



# Poisson Regression

	Pr
(Intercept)	$< 2e-16$ ***
animal_typeDOG	$4.70e-09$ ***
month_ordered	$< 2e-16$ ***
intake_typeOWNER SURRENDER	$< 2e-16$ ***
intake_typeSTRAY	$< 2e-16$ ***
chip_statusSCAN CHIP	$6.58e-07$ ***
chip_statusSCAN NO CHIP	$7.55e-12$ ***

**AIC:  
15692**

Serious  
*Overdispersion!*

**Dropped**

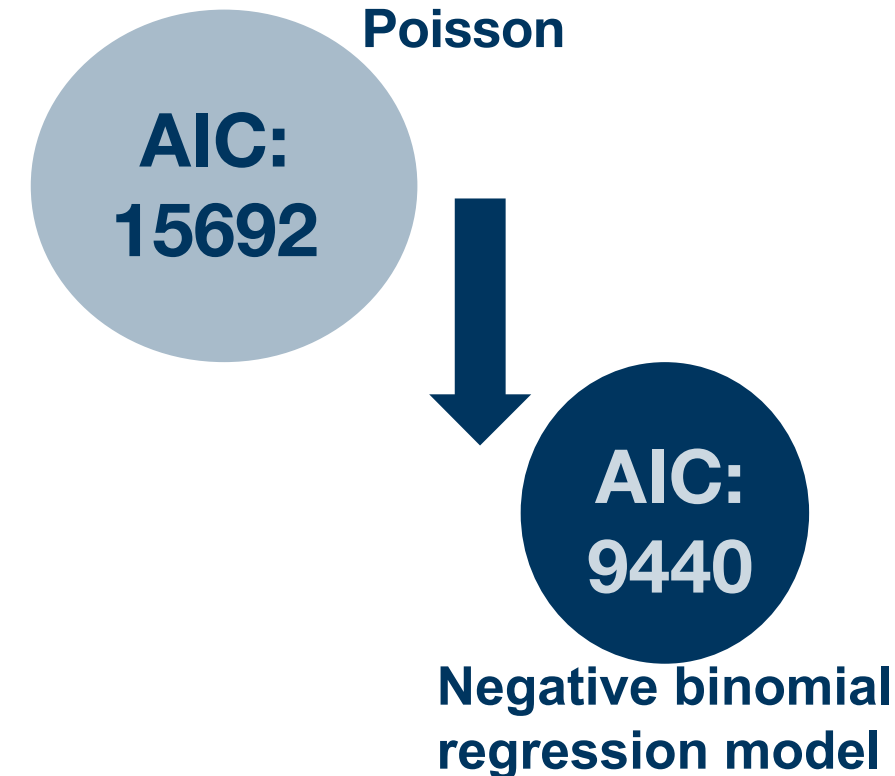
**Dispersion  
8.01 >> 1.5**



## Negative binomial regression model

	Pr
(Intercept)	< 2e-16 ***
intake_typeOWNER SURRENDER	2.10e-09 ***
intake_typeSTRAY	1.88e-05 ***
month_ordered	7.66e-05 ***
chip_statusSCAN CHIP	0.03571 *
chip_statusSCAN NO CHIP	0.00491 **
animal_typeDOG	0.09949 .

**Stepwise** used to select optimal variables

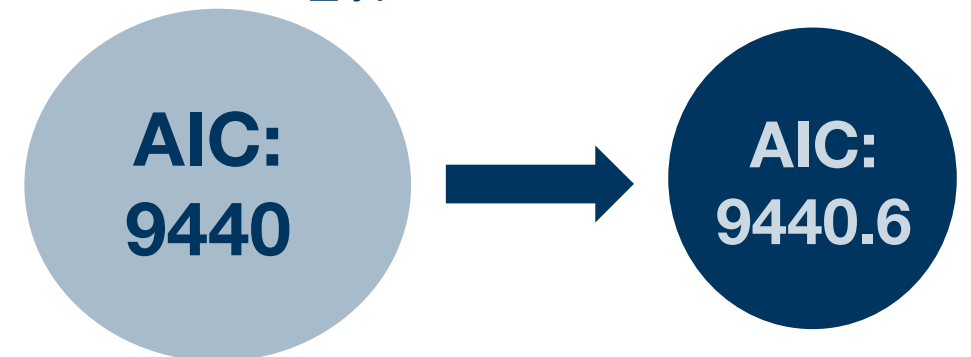


# Negative binomial regression model

	Pr
(Intercept)	$< 2e-16$ ***
intake_typeOWNER SURRENDER	$3.68e-10$ ***
intake_typeSTRAY	$1.27e-05$ ***
month_ordered	$5.00e-05$ ***
chip_statusSCAN CHIP	0.01969 *
chip_statusSCAN NO CHIP	0.00323 **

