Coverage probability for Poisson counts

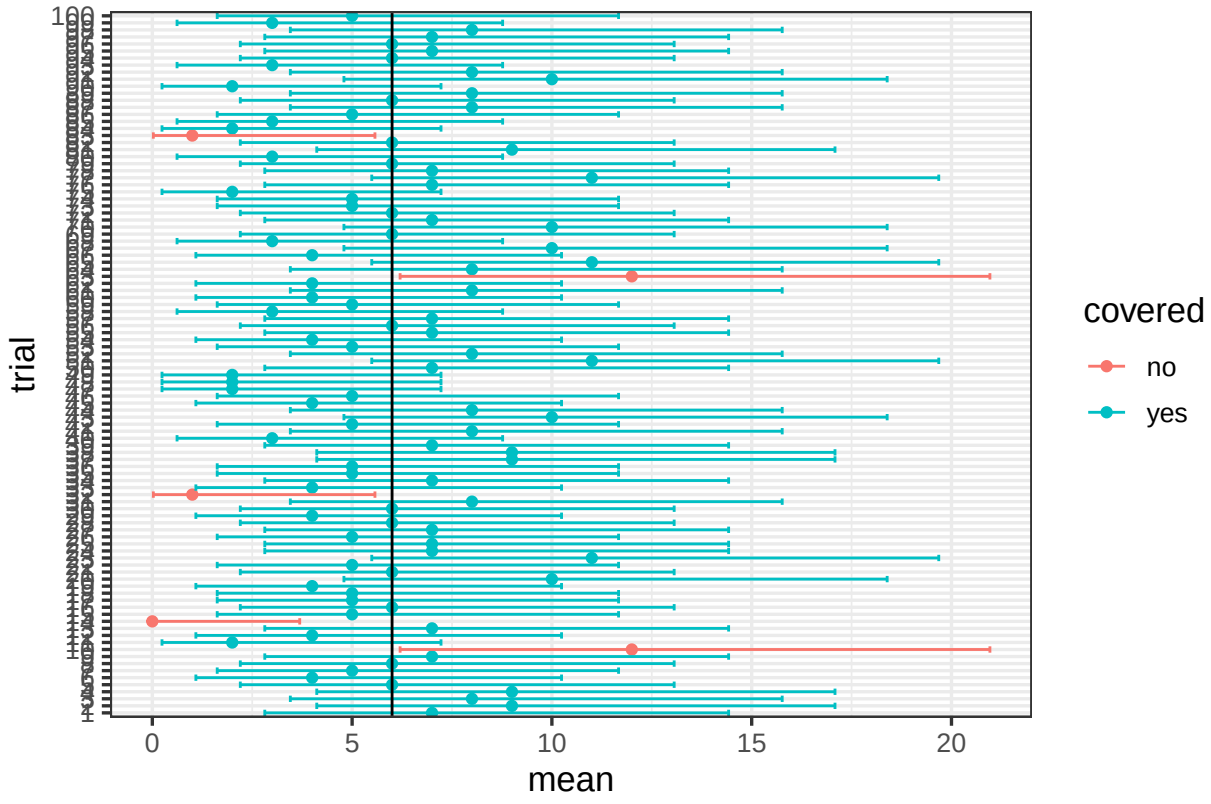
```
# load packages
library(plyr)
library(dplyr)
library(ggplot2)
library(mosaic)
```

Poisson based Confidence interval

```
# possion based CI
set.seed(12345)
true_lambda <- 6
sims <- rpois(100, lambda = true_lambda)
df <- plyr::ldply(sims, function(i){
  z_ci <- poisson.test(x = i, T = 1)$conf.int
  c(z_ci,i, dplyr::between(true_lambda, z_ci[1],z_ci[2]))
})

df$trial <- factor(seq_along(df$V1))
colnames(df) <- c("lower","upper","mean", "covered", "trial")
df$covered <- factor(df$covered, levels = 0:1, labels = c("no","yes"))
df$width <- df$upper - df$lower

p <- ggplot(df, aes(mean, trial, colour = covered))
p + geom_point() +
  geom_errorbarh(aes(xmax = upper, xmin = lower)) + geom_vline(xintercept = true_lambda) +
  theme_bw(base_size = 13L) + labs(caption = sprintf("average CI width is %0.2f", median(df$width)))
```



