Journal of Life Care Planning, Vol. 12, No. 1, (3-13)

Estimating Life Expectancy: A Physiatric Perspective

Bill S. Rosen, Reg L. Gibbs and Ashley K. Crtalic

Abstract

Physiatrists are often asked to consult or even author a life care plan for a specific individual. When engaged in such work, a physiatrist should be prepared to provide an opinion on life expectancy. All opinions expressed in the plan, including predicting life expectancy, should be based on education, training, medical literature, and clinical experience. Familiarity with evidence-based literature regarding an individual's condition(s) and/or similar conditions is a critical part of the foundation upon which physiatric opinions are based. Data on life expectancy is one type of evidence-based literature with which the physiatrist should become familiar. This article takes a general look at life expectancy determination by physiatrists. Several different approaches to determining longevity exist and these will be reviewed. For reasons discussed in this article, we favor the multiplicative approach to estimate life expectancy. Ideally, a physiatrist should have the opportunity to work with a life expectancy biostatistician when calculating an individual's longevity.

Introduction

Physical Medicine and Rehabilitation, also known as physiatry, is the specialty of medicine that evaluates and treats patients who have experienced an injury, an illness, or a disabling medical condition that has resulted in a loss of, or a reduction in, functional capacity. Physiatrists treat a broad range of medical conditions across the entire life span, from progressive neuromuscular diseases to carpal tunnel syndrome. After evaluating a patient, a focus of the physiatrist is to restore his or her functioning or bring the individual/patient to their maximum level of functioning, despite the underlying condition. Physiatrists recognize that by enhancing function, quality of life is improved. Additionally, a physiatrist seeks to minimize morbidity and mortality whatever an individual's medical circumstances. In providing such care, the physiatrist must recognize the expected natural course of a patient's condition. Through training, the physiatrist becomes familiar with the effect of a variety of specific medical disorders on life expectancy.

Physiatrists, with their broad-spectrum clinical background, are uniquely qualified to act as a consultant in the life care planning process (Bonfiglio, 2010). In providing such comprehensive consulting services, an experienced physiatrist may be asked and thus, should be prepared to voice opinions regarding life expectancy. This article outlines the approaches a physiatrist can take regarding the issue of predicting life expectancy, particularly when providing information to life care planners. Initially, we will provide some basic information that should be understood before estimating an individual's life expectancy. Then we will identify a variety of factors that should also be considered, either because they are known to affect life expectancy or because similar conditions have been shown to have such an effect. When estimating life expectancy, a physiatrist's opinions should not be based merely on anecdotal experience, but on available medical and biostatistical data, coupled with clinical

experience. By following this strategy, the physiatrist avoids relying solely on anecdotal information, which can undermine the scientific method and/or knowledge. In closing, we present two case histories illustrative of how our suggested methodology has been used.

Basic Considerations

According to Mosby's Medical Dictionary (2009), life expectancy is "the probable number of years a person will live after a given age, as determined by mortality in a specific geographic area. It may be individually qualified by the person's condition or race, sex, age, or other demographic factors." Put more simply, life expectancy is the average number of remaining years of an individual's life. The average, however, does not apply to every individual. Observing young and middle-aged people walking through an airport or strolling through a park, one will quickly notice that not everyone walks at the average walking speed of 2.5 miles per hour. The same holds true for life expectancy. Not everyone will live to the average life expectancy, some will live longer and others less.

When relating average life expectancy to an individual, a physiatrist must rely on his or her clinical experience, education, and training, and on evidence-based medicine, particularly data collected by life expectancy experts or organizations that compile such information. Having a consulting physiatrist with a busy and relevant clinical practice, combined with board certification is ideal, insuring the consultant has the basic medical foundation and experience to provide opinions to a life care planner. When giving opinions on longevity, familiarity with evidenced-based information about life expectancy is critical, as it is the starting point of any estimate of life expectancy. Such data is the cornerstone of an analytical assessment in determining an individual's longevity relative to average.

