

The Effect of Sleep Hours on the Risk of Getting Heart Disease

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Abstract. Heart disease has already become one of the diseases with highest fatality rate, and the number of patients shows an increasing trend worldwide. This paper mainly explores the relationship between sleep time and the prevalence rate of heart disease. This research analyzes a large sample(10000 population) from the Health dataset sample, to conduct statistical analysis on heart disease patients and individuals with sleep hours less than 7. Plotting ROC curve and establishing single factor cox regression model, and then adding more relevant factors that affect heart disease to make a multiple factor cox regression model, such as gender, BMI and diabetes, to check whether the result is still valid when several factors are considered. Also, the hazard ratio(HR)and confidence interval (CI)of 95% for each factor are recorded. This paper finds that short sleep time is a significant factor for the cause of heart disease. AUC value is greater than 0.7, and both two cox regression model shows $p < 0.0001$. And keeping sufficient sleep time would be helpful for reducing the risk of getting heart disease.

Keywords: heart disease, sleep hours, ROC curve

1. Introduction

Heart disease is a severe disease and it has significant threats to human health, and its mortality rate ranks first globally over a long period of time. Almost half of the people die from heart disease [1]. And now, with the development of society and changes in lifestyle, the number of young patients with heart disease rises magnificently [2]. Heart disease has put a strain on patients' mental health and working performance, the quality of life of patients and their family would also be significantly affected, while heart disease would cause a heavy burden on the social economy and public health [3].

In recent years, the heart disease problem has become more and more serious, and sleep time is a very crucial factor for people's health, which is linked to many disorders like diabetes and high blood pressure [4-5]. Hence, sleep factor may also have some impact on getting heart disease. Exploring whether the sleep time factors affect heart disease could help people prevent the disease. Hence, reduces the heart disease risk through providing them with relevant suggestions.

This essay discusses the effect of sleep time on the risk of getting heart disease, and it aims to provide suggestions to prevent heart disease. This research used several statistical means to test the effect of short sleep time(less than 7hours) on heart disease. The research could help improve the

health awareness of the public and provide suggestions for heart disease prevention. For future explorers, they can also consider sleep time as a common factor to evaluate the risk of heart disease, and do some further research into sleeping time.

2. Research design

Using a public Health dataset sample about heart disease of 10000 individuals. Selecting people with sleep hours less than 7 hours, to plotting ROC curve(receiver operator characteristic curve) of sleep hours predicting heart disease, in the range of age 35 to 50 population, and calculating the AUC value(area under the ROC curve) of the curve.

Establishing a single-factor Cox regression model to test the relation between sleep factor and heart disease. In addition, the research also mixed several common heart disease factors, including age, gender, BMI value and diabetes. Those data are used to establish a multiple-factor Cox regression model.

3. Results

The data from heart disease and sleep time statistics show that:

Figure 1 shows the ROC curve, and the AUC value calculated. The result gained:
AUC value = 0.742; $0.742 > 0.7$, which means the ROC curve is meaningful.
95%CI(Confidence interval) of 0.732 to 0.751.

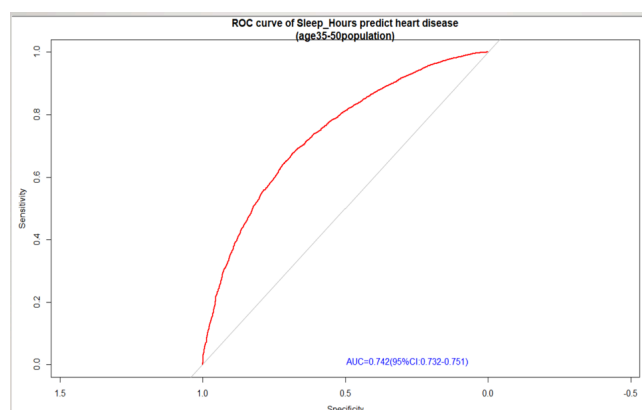


Figure 1. ROC curve of sleep hours predicts heart disease in the age range of 35

Figure 2 illustrates the relationship between the sleep hour factor and heart disease risk using a single Cox regression model. For the data shown on the graph:

HR value(hazard ratio) 0.39; $0.39 < 1$, shows that the risk of getting heart disease would decrease when sleep time increased by 1 hour.