After excluding animal\_type, it performs similarly but is simplified

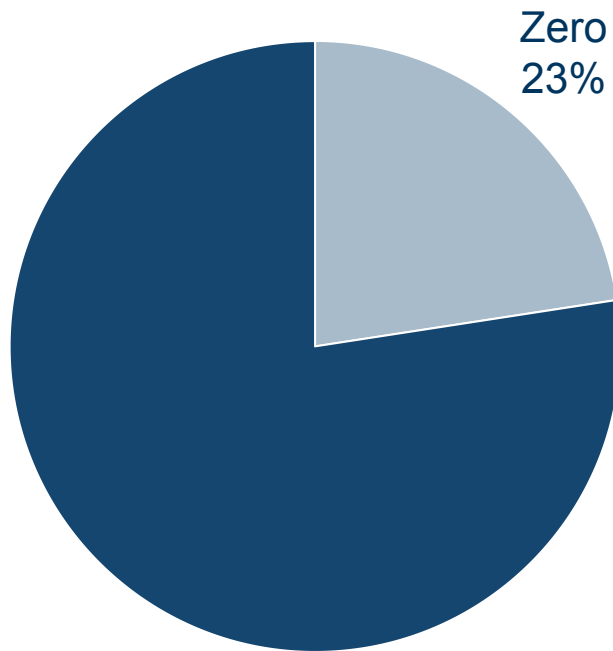
include animal\_type



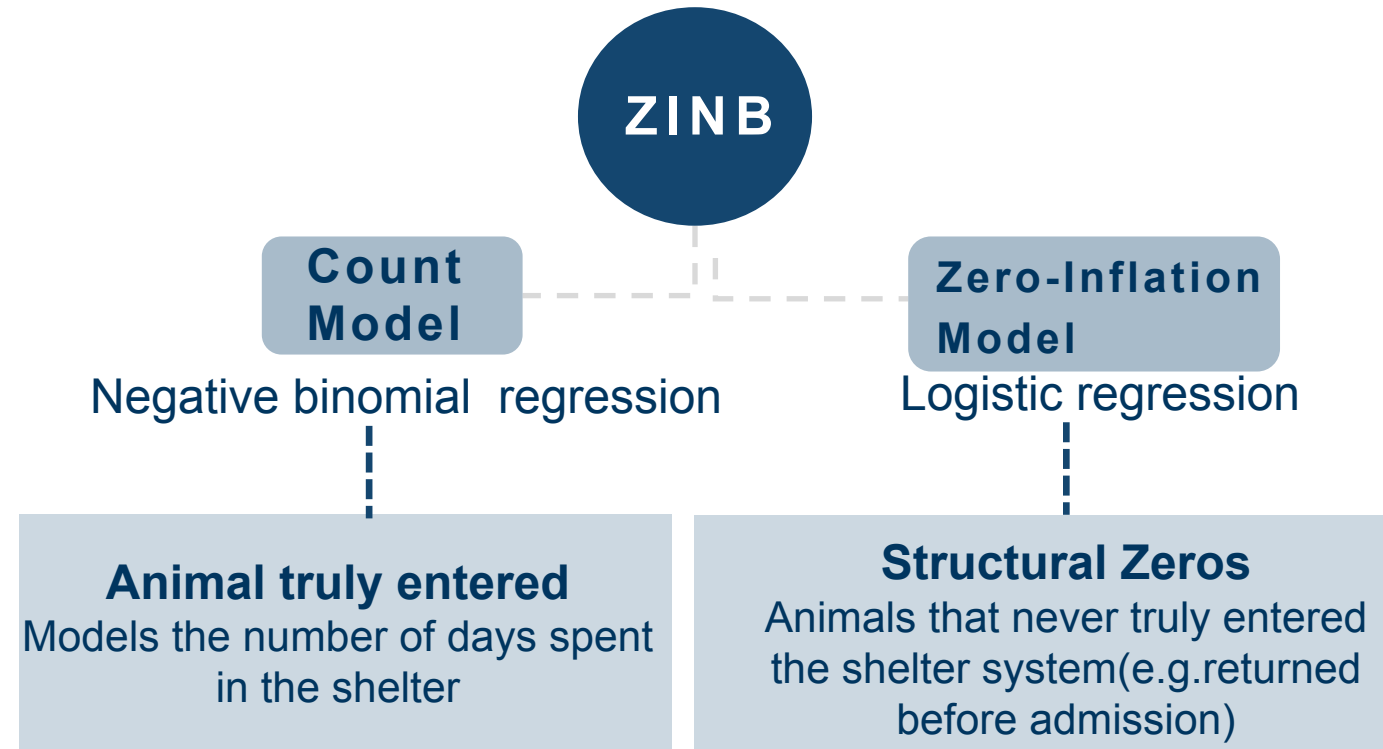
Exclude animal\_type

# Zero-Inflated Negative Binomial Model

The amount of Zero in *time\_at\_shelter*



**Excess zeros** in *time\_at\_shelter*



# Zero-Inflated Negative Binomial Model

## Count model

Estimates how many days an animal stays in the shelter (if it truly entered)

	Estimate	Pr
(Intercept)	2.513081	< 2e-16 ***
intake_typeOWNER SURRENDER	-0.657431	6.47e-09 ***
intake_typeSTRAY	-0.345890	0.001047 **
month_ordered	-0.026263	0.000668 ***
chip_statusSCAN CHIP	-0.012541	0.938263
chip_statusSCAN NO CHIP	0.033997	0.823711
animal_typeDOG	0.030271	0.664766
Log(theta)	0.359465	4.38e-08 ***

AIC = 9335.147 lowest among three model

**OWNER SURRENDER** and **STRAY** have significant negative coefficients

These animals tend to stay fewer days. Stray animals stay  $\exp(-0.346) \approx 0.71$  times as long.