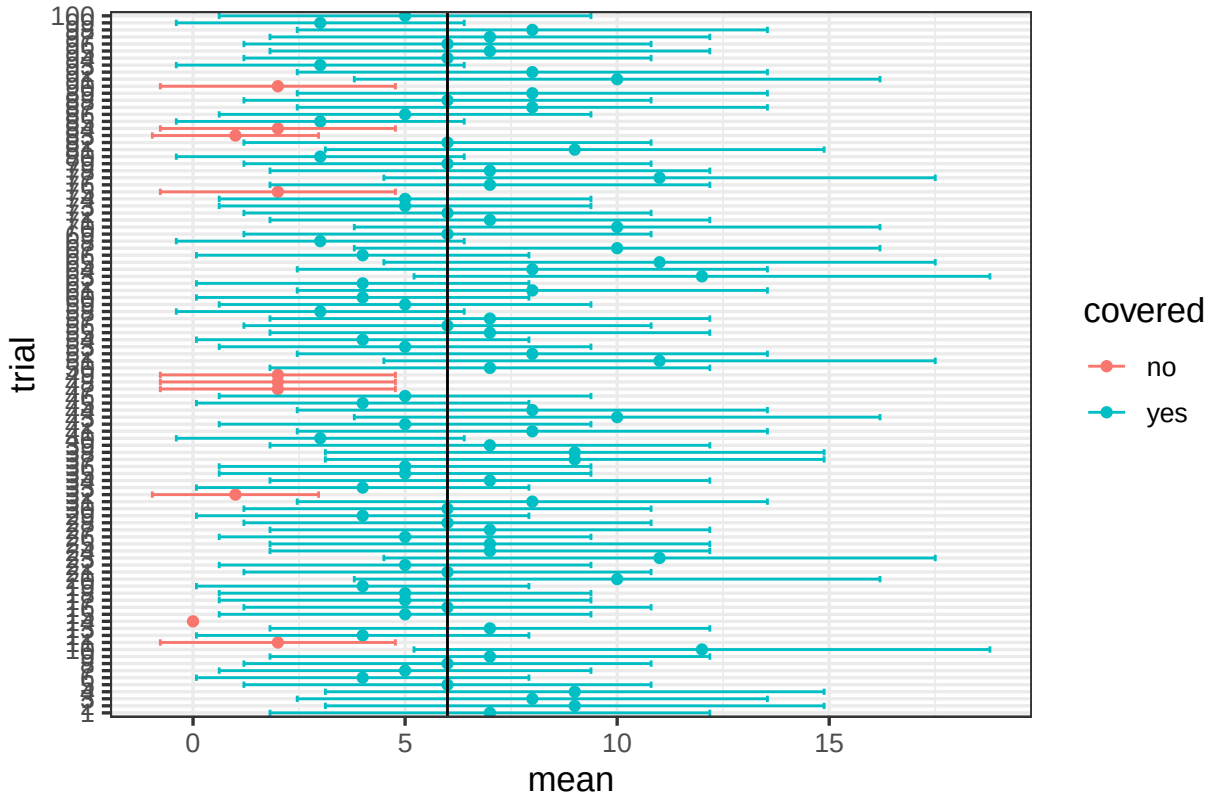
Normal based CI

We see that the coverage rate is not as good for the normal approximation when $\mu = 6$.

```
set.seed(12345)
true_lambda <- 6
sims <- rpois(100, lambda = true_lambda)
df <- plyr::ldply(sims, function(i){
  z_ci <- qnorm(p = c(0.025, 0.975), mean = i, sd = sqrt(i))
  c(z_ci,i, dplyr::between(true_lambda, z_ci[1],z_ci[2]))
})

df$trial <- factor(seq_along(df$V1))
colnames(df) <- c("lower","upper","mean", "covered", "trial")
df$covered <- factor(df$covered, levels = 0:1, labels = c("no","yes"))
df$width <- df$upper - df$lower

p <- ggplot(df, aes(mean, trial, colour = covered))
p + geom_point() +
  geom_errorbarh(aes(xmax = upper, xmin = lower)) + geom_vline(xintercept = true_lambda) +
  theme_bw(base_size = 13L) + labs(caption = sprintf("average CI width is %0.2f", mean(df$width)))
```



average CI width is 9.35