**Objectives of the Video**

We will discuss:

- The motivation for the Poisson Regression model with Robust Standard Errors

- The difference between this model and the "regular" Poisson Regression model

- The interpretation of the model's parameters

**Poisson Regression with Robust Standard Errors**

Our focus, however, is to discuss **Poisson Regression with Robust Standard Errors**

- Modified Poisson Regression that can work with response variables with binary outcomes
- Addresses problems with overdispersion

**Poisson Regression with Robust Standard Errors**

Main problem is with the Poisson assumption of

$$E(Y_i) = Var(Y_i)$$

- With binomial data, Poisson regression usually underestimates variance of data
- We need a way to address this problem when making inferences

**Poisson Regression with Robust Standard Errors**

The only adjustment to make:

- The standard errors of the estimated predictors $(\hat{\beta})$ are replaced with "robust" standard errors from the sandwich estimator

$$Var(\hat{\beta}) = (X^T X)^{-1} X^T \Sigma X (X^T X)^{-1}$$

where $\Sigma$ is the covariance matrix of the residuals

**Poisson Regression with Robust Standard Errors**

- Simple to implement through software such as R with the "sandwich" library

- Everything else is kept the same, such as the values of $\hat{\beta}$ (the maximum likelihood estimates of $\beta$) as well as their interpretations

## Regression for Data with Binary Outcomes

Multiple methods for regression of data with binary outcomes

- Logistic Regression is a popular alternative

Many real-world scenarios can be modeled with binary regression

- Health-related problems such as association of disease and certain factors
- Widely used methods in Epidemiology and Public Health

## The Data

Pima Indians Diabetes dataset

- Contains health measurements for subjects and their status of being diabetic or not
  $\rightarrow$ Diabetes status is the outcome variable

- Originally from the University of California, Irvine Machine Learning Repository. Still available through Kaggle