Q4, CA 26 (Oct. 26)

want: probability that a 45 year old college graduate w/out diabetes smokes one cigarette per day

$$P(Y_i = 1) = \frac{e^{-\lambda_i} \lambda_i^1}{1!} (1-\alpha_i) = e^{-\lambda_i} \lambda_i (1-\alpha_i)$$

$$\hat{\alpha}_i = \frac{\exp\{-2.51 + 0.051(45)\}}{1 + \exp\{-2.51 + 0.051(45)\}} = 0.45$$

$$\hat{\lambda}_i = \exp\{2.92 - 0.067\} = 17.34$$

$$\hat{P}(Y_i = 1) = 17.34 \left(e^{-17.34}\right)(1 - 0.45) \approx 2 \times 10^{-7}$$

$$P(Y_i = 0) = e^{-\lambda_i}(1-\alpha_i) + \alpha_i$$

Lab 7, Q8

Perform a hyp. test to investigate whether threads in different forums have different #s of posts, after accounting for views, author experience, and state

model 1: ZIP model

$$\log\left(\frac{\alpha_i}{1-\alpha_i}\right) = \beta_0 + \beta_1 \text{Views} + \beta_3 \text{Author Exp.} + \beta_4 \text{State} + \beta_5 \text{Forum HW} + \dots + \beta \text{ Forum Sci.}$$

$$\log(\lambda_i) = \text{"} \qquad \text{"}$$

```
m1 <- zeroinfl(Posts ~ Views + Experience + State + Forum |
                 Views + Experience + State + Forum)

m2 <- zeroinfl(Posts ~ Views + Experience + State |
                 Views + Experience + State)
```

For this course:

- If no overdispersion ($\phi = 1$), we can use Poisson
- If $\phi > 1$, we can use quasi-Poisson or NB

CA 14 (Sept. 23)

Track conditions: Good, Fast, Slow

$$\log\left(\frac{\hat{\pi}_{i(\text{Good})}}{\hat{\pi}_{i(\text{Slow})}}\right) = -39.68 + 0.77\,\text{Speed}_i$$

$$\hat{\beta}_1 = 0.77$$

$\Rightarrow$ an increase of 1 unit in Speed is associated with a change in the RR of Good vs. Slow track conditions by a factor of $e^{0.77} = 2.16$

Lecture 15 (and Class activity 15) (Sept. 26)

$$\log\left(\frac{\hat{\pi}_{i(\text{Short})}}{\hat{\pi}_{i(\text{None})}}\right) = -8.234 + 0.456\,Age_i - 0.0065\,Age_i^2$$

$$\log\left(\frac{\hat{\pi}_{i(\text{Long})}}{\hat{\pi}_{i(\text{None})}}\right) = -5.083 + 0.3666\,Age_i - 0.00628\,Age_i^2$$

want: $\hat{\pi}_{i(\text{short})}$

Age = 25

$$\hat{\pi}_{i(\text{short})} = \frac{\hat{\pi}_{i(\text{Short})} / \hat{\pi}_{i(\text{None})}}{1 + \frac{\hat{\pi}_{i(\text{short})}}{\hat{\pi}_{i(\text{None})}} + \frac{\hat{\pi}_{i(\text{Long})}}{\hat{\pi}_{i(\text{None})}}}$$

$$\frac{\hat{\pi}_{i(\text{short})}}{\hat{\pi}_{i(\text{None})}} = 0.408 \qquad \Rightarrow \qquad \hat{\pi}_{i(\text{short})} = \frac{0.408}{1 + 0.408 + 1.15}$$

$$\frac{\hat{\pi}_{i(\text{Long})}}{\hat{\pi}_{i(\text{None})}} = 1.15$$

$$\frac{\hat{\pi}_{i(\text{short})}}{\hat{\pi}_{i(\text{Long})}} = \frac{0.408}{1.15} = 0.35$$

$\Rightarrow$ prob. of short term use is 0.35 times prob. of long term use

$$P(Y_i = y) = \begin{cases} e^{-\lambda_i}(1-\alpha_i) + \alpha_i & y = 0 \\ \dfrac{e^{-\lambda_i}\lambda_i^{y}}{y!}(1-\alpha_i) & y > 0 \end{cases}$$

$$P(Y_i = 1) = e^{-\lambda_i}\lambda_i(1-\alpha_i)$$

$$P(Y_i = 2) = \frac{e^{-\lambda_i}\lambda_i^{2}}{2}(1-\alpha_i)$$