$P < 0.001$; sleep hour is a highly significant factor, and short sleeping time have actual effects on heart disease.

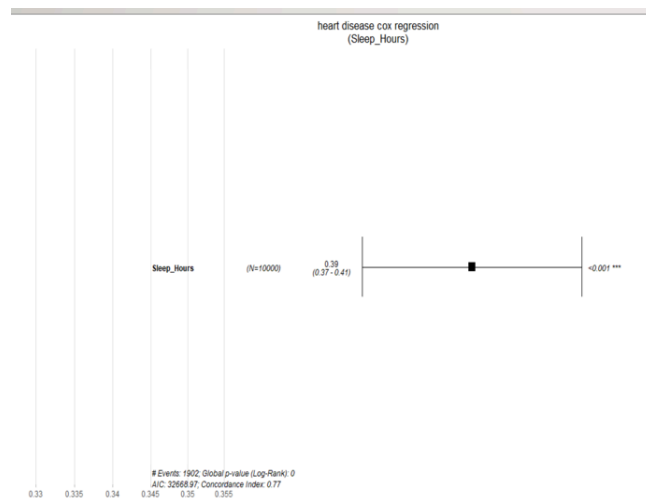


Figure 2. Single factor cox regression model of sleep hours affecting heart disease rate

The research then involves several confounding factors to make a multiple factor cox model, including common heart disease causing factors like age, gender, BMI value and diabetes [6].

The result is still valid as P value is smaller than 0.001; HR value=0.74 with CI of 0.72-0.75.

The information below defines the formulas, data and core settings used in establishing the multiple factor regression model.

Call:

```
coxph(formula = Surv(time, status) ~ Sleep_Hours + Age + Gender + BMI + diabetes, data = data)
```

n= 10000, number of events= 9568

```
coef exp(coef) se(coef) z Pr(>|z|)
```

```
Sleep_Hours -0.303972 0.737882 0.009045 -33.61 <2e-16 ***
```

```
Age 0.051177 1.052509 0.002260 22.65 <2e-16 ***
```

```
Gender 0.020742 1.020959 0.020542 1.01 0.313
```

```
BMI 0.081303 1.084699 0.003484 23.34 <2e-16 ***
```

```
diabetes 0.513414 1.670987 0.028247 18.18 <2e-16 ***
```

```
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
exp(coef) exp(-coef) lower .95 upper .95
```

```
Sleep_Hours 0.7379 1.3552 0.7249 0.7511
```

```
Age 1.0525 0.9501 1.0479 1.0572
```

```
Gender 1.0210 0.9795 0.9807 1.0629
```

```
BMI 1.0847 0.9219 1.0773 1.0921
```

```
diabetes 1.6710 0.5984 1.5810 1.7661
```

```
Concordance= 0.639 (se = 0.003 )
```

```
Likelihood ratio test= 2206 on 5 df, p=<2e-16
```

```
Wald test = 2204 on 5 df, p=<2e-16
```

```
Score (logrank) test = 2212 on 5 df, p=<2e-16
```

4. Conclusion

This essay mainly discusses the relationship between sleep time and heart disease using statistical means. This proves that people with long term sleep deprivation are more likely to get heart disease. The research used a large sample to test the relationship between heart disease and sleep time, and several common heart disease factors are also considered. However, this essay also has some limitations; only sleep time lengths are included, rather than the sleep quality. And the sleep time mainly depends on the memories of individuals, which may not be accurate. Also, the research does not take many different precise sleep times to test the effect. In the future, more large-scale and specific research can be made to further explore the principle of sleep time affecting the disease, and discover the most appropriate sleep time for preventing heart disease.

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