64.9** (upper limit). Based on a reasonable degree of life underwriting certainty, these relative risk estimates serve as the multipliers to adjust Mr. Doe's life expectancy.[15]
7. *Calculate the adjusted life expectancy for the individual, using the selected base life table adjusted by the multipliers described in step 6.* Three Excel spreadsheets were constructed to produce base life tables with the same data found in the 2007 U.S. general population life tables for white males. Each of these life table spreadsheets then were adjusted to produce a different life expectancy: a <u>middle</u> life expectancy (using the **53.8** multiplier taken from the Beck, et al. article), an <u>upper limit</u> life expectancy (using the lower 95% confidence interval **41.8**, since a small multiplier creates a longer life expectancy), and a <u>lower limit</u> life expectancy (using the upper 95% confidence interval **64.9**, since a large multiplier creates a shorter life expectancy).

The middle, lower limit and upper limit multipliers that best represented Mr. Doe's excess risk from risky motorcycle riding and fatal motorcycle accidents were applied to the base life table assuming a constant exposure over Mr. Doe's expected future lifetime. The lower and upper limit multipliers reflect the 95% confidence interval that was found in the Beck, et al. article that measured the relative risk of fatal injuries for motorcycle riders age 25 to 64 in comparison to all those age 25 to 64. In brief, 95% confidence intervals indicate statistically where a risk is likely to occur, with the middle risk being the most likely. The risk being measured would not likely occur outside of the 95% confidence interval.

As previously stated, Mr. Doe's primary risk of death was from risky motorcycle riding and its associated risk of fatal motorcycle accidents, because any increased risk associated with Mr. Doe's history of two arrests for simple possession of methamphetamine could not be assessed with certainty. Risky motorcycle riding was a risk that Mr. Doe was exposed to constantly over time; a risk that Mr. Doe repeated many times within a year; a risk that Mr. Doe was not likely to decrease in the future; and a risk that would not likely decrease in outcome severity over time. There was no evidence in Mr. Doe's file that Mr. Doe would have given up risky motorcycle riding as he got older, no matter how many motorcycle accidents and broken bones he had, or how many motorcycle speeding citations he received. Based on a reasonable degree of life settlement certainty, his overall excess mortality risk would follow a constant pattern, and therefore the multipliers were applied accordingly to the base life table.[18]

If Mr. Doe had the same mortality risk as the average U.S. white male as of October 4, 2011, his life expectancy using the most contemporaneous U.S. life table at the time of case investigation would have been **31.0** years. Based on a reasonable degree of life underwriting and life settlement certainty, on the morning of his death on October 4, 2011, Mr. Doe had a middle life expectancy of **3.1** years; his lower limit life expectancy was **2.5** years, and his upper limit life expectancy was **3.8** years. Mr. Doe's primary excess mortality risk was from risky motorcycle riding and its associated risk of fatal motorcycle accidents.

Mr. Doe's personal history of risky motorcycle riding and the evidence supporting that history had to be included in the report of his life expectancy to the county to document the accuracy of Mr. Doe's life expectancy calculation. Mr. Doe's personal history of two arrests for simple possession of methamphetamine had to be included in the report of his life expectancy to the county to document the completeness of the investigation of Mr. Doe's mortality risks, and their consideration in evaluating Mr. Doe's primary risks of death.

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6. Woodman HA. Principles of risk selection and classification. Chapter 3, in: Medical selection of life risks, 5th edition. Brackenridge, Croxson, MacKenzie, eds. Palgrave Macmillan. 2006, p 35. "It is the task of the underwriter to assess the degree of extra mortality that might be expected, and to make certain that the risk is placed in the same class as others having the same expected mortality. The appropriate ratings for impairments may be developed from the results of previous intercompany mortality studies, from studies of a company's own experience, from studies published in the medical literature, and from current clinical opinion on prognosis in the light of developments in medical treatment and surgical procedures."

7. Fasano M. Underwriting. Chapter 6, in: Life markets: trading mortality and longevity risk with life settlements and linked securities. Bhuyan V, ed. Wiley Finance. 2009, p 25. "Life insurance underwriting has developed from the extensive mortality experience of the life and reinsurance companies. Excess mortality for most medical conditions has been analyzed and translated into 'debits,'

which converts this additional mortality into a percentage of standard mortality… Over the years, debit methodology has proven to be a reliable predictor of excess mortality for the life insurance market."

8. Fasano M. Underwriting. Chapter 6, in: Life markets: trading mortality and longevity risk with life settlements and linked securities. Bhuyan V, ed. Wiley Finance. 2009, p 26. "The modified debit methodology starts with the debit methodology developed for life insurance underwriting and adjusts it to the life settlement demographic."

