Telomeres, the protective DNA-protein complexes found at the ends of eukaryotic chromosomes, are essential in yeast and probably most other eukaryotes. They allow the cell to distinguish intact chromosomes from broken ones, to protect chromosomes from degradation, and are substrates for novel replication mechanisms. Since telomere shortening limits the lifespan of cells, this study was prospective with the aim of detecting the relationship between telomere features and demographic characteristics, such as smoking status, pack years, history of COPD, etc. Besides, a telomere length range for healthy people was present in this study.

**Model and Method**

Kolmogorov–Smirnov test was used to test normality of the distribution of telomere length. The null hypothesis of this test is: Data comes from the normal distribution.

Student’s t-test, Pearson’s product-moment correlation test, Pearson’s chi-squared test and multiple linear regression model were performed to examine the relation between telomere length and demographic characteristics.

Because of telomere length varies among different cells, we can not measure the exact length, in this study, 25-30 cells were measured for each subject. Hence, measurement error was introduced in order to account for the effect of telomere length measurement errors due to external factors.

\[
Y_{true} + \epsilon_{measure} = \hat{Y}_{measure} = X\beta + \epsilon_{model}
\]

\[
Y_{true} = X\beta + \epsilon_{model} - \epsilon_{measure}
\]

Where \(Y_{true}\) is the true value of telomere length; \(\hat{Y}_{measure}\) is the measured telomere length; \(X\) is the explainable variables; \(\epsilon_{model}\) is the fitting error or residual; \(\epsilon_{measure}\) is the measurement error of telomere length.

Though the estimation of coefficient (\(\beta\)) will not be changed, the variance becomes larger in a measurement error model.

\[
E(\epsilon) = E\left(\left(X'X\right)^{-1}X\epsilon\right) = E\left(\left(X'X\right)^{-1}X(X\beta + \epsilon_{model} - \epsilon_{measure})\right)
\]

\[
= E\left(\left(X'X\right)^{-1}X\epsilon\right) = \left(X'X\right)^{-1}(E(\epsilon_{model}) - E(\epsilon_{measure})) = 0
\]

\[
V(\epsilon) = \left(X'X\right)^{-1}\text{var}(\epsilon_{model})\left(X'X\right)^{-1}
\]

\[
= \left(X'X\right)^{-1}\text{var}(\epsilon_{model})\text{var}(\epsilon_{measure})\left(X'X\right)^{-1}
\]

Where \(\left(X'X\right)^{-1}\text{var}(\epsilon_{model})\left(X'X\right)^{-1}\) is the variance of coefficients without measurement error; \(\left(X'X\right)^{-1}\text{var}(\epsilon_{measure})\left(X'X\right)^{-1}\) is the added variance when introducing measurement error into the model.

205 participants were analyzed in this study. 95 among 205 were Male. Age varied from 33 to 86 and the average was 66.4. 32 (15.7%) subjects were current smokers while 78 (38%) were non-smokers. The mean of pack years was 16.83 with standard deviation (SD) 22.67, the mean of years smoking was 17.88 with SD 18.6.

**Telomere Length Range for healthy people**

From the normality test, we found telomere length followed normal distribution. Hence, mean and standard deviation of each telomere length were calculated. For each telomere, mean±6*standard deviation was defined as the telomere length range. Following tables showed the telomere length range for healthy people. (first 3 chromosomes)

It is widely recognized that telomere length has a highly significant negative correlation with age. The older, the shorter length. This study also supported this point view.

### Results

**Telomeres that are associated with smoking status**

Following tables displayed the models between telomere lengths and smoking status.

As age increases, telomere length decreases, holding other covariates constant. As pack year increases, telomere length decreases, holding other covariates constant.

As activity hours increases, telomere length decreases, holding other covariates constant.

As smoking years increases, telomere length decreases, holding other covariates constant. Comparing with non-smokers, current smokers have longer telomere length, holding other covariate constant.

### Conclusions

All telomere length gradually decreases as subject’s age increases. Length of telomere S5q1, S7q2, S14q1 and Yp were negative associated with pack year, which meant the more packs people smoke, the shorter telomere length; length of telomere S8q2, S17p2 and S18p1 were negative associated with years have been a smoker, which meant the longer people have been a smoker, the shorter telomere length; length of telomere S8q2, S15p1, S17p2, S18p1, S19q2 and S20q2 were longer for current smoker comparing with non-smoker. What is more, there were another 30 telomere lengths which were negative associated with history of COPD. This meant people who had history of COPD had shorter telomere length, however, it was important to notice that history of COPD was related with pack years. The remaining 56 telomeres did not show significant relation with smoking status.

### References


