Homework 2

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Problem 1

(i)

We are not able to calculate variance with the information given in this problem. We need the number of events and number of observations at risk for each time point leading up to the time point j.

(ii)

For an asymptotically normal random variable, either the delta method or an endpoint transformation produce desired outcome.

We will use the endpoint transformation method to find a confidence interval for the log-odds of surviving past a time point t_j.

First, obtain a confidence interval for the probability of surviving, which is given by

$$\widehat{S(t_j)} \pm 1.96 * \sqrt{Va\widehat{t(S(t}_j))} = (lb, up)$$

The, for the log-odds of survival, a confidence interval is given by

$$(log\frac{lb}{1-lb}, log\frac{ub}{1-ub})$$

Delta Method

if we have to determine the variance, as stated in the Note section, we would use the delta method approach to get variance of $T(S(t_j))$.

First, define $g(S(t_j)) = log\frac{S(t_j)}{1-S(t_j)}$

Then, $g'(S(t_j))^2 = \frac{d}{dS}g(S(t_j)) = (\frac{1}{S(t_j)} + \frac{1}{1-S(t_j)})^2$

Therefore, $Var[T(S(t_j))] = (\frac{1}{S(t_j)} + \frac{1}{1-S(t_j)})^2 * Var(S(t_j))$

We will need to compute this variance at t_j using the value of $S(t_j)$ and its variance.

Then we compute a 95% confidence interval: $T(S(t_j)) \pm 1.96 * \sqrt{Var[T(S(t_j))]}$

(iii)

Alternative hypothesis: $H_a : S_1(t_j) \neq S_0(t_j)$

Test statistic: $\frac{(S_1(t_j)-S_0(t_j))-0}{\sqrt{Var(S_1(t_j))+Var(S_0(t_j))}}$

Since both $S_1(t_j)$ and $S_0(t_j)$ are normally distributed, we can conduct the two sided test using 1.96 - a 97.5th quantile of standard normal distribution.

If the absolute value of our test statistic is greater than 1.96, then we can reject the null hypothesis and conclude that the survival probability past time point t_j is different for the two groups.

(iv)

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Problem 2

(i)

Figure 1 shows the two KM survival curves for the two groups. It appears that group 2, with a percutaneously placed catheter, has more evidence that this method of placement delays time of infection more effectively.

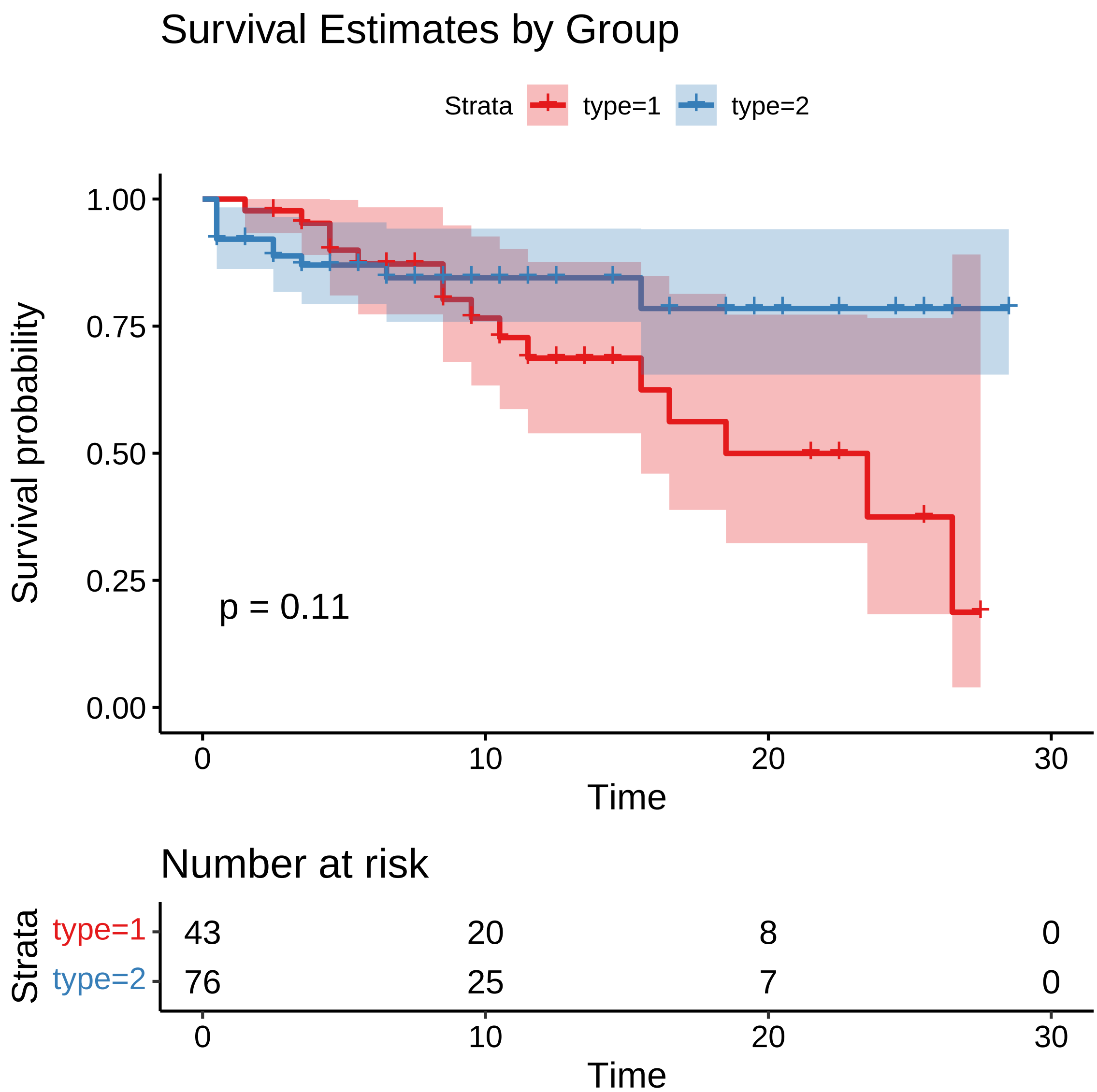

Figure 1: Kaplan Meier Estiamtes for time to infection in weeks the two groups

(ii)

(iii)

(iv)

(v)

Problem 3

(i)

(ii)

(iii)

(iv)

(v)

(vi)

(vii)