Plotting the p-value for a Binomial test

The other day we looked at this example:

Suppose we take a sample of size $n = 40$ and our null hypothesis is $H_0 : p = 0.2$

If the null hypothesis is true and conditions check out, our sampling distribution is $X \sim \text{Binomial}(40, 0.2)$

Suppose that the alternative hypothesis is

$H_A : p > 0.2$

Suppose that we observe $x = 14$. The p-value is $P(X \geq 14) = P(X > 13)$.

How can we plot this?

```r
x <- 14
n <- 40
p <- 0.2

binom_dist_to_plot <- data.frame(
    num_successes = seq(from = 0, to = n)
  ) %>%
  mutate(
    pv = factor(c(rep(0, x), rep(1, n - x + 1))),
    probability = dbinom(x = seq(from = 0, to = n), size = n, prob = p)
  )

ggplot(data = binom_dist_to_plot,
    mapping = aes(x = num_successes, y = probability, fill = pv)) +
  geom_col() +
  geom_vline(xintercept = x) +
  xlab("Number of Successes") +
  scale_fill_manual("Included\nin p-value\ncalculation?",
    labels = c("No", "Yes"), values = c("black", "red")) +
  theme_gray(base_size = 14)
```