Survival Function Estimates for Senior Tour Golfers

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Abstract

In this paper we present survival function estimates for elite professional golfers who have participated on or presently participate on the Champions (Senior) professional golf tour.   Our primary data set consists of 313 Champions tour golfers who have won at least one regular PGA tour event or one Champions tour event.   Kaplan-Meier survivor function estimates indicate that 88% of these golfers should survive beyond age 76 as compared to about 50% of the American male population of similar birth cohorts who have also reached age 50. The estimated Kaplan-Meier median survival age is 88 years. Our results show their life expectancies are high in comparison to the general male population of the United States and also relative to the life expectancy advantages of other elite athletes over comparison populations as reported in the literature. This survival advantage could be attributed to the high level of physical activity of senior golfers, but also to the higher socio-economic status of golfers.

Key words: exercise, lifespan, longevity, senior professional golfers, physical activity, walking, morbidity

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Introduction

A number of studies have shown elite male athletes to have lower mortality rates or longer life spans than comparison male populations. A review of this literature (Teramoto M., Bungum , 2010) reported superior survival rates and roughly five years longer life expectancy for endurance (aerobic) and mixed sport athletes (aerobic and anaerobic) but unclear survival advantages for anaerobic athletes. Reductions in cardiovascular disease mortality contributed importantly to survivorship in the first two groups. Explanations offered for the favorable elite athlete – survival relationship in this review included: high volumes of endurance training during competitive years had favorable carryover effects on health in later life, genetic factors that facilitated athletic competition at the highest levels independently contributed to longer life spans, and the higher activity/exercise rates and lower smoking of elite athletes throughout their lives favorably impacted life spans (Sarna S, Sahi T, Koskenvuo M, et al. 1993 and Löllgen H., Böckenhoff A. and Knapp G. 2009). Additional explanations from the literature for the elite athlete survivor advantage are favorable heights and weights among elite athletes, access to high-quality health care during athletic careers, and access to high-quality health care after athletic careers due to high income (Saint Onge J. M., Rogers, R. G., Krueger P. M., 2008).

In this paper we add to the research on elite athletes and survivorship by examining mortality among select members of the U.S. Champions (Senior) professional golf tour. This tour is limited to players 50 years and older. Nearly all players who qualify for regular participation have had successful careers on the regular PGA tour as measured by career money winnings and/or career victories. For example, players in the top 30 all-time money winners on the regular PGA Tour of at least 50 years of age are eligible to compete in any Champions tour

event (Champions Tour Fact sheet). The tour started in 1980 with four tournaments, grew to 24

tournaments by 1984, and to nearly 40 tournaments by the end of the decade.   Prize money was

over $50 million in 2010 and 13 competitors won over $1 million each (Professional Golf

Association Web Site).

        Golf is a demanding game performed at the professional level by elite athletes.

According to the ESPN website a panel of experts in 2010 ranked it 18 out of the 60 major sports

in requirements for "hand eye coordination," 24 out 60 in requirements for "power" (the ability

to produce strength in the shortest possible time) and 16 in "analytic aptitude" (the ability to

evaluate and react appropriately to strategic situations). The experts did rate golf 52 in

"endurance" out of the 60 sports, but recent evidence seems to indicate that moderate physical

activity into old age might be more beneficial than high endurance physical activity. A recent

study (Wilson, M., O'Hanlon, R. et al., 2011) found high levels of myocardial fibrosis in healthy

lifelong male intense endurance athletes compared to control groups of age-matched veterans as

well as young athletes. While not a high endurance sport the physical stamina required for

tournament golf is nevertheless significant. A three or four round tournament will also have a

pro am round and practice rounds.   An 18 hole golf round takes four to five hours to complete,

much of it spent walking over uneven terrain at a brisk pace. Players cannot use golf carts on the

regular PGA tour but have the option to use carts on the Champions tour.   The majority of

Champions tour golfers do not use carts but walk the course to keep muscles loose and warm