One potential shortcoming of life expectancy data is that it is often collected at tertiary centers or by those doing research and/or providing 'cutting-edge' care. Consequently, the data may not necessarily reflect the care available to a specific patient or the care that he or she is receiving. For instance, statistics on life expectancy following spinal cord injury in the United States are based on data pooled from the Model Spinal Cord Injury System programs (National Spinal Cord Injury Statistical Center, 2011). A paraplegic living in rural Oregon or in inner-city Detroit, where model systems are unavailable, will not necessarily have the same health care opportunities as a paraplegic living in Palo Alto who receives care at Santa Clara Valley Medical Center. A paraplegic whose spouse is a certified rehabilitation nurse and who receives regular treatment from a physiatrist, who also makes occasional house calls, will have a very different and likely significantly improved life expectancy than a patient without such advantages. Thus, a consulting physiatrist should not only have some knowledge and familiarity with life expectancy tables and/or data for a given condition or similar conditions (in the event that data for a particular condition is lacking), but should also recognize what shortcomings, if any, may exist in available data relative to the individual about whom he or she is consulted.

Life expectancy data can be plotted on a survival curve. The median survival time is the time at which only fifty percent of a given group of people are still alive. Knowing this information, the physiatrist, with his working knowledge of a particular individual, should be able to provide opinions and conclusions on where that individual lies on his or her cohort's survival curve. For example, if a survival curve of individuals born in 1900 shows that fifty percent were deceased by age sixty; a person born during this year would more likely than not live between twenty and seventy-five years, since persons living this long comprise the median fifty percent of the cohort. As healthcare and our understanding of adverse health habits

improves, life expectancy has increased, and the age range of the middle two quartiles has also narrowed. By working with a life expectancy biostatistician, a physiatrist will know more precisely the current average age of death and also the middle quartiles of an individual's survival curve and the age range in which fifty percent of the peer population will die. Using medical knowledge specific to physiatry, which is overviewed in this article, coupled with biostatistical data on life expectancy, a physiatrist can then estimate an individual's likely age of demise or determine a range of ages within which death is expected to occur.

With a more sophisticated understanding of health care issues and better medical care, a positive impact on overall life expectancy and a compression of morbidity has occurred (Shrestha, 2006). Over the past few decades early survival following injury has increased for at least some who have suffered catastrophic trauma, particularly spinal cord and traumatic brain injured persons. However, survival data collected one year post-injury reveals that these individuals do not enjoy the same improvements in life expectancy as their non-disabled peers have (DeVivo, 2007). Thus, for at least some diagnoses, survival from the acute to chronic stage has improved, but longevity within the chronic phase has not kept pace with the overall improvements enjoyed by non-disabled peers.

The more information that is available to a physiatrist regarding a patient and his or her condition(s), the more accurate the estimate of the individual's life expectancy will be. If adequate specific clinical information is not available, then the statistical average or a close approximation of this figure should be used. Ideally, the physiatrist will have an opportunity to review all relevant medical records, take a detailed history and perform a thorough physical examination. When predicting life expectancy, a thorough physical examination can provide additional insights that a medical record may not reveal. An excellent, but relatively brief, discussion of the pertinent details to be noted during the physical examination when predicting life expectancy can be found in an article authored by Shavelle and Delaney (2010).

It is also important to recognize that many conditions have a bimodal curve with an increased likelihood of early mortality, particularly in the first year or two after a patient is diagnosed with a particular condition. Thus, when estimating life expectancy after the first year of recovery, it is important that statistical data examined exclude those who suffered early mortality, as they are no longer part of the relevant cohort and their inclusion will skew the estimate. By including data on those with early mortality, the life expectancy curve will be skewed to the left, showing an exaggerated abbreviation of life expectancy for the remainder of the cohort.

Life Expectancy Factors to be considered

When estimating life expectancy for a specific individual, many factors should be considered besides the primary diagnosis. These factors may expand or abbreviate life expectancy and include, but are not limited to, the presence of secondary conditions and/or comorbidities, access to health care, family history, presence of complications before and after the primary diagnosis has been made, and complication frequency. Other relevant factors are the patient's mental health status, any history of substance abuse, presence or absence of social support systems, and the patient's degree of medical compliance. Level of physical and cognitive independence/functioning (including swallow and feeding status) also has a bearing on life expectancy, as does a patient's level of regular physical activity, along with the level of care received/required to date, continence status, level of formal education, and the individual's socioeconomic status. A secondary diagnosis or comorbidity is thought to increase the burden of disease, resulting in an abbreviated life expectancy, often referred to as disability adjusted

life years (Murray, 1994). In general, the less severe a comorbid condition, the less the impact on life expectancy (Haagsma et al., 2011).

