Accident death among left-handed and right-handed people

Summary

People's lifestyles and behaviors could influence the mortality rate. We investigated on British first class cricketers born 1840-1960 with the focus on comparing the accident deaths for left-handed and right-handed people. We've successfully proven that left-handed people are more susceptible to accidental death than right-handed people, and this hazard increases with time according to the censoring data.

Introduction

Data analyzed in this report is cricketer which contains the lifespan, life-or-death information of British first class cricketers born 1840-1960. We want to evaluate the hypothesis that whether left-handed people are more vulnerable to accidental death compared to right-handed people by applying survival analysis.

Uncensored

0.0.1   Method

Since we are doing survival analysis, a Weibull model with Bayesian inference is implemented. The Weibull distribution for lifetimes is usually left-skewed. Firstly, we construct the model with uncensored data for those who has died due to accident as below:

$$Y_i \sim \text{Weibull}(\lambda_i, \alpha)$$
$$\lambda_i = \exp(-\eta_i)$$
$$\eta_i = X_i\beta$$

where Y_i is the lifespan for i_{th} accidental dead individual, and it follows Weibull distribution, λ_i is the scale parameter that changed by η_i. η_i represents the characteristics life of dead cricketers, X_i refers to the fixed effects decade and left-handed, and α is the shape parameter. βs are logs of rate ratios where a larger β results to a smaller λ_i and the deaths happen quickly.

It can be seen from Figure 1, the value for α seems reasonable to be 5 or 10. Therefore, we choose 7.5 with standard deviation 2/3, and set log-Normal(log(7.5),2/3) to be our prior.

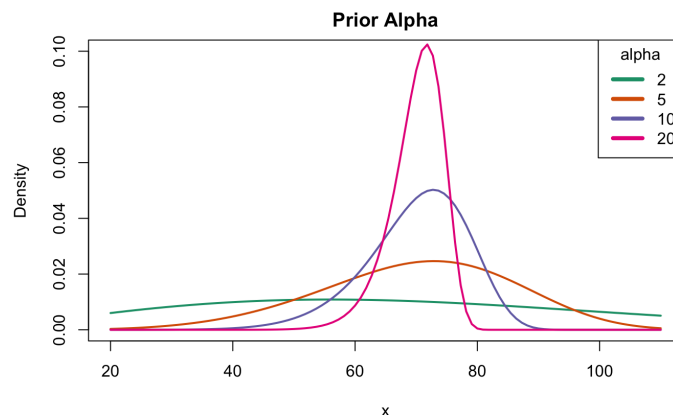Figure 1: Choosing Prior for Alpha

0.0.2   Results

Table 1: Summary of Parameter Rate Ratio for Accidental Death

	mean	sd	0.025quant	0.975 quant
(Intercept)	0.613	0.180	0.239	0.947
Decade	0.131	0.060	0.018	0.254
Lefty	0.076	0.135	-0.198	0.336
Alpha	1.727	0.110	1.521	1.953

It can be seen from Table 1 that the mean value for decade is 0.131, it means that the time scale for dying is 13.1% smaller for each decade. The mean value for lefties is 0.076, and the time scale for dying is 7.6% smaller for lefties. Then lefties age 7.6% more quickly and die earlier compared to right-handed people.

Censored

0.0.3   Method

Secondly, we include the cricketers who aren't dead yet and their lifetime is unknown, but it's between their current age and ∞. Then we censoring the data as a hierarchical model as following:

$$Z_i | Y_i, A_i = \min(Y_i, A_i)$$

$$E_i | Y_i, A_i = I(Y_i < A_i)$$

$$Y_i \sim \text{Weibull}(exp(\eta_i), k)$$

$$\eta_i = X_i\beta$$

where A_i is individual i's age in 1992, Z_i and E_i are two censors. Z_i is individual's age, minimal value of his lifespan if the person has passed away, or their current age in 1992. E_i is an event indicator of whether the person has died or not. Still, we assume that Y_i follows Weibull distribution with expected value η_i

0.0.4 Results

Based on the graph of cumulative hazard of left-handed people's accidental death, people tend to have an increasing trend of hazard with the increase of ages. According to Figure 2(b), the credible interval for the cumulative hazard lies on the trend and does not have a wide range. Therefore, we say it is statistically significant.
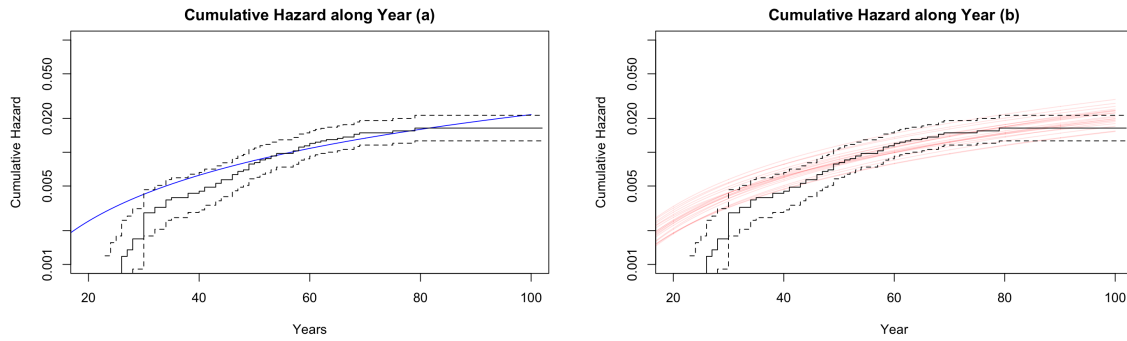

Figure 2: Mean and Confidence Interval for Posterior Hazard

Table 2 gives the parameter rate ratio, it shows that left-handed people have 2.4% more rate of aging. In another word, left handed-people have 2.4% higher chance of dying in accident than right handed people. With one decade passing through, the newborns will have lower chance of dying by accident of 26.4% which is a bit different from the uncensored data. Thus, we conclude that left handed people have larger rate of dying in accident with time goes by than right handed people.

Table 2: Summary of Parameter Rate Ratio for Censored Accidental Deaths

	mean	0.025quant	0.975 quant
(Intercept)	-2.844	-3.301	-2.431
Decade	-0.264	-0.844	0.303
Lefty	0.024	-0.443	0.453
Alpha	1.366	1.211	1.534

Based on Figure 3, left handed people have higher relative rate of dying by accident, especially without censoring. However, recent years of accidental death rate decreased as shown that blue lines have

smaller rate and lower density. Thus, we say being born in later years have lower chances of dying by accident, but left handed people have larger chances dying in accident than right handed people.
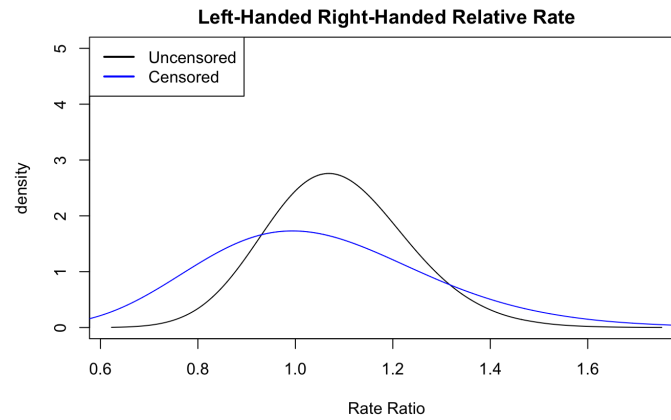

Figure 3: Relative Rate for Left Handers vs. Right Handers