(Cotton D, Wolohan J T., 2003).   Players also practice, even on tournament days, often taking

hundreds of full swings of golf clubs. The full swing of a professional golfer is a hard swing

using all of the major muscle groups

An advantage of studying the longevity of Champions Tour golfers as compared to other elite athletes is the likelihood that high levels of physical activity have been maintained by the golfers through their adult lives into their fifties. Many other elite athletes stop competing at a relatively young age and their physical activity after competition is unknown. Champions Tour golfers, on the other hand, probably have had little down time between participating on the regular PGA Tour and the Champions Tour. For example, the number of PGA tour events played by the youngest 19 members (those born in 1958 and 1959) of the Champions tour in our data set in the year prior to joining the Champions tour are 13,1,1,9,9,1,11,7,0,1,1,25,5,0,16,1,3,1,2. Skills can also be maintained prior to joining the Champions tour through regular practice and by participating in local and regional tournaments and exhibitions.

Playing golf at the amateur level has been associated with favorable health outcomes. One study (Parkkari J, Natri A, Kannus P, et al., 2000) found that playing golf 2 to 3 times a week and walking the course increased treadmill endurance, reduced weight, waist circumference, and skinfold thickness, and increased HDL cholesterol among Finnish male subjects 48 to 64 years old. A second study of 300,000 members of the Swedish golf Federation found their standardized mortality rate to be .60 compared to the general population, controlling for age, sex, and socioeconomic status (Farahmand B, Broman G., de Faire U, et al. 2009). Lower handicaps and more recent membership in the Federation were associated with lower standardized mortality ratios among the golfers. The authors expect that these factors were associated with more frequent play. The authors reported that golfers in Sweden rarely use a cart and can play 6 to 8 months per year. They believe increased physical activity explained the mortality reductions but recognize that the genetic factors that make participation more

rewarding could be independently related to life expectancy. To control for a possible

confounding effect of genetic factors on the physical activity - mortality rate relationship another

study used data from the Swedish twins registry (Carlsson S, Andersson T, Lichtenstein P, et al.

2007). The research showed that among identical twin pairs a more active twin member had a

20% reduced risk of all cause mortality and a 32% reduced risk of cardiovascular disease

mortality.

Methods

We estimate the Kaplan Meier survival function for professional golfers on the PGA's

Champions Tour. Fifteen hundred fifty four golfers have won prize money on the Champions

Tour since its inception in 1980 through 2009. Five hundred one of these have won prize money

in five or more events (PGA Tour data). Three hundred thirteen of the 501 have had a

tournament victory on the regular PGA tour or the Champions tour according to Wikipedia. It is

these 313 golfers that form our primary data set because their birth dates and death dates (if

deceased) appear in Wikipedia. Career Championship tour money winnings average $2.7

million for these 313 golfers as compared to $260,000 for the balance of the 501 players with

prize money in five or more events. The accuracy of Wikipedia is a subject of academic debate

(see Fallis D, 2008 and Chesney T., 2006), and we have verified the golfer vital statistics in two

ways. First, the PGA tour has provided us with the birth dates of Champions tour golfers that

they have in their files. They have birth dates for 224 of the 313 golfers. The PGA tour data are

independent of the Wikipedia birth data in the sense that the tour did not provide their data to

Wikipedia, although their annual press guides could have been used as a Wikipedia source.

Second, an internet search on the 34 deceased golfers was performed to find other records of the

golfer death dates that clearly have not relied on the Wikipedia data, such as newspaper stories,

obituaries, and athletic halls of fame.   This search also enabled an additional check on the birth

dates. The results of these checks showed the Wikipedia vital statistics to be 100 percent

accurate. There were two conflicts between the PGA data and the Wikipedia data; these were

resolved in favor of the Wikipedia data. There were no conflicts in the vital statistics of the

Wikipedia data and the internet search results for all 34 deceased golfers; in every instance birth

dates and death dates were verified from independent sources. Vital statistics may well be an

instance where Wikipedia "open access" methods provide data equal to or superior to traditional

sources.