9. Bickley MC, Brown BF, Brown JL, Jones HE. Life and health insurance underwriting, 2nd edition. Life Office Management Association, 2007. Summary: This textbook is required reading for those studying for a professional life insurance credential. It details the underlying reasons and methods for life insurance underwriting.

10. Aspinwall J, Chaplin G, Venn M. Life insurance: primary and secondary markets. Chapter 1, in: Life settlements and longevity structures. Wiley Finance. 2009, p 17. "(Life settlement) medical underwriter: Sometimes confusingly referred to as the 'life expectancy provider,' the medical underwriter uses its knowledge of elder mortality and medical records of the insured to provide a life expectancy report for the insured."

11. Brackenridge RDC. A historical survey of the development of life assurance. Chapter 1, in: Medical selection of life risks, 5th edition. Brackenridge, Croxson, MacKenzie, eds. Palgrave Macmillan. 2006, pp 9-10. Summary: Scientific underwriting uses a method of risk evaluation called the numerical rating system, based on the relative risk found in mortality studies of large groups of people. Oscar Rogers and Arthur Hunter introduced these methods in 1919, which are used universally throughout the life insurance industry.

12. Pokorski RJ. Mortality methodology and analysis seminar. Chapter 2, in: Medical risks: 1991 compend of mortality and morbidity. Singer, Kita, Avery, eds. Praeger. 1994. Summary: This material provides the core instruction for the basic mortality methodology course available through the American Academy of Insurance Medicine. This material is a guide for developing appropriate multipliers or "debits" from available information on mortality experience.

13. Kita MW. Morbidity/mortality abstraction – finding suitable articles. Chapter 3, in: Medical risks: 1991 compend of mortality and morbidity. Singer, Kita, Avery, eds. Praeger. 1994. Summary: this chapter details criteria for selecting medical literature sources that are most appropriate for extracting risk factor information to be used in life underwriting risk assessment.

14. Singer RB, Kita MW. Guidelines for evaluation of follow-up articles and preparation of mortality abstracts. Chapter 4, in: Medical risks: 1991 compend of mortality and morbidity. Singer, Kita, Avery, eds. Praeger. 1994. Summary: This chapter details the methods used in abstracting relative risk information as factors (multipliers) to be used in life underwriting risk assessment.

15. Aspinwall J, Chaplin G, Venn M. Life insurance: primary and secondary markets. Chapter 1, in: Life settlements and longevity structures. Wiley Finance. 2009, p 25. "Information has a very short half-life. Given the speed with which life expectancy underwriters adjust their methodologies, investors should try to refresh medical information and life expectancy assumptions regularly. As this may have an

impact on revenue recognition, investors should agree (on) an appropriate policy to address such information updates with senior management, advisers and auditors when setting up their business."

16. Kita MW. The rating of substandard lives. Chapter 5, in: Medical selection of life risks, 5th edition. Brackenridge, Croxson, MacKenzie, eds. Palgrave Macmillan. 2006, p 72. "(T)he standard risk is assigned a value of 100% (i.e. one unit of risk). Unfavorable risk factors, conditions or impairments expected to produce excess mortality risk are added to that baseline risk."

17. Arias E. United States life tables, 2007. National vital statistics reports; vol 59 no 9. Hyattsville, MD: National Center for Health Statistics. 2011. http://www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_09.pdf, pp 16-17.

18. Bickley MC, Brown BF, Brown JL, Jones HE. Underwriting individual life insurance: personal factors. Chapter 7 in: Life and health insurance underwriting, 2nd ed. Life Office Management Association. 2007, pp 173-174. "Underwriters carefully investigate a proposed insured who has a history of criminal activities. Although the underwriter cannot predict that criminal activity will recur, such a case requires a thorough review of the facts, an extensive inspection report, a review of court records, and detailed interviews with people who know the current activities and character of the proposed insured. Underwriters typically rate or decline such cases. In assessing a case in which criminal history is present, the underwriter keeps in mind that the extent of a proposed insured's criminal activity may be difficult to assess because information is reported only for incidents for which the proposed insured was arrested. Other events may have occurred but may not have been reported. Moreover, a plea bargain may conceal the true nature and seriousness of a criminal offense."

19. Smith N. Substance abuse and dependency. Chapter 12, in: Intermediate non-medical life insurance underwriting, 2nd edition. Education committee of the Academy of Life Underwriting. 2007, p 1. "The mortality and morbidity of substance abuse are secondary to induced changes in behavior and judgment, abrupt withdrawal syndromes, direct acute and chronic effects of the drug, and secondary risks from the route of administration. Many drugs of abuse involve criminal associations and increased mortality risk from violent events."

20. Beck LF, Dellinger AM, O'Neil ME. Motor vehicle crash injury rates by mode of travel, United States: Using exposure-based methods to quantify differences. *Am J Epidemiol*. 2007;166:212-218.

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