Three models for predicting life expectancy have been proposed and may be utilized when assessing the impact of comorbidity on a condition (Mathers, Iburg & Begg, 2006) and (van Baal, Hoeymans, Hoogenveen, de Wit, & Westert, 2006). One of these is the maximum limit approach, in which the most disabling of a patient's comorbidities is given the greatest or sole weight. This model assumes that a comorbid disease does not affect the disability of a patient unless its disabling effect generally exceeds the disabling effect of the patient's primary condition. In this approach, only the condition which has the biggest impact on survival is considered and the effects of the other conditions are ignored. Another model is the additive approach, which assumes that the effect of a comorbid disease simply adds to the disabling effect of the primary disease. The disability weights of the comorbid diseases are simply added up. The third approach is the multiplicative model. In this model, a comorbid disease is assumed to increase a patient's 'utility' loss, with the total effect being less than the sum of loss from the primary condition and the loss due to the comorbid condition, independent of the original or primary disorder. The multiplicative approach is based on the finding of researchers that the marginal increase in a patient's overall disability decreases as the number of chronic conditions increases (Verbrugge, Lepkowski, & Imanaka, 1989). In other words, relevant co-morbid conditions result in a percent reduction and, this percent reduction is combined, rather than added (additive approach) or ignored (maximum approach). The impact on disability and the resulting reduction in life expectancy may be calculated using certain mathematic formulas (van Baal, Hoeymans, Hoogenveen, de Wit, & Westert, 2006).

Recent literature supports the view that the maximum limit approach underestimates life expectancy by not considering co-morbid factors. That is, co-morbid factors can and often will have a deleterious effect on longevity (Haagsma et al., 2011). Comparing the additive and multiplicative approach, the later seems to be a more accurate model and at least is shown to be true in predicting disability, which also correlates with longevity. Further, the multiplicative approach is the more conservative method and thus, more defensible. The advantages of the multiplicative approach are discussed in more detail in the two case histories presented at the end of this article.

Potential Modifiers of Life Expectancy

As a general rule, access to health care will have a positive effect on life expectancy, but overutilization can also result in an increase in secondarily acquired conditions. For instance, among patients with spinal cord injury it has been found that frequent clinic visits are correlated with a higher incidence of infections, including infection with resistant organisms (LaVela et al., 2007). Thus, access to adequate healthcare should be considered an expander of life expectancy, but the frequency and depth of recent healthcare needs should not be ignored when predicting life expectancy. A high frequency of medical complications, such as recurrent respiratory infections in spinal cord injury survivors (Frankel et al., 1998) has been shown to be a risk factor for abbreviated life expectancy, as have substance abuse (Krause & Saunders, 2010), mental health conditions (Russ et al., 2012), and race (Williams, 1999). The effect of family history on longevity is well known (Barzilai et al. 2003) and thus, should also be considered. Some of the aforementioned risk factors impacting life expectancy are potentially modifiable. The life care plan should address these concerns and provide a realistic plan that can be implemented to decrease the risk of their effect. The physician should consider whether such care will successfully prolong life expectancy.

Lack of medical compliance is a risk factor for early demise and has been well-researched in the diabetic population (Currie et al., 2012). The same trend has been noted in patient populations more specific to physiatry, such as those with spinal cord injury (Guihan & Bombardier, 2012). Level of physical and cognitive independence (including feeding/swallow) is well known to be a risk factor for compression of life expectancy, particularly in the cerebral palsy and brain injured populations (Strauss, Kastner, Ashwal & White, 1997) (Thomas & Barnes, 2010). Furthermore, poor nutrition in individuals with significant chronic diseases, such as spinal cord injuries, is known to be a risk factor for increased morbidity and mortality (Wall, Mangold, Huch, Corbett, & Cooke, 2003).

Complexity of care needs can have a bearing on a patient's life expectancy. For instance, an individual with recurrent pneumonia who has dysphagia and respiratory muscle weakness will have a shortened life expectancy. However, an individual with chronic distal tibia osteomyelitis who undergoes amputation may thereby eliminate his or her negative risk factor or at least significantly reduce it, especially if there is a paucity of comorbidities.

Level of educational attainment is directly correlated with greater life expectancy (Meara, Richards, & Cutler, 2008). Like education, high socioeconomic status results in a prolongation of life (Mirowsky & Ross, 2000). Incontinence of the bowels and/or bladder compresses life expectancy (Thomas & Barnes, 2010). Medical literature is filled with examples of epilepsy, particularly poorly-controlled seizure disorders, having a negative impact on life expectancy (Neligan et al., 2011) and (Day, Strauss, Shavelle, & Wu, 2003).