Of the 313 senior tour golfers in our "Wikipedia data set" through 2009, 34 are deceased,

27 are alive and over age 80, 63 are alive and between ages 70 and 79, 88 are alive and between

ages 60 and 69 and 101 are alive and between ages 50-59. In addition to the right censored (not

deceased) observations, 57 of the observations are left censored, having first played on the

Champions tour after the age of 50.   Most of the left censored observations result from

participants being older than age 50 in the early years of the tour

Results

A graph of the Kaplan Meier survival function for these 313 golfers, taking account of

the left and right censoring, is presented in figure 1 with the 95% confidence interval. The

Kaplan Meier procedure places an upper bound on the estimated survivorship of live subjects. It

is equal to the age of death of the deceased subject that has lived the longest, providing that age

exceeds the age of any of the live subjects. This is the case for the Champions tour data and

maximum survivorship is set at 92 years in the Kaplan Meier estimates graphed in Figure 1.

Also presented in figure 1 are graphs of survivor functions from Social Security Administration data for American males that reached the age of 50 in 1990 and that reached the age of 50 in 2000. (Standard errors cannot be calculated from the Social Security Administration data.) The median age that participants on the Champions tour in our sample reached age 50 is 1994. The Social Security data show that 50% of American males that were age 50 in 1990 or age 50 in 2000 should survive beyond age 76 and age 78, respectively. The Kaplan-Meier estimates for the Champions tour golfers in our sample show that 87% should survive beyond age 76. The Kaplan-Meier median survival age for the Champions tour golfers is 88 years.

Wikipedia has vital statistics for another group of professional golfers, 50 years old and over, that provide support for the results for the Champion tour golfers. These are the winners of the PGA senior open championship. This tournament has been conducted since 1937 and is open to top professional golfers who meet the age requirement (Senior PGA Qualifying Requirements, 2010). There have been 48 different winners of this tournament. (The tournament was not played during World War II and some players have won multiple times.) Wikipedia has vital statistics for 39 of these 48 winners. The nine missing observations are among the first 13 winners. Fourteen of the 39 golfers are deceased, 6 are aged 80 and over, 6 are aged 70-79, 8 are aged 60-69, and 5 are aged 50-59. Twenty one of the winners of this tournament are also in our Champions tour data set. The Kaplan-Meier estimates for these winners give results similar to the Champions tour sample. The estimates show that 91% should survive beyond age 76 and the median survival age is 90 years. The average birth year of these golfers is 1929.
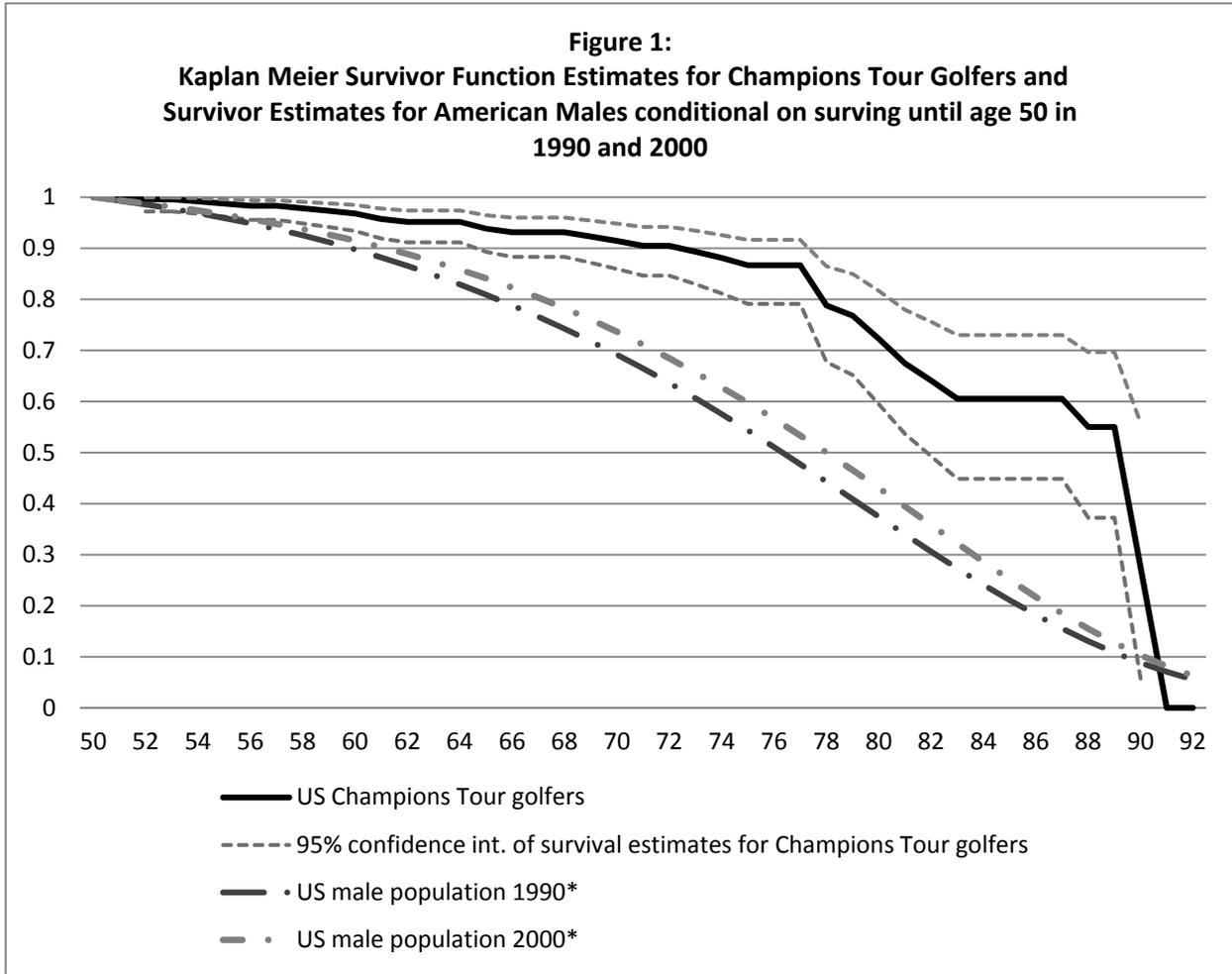
Discussion