**month\_ordered** is also significantly negative

animals arriving later in the year tend to stay shorter. For each later month, time in shelter decreases by 2.7%.

**chip\_status** and **animal\_typeDOG** are not significant

have little impact on length of stay.

# Zero-Inflated Negative Binomial Model

## Zero-inflation model

Models the probability that a zero is a structural zero – animal didn't really enter the shelter

	Estimate	Pr
(Intercept)	-12.35866	0.923125
intake_typeOWNER SURRENDER	12.14699	0.924438
intake_typeSTRAY	12.36739	0.923071
month_ordered	0.04147	0.106656
chip_statusSCAN CHIP	-1.36654	0.000202* **
chip_statusSCAN NO CHIP	-1.59158	3.01e-07 ***
animal_typeDOG	-0.49316	0.016035 *

AIC = 9335.147 lowest among three model

**SCAN CHIP** and  
**SCAN NO CHIP** have  
significant negative  
coefficients

Animals with chip-related info are less likely to be structural zeros. Having a scannable chip *reduces odds* of being a structural zero by  $\exp(-1.37) \approx 0.25$ .

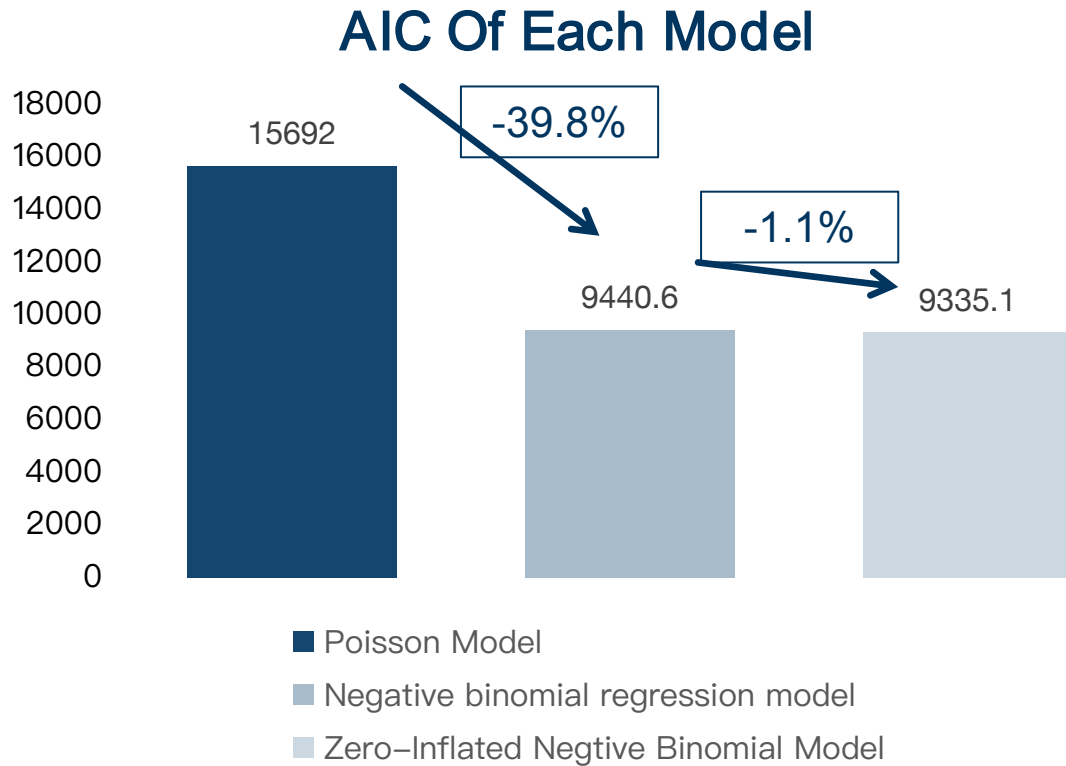
**animal\_typeDOG** is  
significant and  
negative

Dogs are less likely to be structural zeros. Dogs are  $\exp(-0.49) \approx 0.61$  times as likely as cats to be structural zeros.

**intake\_type** and  
**month\_ordered** are  
not significant here.

Have little impact on  
structural zero.

# Model Comparison



**The Zero-Inflated Negative Binomial (ZINB) model has the lowest AIC of 9335, indicating the best fit.**

**It captures both overdispersion and excess zeros, which the Poisson and NB models cannot fully handle.**