Case Reports

Case #1

Ms. C was an 82-year-old retired schoolteacher at the time of her injury in a pedestrian versus motor vehicle accident. For the past fifteen years she had been a volunteer at a senior citizens' center, working in the center's thrift store. Her health had been excellent, with no history of medication use or other problems, but her thrift store co-workers had noted a slowly progressing dementia over the past five years. Ms. C's doctor was also aware of her declining health/early onset dementia. Three years after her declining health was noted, a co-worker wrote a letter to Ms. C's doctor, concerned about her continuing to drive. A thorough examination was made and her diagnosis remained early onset dementia. Aricept therapy was initiated and her family members were contacted to obtain collateral information on her functioning. Closer observation by her family was recommended. Regular four- to six-month follow-up exams were also recommended and were given, with cognitive monitoring. On mini-mental tests her performance was consistently measured in the 28 to 29 range, until her last follow-up exam three weeks before the accident, when her score dropped to 26.

Unfortunately, no intervention was pursued and three weeks after this appointment Ms. C walked behind a delivery truck that was backing up in a parking lot. Ms. C. was hit, sustaining fractures of both knees that necessitated bilateral total knee replacement. After surgery she was placed in a nursing home permanently. Despite recurrent infections and MRSA colonization, she was able to ambulate household distances, but towards the last six months of her life she declined such that she could now only transfer and ambulate (very short distances) with minimum to moderate assistance. She was able to feed herself with setup and cuing. Continence could be maintained with timed voiding, though occasional accidents did occur. All of these self-care functions were clearly deteriorating, based on nursing chart notes. Her mini-mental exam score had now dropped to 21.

Two years after the pedestrian versus motor vehicle accident, a physiatrist was consulted

to determine Ms. C's future care needs and life expectancy. By this time she had lived with progressive dementia for at least seven years. Her dementia was felt to be still mild, but trending to moderate with a continued deterioration in her mini-mental exam score, now ranging from 19 to 21. Examination results were otherwise remarkable only for limited range of motion in her knees and some redness along the incisions, but no discharge. She also had a mild extensor response on balance testing, but could perform a wide-based Romberg test.

This case presents multiple concerns when attempting to predict life expectancy. First, at the time of consultation Ms. C had already lived at least 2.5 years longer than the statistically average likely endpoint for patients with a progressive dementia diagnosis. Typically, individuals with dementia live an average of 4.5 years after diagnosis (Xie, Brayne, & Matthews, 2008). Second, there is a paucity of literature on predicting the longevity of those individuals with chronic conditions who have already outlived their statistical average life expectancy. At the time of physiatric consultation, Ms. C was still walking, albeit short distances and with help. She was able to eat orally without much difficulty and was, for the most part, still continent. Had she not had dementia or pedestrian versus motor vehicle accident, like other healthy 82 year olds, Ms. C would have likely lived an additional eight more years (Arias, Rostron, & Tejada-Vera, 2010).

Since very little data on the life expectancy of long-lived dementia patients exists, data on brain injury survival were reviewed (Shavelle & Delaney, 2010) and considered. Looking at such data, at age fifty, the inability to walk and to feed oneself compresses life expectancy by approximately thirty-three percent in the brain injured population. Reviewing the data further, it was also noted that as age increases, the percentage of drop in life expectancy also increases by two to three percent per decade. Recognizing that Ms. C's dementia was progressive, it was anticipated that in a very short period of time--perhaps as little as six months--she would lose many or most of her remaining key functional abilities. In addition to dementia, Ms. C experienced chronic bacterial colonization with intermittent infections that were draining her physiological reserves. Using the multiplicative approach to aging with co-morbidities, a reduction in life expectancy of about seventy-five percent was predicted, relative to her otherwise healthy peers. By using brain injury data, it was calculated that Ms. C would have a reduction in life expectancy of 50% relative to her healthy peers, if her diagnosis had been a brain injury, rather than a progressive dementia. Combing this reduction with her chronic infection and her progressively declining cognitive, as well as global level of functional decline, an additional compression in life expectancy was felt to be an accurate assumption. It was felt that these co-morbid factors would reduce her life by an additional 25%. In sum, at the time of consultation, Ms. C. was eighty-four years old. As a member of the general population, she could statistically expect to live another seven years. Taking into account her dementia and co-morbid conditions, an estimate of one to two more years of life was made, with death anticipated between the age of eighty-five and eighty-six. As it turns out, six months after this estimate was provided, Ms. C. died of a respiratory infection/pneumonia.