In this paper we have presented survival estimates for elite professional golfers who have competed into their fifties. Our results show their life expectancies are high in comparison to the general male population of the United States and relative to the life expectancy advantages of other elite athletes over comparison populations as reported in the literature. It is also true that the physical activity of other elite athletes after competition, which often ends in early adulthood, is unknown but probably less than that of the professional golfers in our samples. Nevertheless, our sample sizes are too small and lengths of follow-up too short in this research to push these findings too far with respect to the results for other elite athletes. There also may be an upward bias in our longevity estimates for golfers due to a "healthy worker effect" (see Abel, E.L., Kruger, M.L. 2006 for professional baseball players). Some professional golfers may have been eligible for the senior tournaments limited to participants aged 50 and over but could not compete because of physical or other limitations. If these golfers also have lower longevity, the survival advantage we estimated for professional senior golfers would be above the one for elite pro golfers in general.

Conclusion

These findings are best considered as another contribution to the growing body of research that shows elite aerobic athletes have longer life expectancies than comparison populations. Whether the increased longevity of these golfers results from more active lifestyles through the adult years, genetic endowments, higher incomes and better health care, or favorable heights and weights awaits further research.

Figures

Figure 1:
Kaplan Meier Survivor Function Estimates for Champions Tour Golfers and Survivor Estimates for American Males conditional on surving until age 50 in 1990 and 2000

Legend:
— US Champions Tour golfers
---- 95% confidence int. of survival estimates for Champions Tour golfers
—·— US male population 1990*
—··— US male population 2000*

Notes:
*Survival Function for the general US male population conditional on surviving until age 50 for the year 1990, 2000 from Table 6: Period Life Tables for the Social Security Area by Calendar Year and Sex for the years 1990 and 2000 in Felicitie C. Bell, and Michael L. Miller, Actuarial Study No. 120, Social Security Administration, August 2005.

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