Review

We've seen (a lot!) of different types of regression over the course of the semester! But at their core, each of the different types is trying to do the same thing: model the relationship between an outcome Y and a set of predictors $X_1, \ldots, X_p$.

We have a decision tree already to help us decide which analysis approach is appropriate for our research question, and below we have another summary table comparing the settings, interpretations, and limitations of the different tools we've covered this semester.

The table below is not exhaustive, but it goes over some of the different regressions we've covered:

Regression	Outcome	Assumptions	Model	Effect Estimate
Linear	Continuous	Linearity, Independence, Normality, & Equal variance	$E[Y_i \mid X_i] = \beta_0 + \beta_1 \cdot X_i$	β_1 is the change in $E[Y_i]$ associated with a one unit change in X
Logistic	Binary		$\text{logit}(P(Y_i = 1)) = \beta_0 + \beta_1 X_i$	e^{β_1} is the odds ratio associated with a one unit change in X
Multinomial	Categorical		$\log(\frac{P(Y=k)}{P(Y=0)}) = \beta_{k0} + \beta_{k1} X_i$	$e^{\beta_{k1}}$ is the relative risk ratio of being in outcome group k as compared to outcome group 0 for a one unit change in X
Ordinal	Ordinal	Proportional odds	$\log\left(\frac{P(Y \geq j)}{P(Y < j)}\right) = \beta_{0j} + \beta_1 X_i$	e^{β_1} is the odds ratio for $Y \geq j$ versus $Y < j$ associated with a one unit change in X. Note that this is the same for all cut-points j.
Poisson	Count Data	$E[Y_i] = Var(Y_i)$, Incidence rate λ is time invariate	$\log(E[Y_i \mid X_i]) = \beta_0 + \beta_1 X_i$ $+ \log(t_i)$	e^{β_1} is the incidence rate ratio associated with a one unit increase in X
Survival (Cox)	Time-to-Event	Proportional hazards Also, Exponential: constant baseline hazard Weibull: Weibull baseline hazard	$\lambda(t \mid X) = \lambda_0(t) \exp\{\beta_0 + \beta_1 X_i\}$	e^{β_1} is the hazard ratio associated with a one unit increase in X