Case #2

Mr. B was a 21-year-old male driving home from work when an oncoming car swerved into his lane, resulting in a head-on collision. Injuries that he sustained included a T12 Burst fracture resulting in ASIA A paraplegia and right lower trunk partial brachioplexopathy leaving him with only residual gross motor function of the hand, but good strength proximally. Mr. B also suffered a mild head injury with a loss of consciousness at the scene and at least four hours of post-traumatic amnesia. He had a normal head CT, but his cognitive status could not be

closely monitored, as he was intubated and taken to the operating room emergently for spinal stabilization. By his second week of hospitalization, his family reported that his cognitive functioning was very close to his pre-injury level.

Mr. B's pre-morbid medical history was remarkable for mild cognitive developmental delay, with some special education coursework in grade school and high school. Mr. B dropped out of high school in the middle of the tenth grade as a consequence of legal difficulties associated with automobile theft and illicit drug use (marijuana, opiates, and alcohol). He never earned a GED, but was able to maintain full-time work. At the time of the motor vehicle accident, he was working two jobs, one a full-time position as a clerk at a fast food restaurant and the other a part- time job making local deliveries. Reviewing Mr. B's co-morbid risk factors for life expectancy determination, his family history is remarkable only for tobacco- and alcohol-related illnesses. Mr. B began smoking cigarettes regularly at age sixteen and continues to do so, smoking about one pack per day, with an eleven pack year history.

Following inpatient rehabilitation, he drifted between his own home with intermittent attendant care and his parents' two homes, as they had divorced when he was in grade school. His post-injury medical history is remarkable for opiate drug-seeking behaviors with ongoing substance abuse (opiates, marijuana and alcohol are known to be abused), medical non-compliance, and poor skin care with multiple skin sores. He has also been fired by multiple providers, primarily due to his opiate abuse and/or opiate contract failures.

Mr. B has been unable to retain the care of a single healthcare provider for more than nine months. He has had many UTIs, skin sores and respiratory infections, conditions that were treated on an outpatient basis. Additionally, he has required hospitalization on three occasions for skin sores. One of these required extensive plastic surgery and two were for treatment of pressure sores that were treated conservatively with debridement and whirlpool and strict pressure relief. He was also hospitalized once each for pyelonephritis and pneumonia. Only after treatment for pyelonephritis was he discharged directly to his home. After being treated for each of the other illnesses, he convalesced for two to six weeks in nursing homes, while care provider arrangements were made and additional antibiotic and/or skin care treatment was provided. Over the past year, he has been free of any major infections and has not needed any antibiotics. He has had only minor skin sores, which have been treated on an outpatient basis. His drug abuse has unfortunately persisted.

Other problems that Mr. B has had are thefts of medications by attendants and a high turnover rate of attendant help. Fortunately, his mother and cousin have been able to fill in for attendants intermittently, while new ones are sought. Mr. B has been receiving eight hours of attendant care per day through Medicaid funding.

An examination of Mr. B made when he was twenty-seven, six years after his accident. His exam was remarkable for mild cognitive impairments, particularly in abstract reasoning, speed of processing, attention, and new learning. He was felt to have decisional capacity, but was gravely disabled. In other words, he was competent to make bad decisions, which his medical history clearly revealed. He had good fine motor use of his now dominant left hand, while his right hand, with residual neurologic impairment, was a weak helper arm. Mr. B was obese with a BMI of thirty-four, he remained a T12 complete ASIA A paraplegic. He had active grade two sores on his heels, but his ischial and trochanteric flaps were well approximated, without evidence of new sores or dehiscence. Three- ounce swallow revealed a chin tuck and delayed double swallow. Mr. B could complete level sliding board transfers, but uneven transfers, especially upward, required assistance. He was independent at intermittent catheterization provided he was wearing sweat pants, but he did not have the fine motor

dexterity to independently handle snaps, buttons or zippers. In matters of bowel care, he was dependent.

As in the case of Ms. C, multiple issues complicate an attempt to estimate the impact of Mr. B's injury on his life expectancy. Even before his catastrophic injury, he had an abbreviated life expectancy relative to his peers. His baseline cognitive impairments, lack of education, and abuse of marijuana, alcohol, and tobacco would all be negative risk factors. And obviously, none of these pre-injury life expectancy risk factors have resolved. Thus, Mr. B will have a compression in life expectancy due to pre-morbid factors.

