Wald tests

Where we're going

Formal definition

Hypothesis tests for a population mean

Let $Y_1, Y_2, \ldots, Y_n$ be an iid sample from a population with mean μ and variance σ^2. We want to test

$$H_0 : \mu = \mu_0 \qquad H_A : \mu \neq \mu_0$$

Hypothesis tests for a population proportion

Let $Y_1, Y_2, \ldots, Y_n \overset{iid}{\sim} Bernoulli(p).$ We want to test

$$H_0 : p = p_0 \qquad H_A : p \neq p_0$$

What is our Wald test statistic?

Testing multiple parameters

Logistic regression model for the dengue data:

$$Y_i \sim Bernoulli(p_i)$$

$$\log\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 WBC_i + \beta_2 PLT_i$$

Researchers want to know if there is any relationship between white blood cell count or platelet count, and the probability a patient has dengue. What hypotheses should they test?

Testing multiple parameters

```
m1 <- glm(Dengue ~ WBC + PLT, data = dengue,
          family = binomial)
summary(m1)
```

```
...
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)  2.6415063  0.1213233   21.77   <2e-16 ***
## WBC         -0.2892904  0.0134349  -21.53   <2e-16 ***
## PLT         -0.0065615  0.0005932  -11.06   <2e-16 ***
## ---
...
```

Can the researchers test their hypotheses using this output?

Class activity

https://sta711-s23.github.io/class_activities/ca_lecture_17.html

> ✚ Wald tests for the dengue data