Considering only his paraplegia, Mr. B would have an average life expectancy of about 40 more years (National Spinal Cord Injury Statistical Center, 2011). What impact will his many co-morbidities have on his life span? Tobacco use can reduce life expectancy by four to ten years (Streppel, Boshuizen, Ocke, Kok, & Kromhout, 2007) (Doll, Peto, Boreham, & Sutherland, 2004), and obesity has a similar negative effect on life expectancy (Prospective Studies Collaboration, 2009) (Peeters et al., 2003). His cognitive dysfunction, due to developmental delay and complicated/aggravated by his head injury will result in a reduction of about seven years (Shavelle & Delaney, 2010). Mr. B's educational limitations, medical non-compliance, and history of multiple healthcare and attendant providers will also lead to an abbreviated life expectancy. His pressure sores and recurrent skin, urinary and respiratory infections drain his physiologic reserves and can be life threatening on their own, particularly if development of a pressure sore coincides with binge use of alcohol or opiate overdose.

Mr. B is a good example of how the maximum limit and additive approaches to determining life expectancy are fraught with problems. The maximum limit approach would result in an estimate of approximately forty additional years of life, since Mr. B's paraplegia has the greatest negative impact on longevity. Utilizing this approach, all of Mr. B's other risk factors effecting his life expectancy would be ignored. On the other hand, using the additive model, Mr. B would be approaching his demise, or arguably, would already have outlived his expected endpoint of his life. Simply adding up all of the known negative risk factors for life expectancy would result in, an indefensible prediction, as it predicted what was felt to be an exaggerated or premature demise. For his life care plan, ultimately, a life expectancy of fifteen to twenty more years of life was predicted, which considers all of his co-morbidities, with a multiplicative approach. In making this estimate, it was recognized that the maximum limit approach would result in an exaggerated life expectancy figure, given the many negative risk factors for compression of the life span present in Mr.B's history. Conversely, the additive approach would result in too great a reduction of life expectancy.

A biostatistician predicted an average life expectancy for Mr. B of thirty-two more years, with a range of twenty-two to thirty-seven more years. Despite a slightly more positive trend in Mr. B's clinical status over the last year, significant destructive behaviors and multiple negative, non-modifiable risk factors persist. Considering all of this information, an estimate of fifteen to twenty-seven more years of life was predicted, with the average age of death at 50, within this range. This range straddles the second quartile of the survival curve and was felt to be accurate and easily defensible, using the multiplicative approach, coupled with the clinical circumstances specific to this individual. The lower range of years was derived by considering the biostatistician's predicted average life expectancy and reviewing the survival curve, combined with several variables, such as Mr. B's degree of medical non-compliance, his relatively high frequency of medical complications, including re-hospitalizations, his high rate of caregiver turnover, a veritable turnstile of primary care providers, poly-substance abuse and his gravely disabled status with regard to decisional capacity.

Conclusion

A life care plan should be personalized, representing the future needs of a specific individual and the duration of time such care needs will be required. When a physiatrist has been engaged as a consultant on life care plan or has been asked to write one, his or her opinions should be based on training, education, the medical literature and experience as well as on a review of available medical records and when possible, a detailed history and physical examination. As part of the physiatrist's responsibility, transitions in care needs with aging should be identified. Similarly, the length of time such care needs will be needed should also be provided. Ultimately, in predicting future care needs, the physiatrist should also be prepared to speak on the issue of life expectancy, as he or she may be asked to do so. If a biostatistician has been engaged to provide the average range of life duration for an individual's peer group, the physiatrist, with their unique qualifications in working with patients suffering from chronic disease states with associated impairments, should be able to present a reliable opinion on where a given individual may lie on their peer group survival curve. By using one of the three approaches discussed in this article, the maximum, the additive or the multiplicative approach, the physiatrist can provide information on longevity that is based on scientific methodology and not solely on anecdotal experiences or guesswork. Anecdotal experiences, particularly those that deviate from scientific foundation, can be difficult to defend due to their lack of credibility and therefore, should be avoided. When formulating conclusions about life expectancy, estimates should be based on a solid grounds of statistical data, when available, and this information should be coupled with known facts about the patient's condition, medical history, and examination findings. If precise data for a particular condition is not available, similar conditions can be considered. By considering this data, input provided into the life care plan will be specific to the individual for whom the plan has been drafted. Further, by working directly with a life expectancy biostatistician, the physiatrist can apply his or her medical knowledge to assist in creating or writing an accurate, individualized life care plan that includes an accurate, well thought out estimation of the duration for all medical care needs.

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Author Bio

Reg Gibbs, MS is a Certified Life Care Planner from Billings, Montana who specializes in neurodevelopmental and neurotrauma cases.