

Poisson Regression

Test name: Poisson Regression

Dataset: D:\DATA ANALYSIS\H Regression Tests and Models\Poisson Regression\dataset.csv

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in Poisson model: 649

Count outcome created: poisson_count = round(G3) clipped at zero

Numeric predictors: G1, G2, studytime, failures, absences, age

Categorical predictors: school, sex, address

Formula: poisson_count ~ G1 + G2 + studytime + failures + absences + age + C(school) + C(sex) + C(address)

Family/link: poisson(link = 'log').

Pearson dispersion estimate: 0.2431

The fitted data show underdispersion rather than overdispersion.

Residual deviance: 247.0655

AIC: 3009.7990

Interpretation: coefficients are log-rate effects; exp(coefficient) is the estimated rate ratio.

Decision guide: $p < 0.05$ and rate-ratio CI not crossing 1 indicates stronger evidence for a predictor effect.

Reporting guide: state count outcome, link, predictors, rate ratios, 95% CIs, AIC, deviance, and dispersion conclusion.

Charts generated: 8

Poisson coefficients

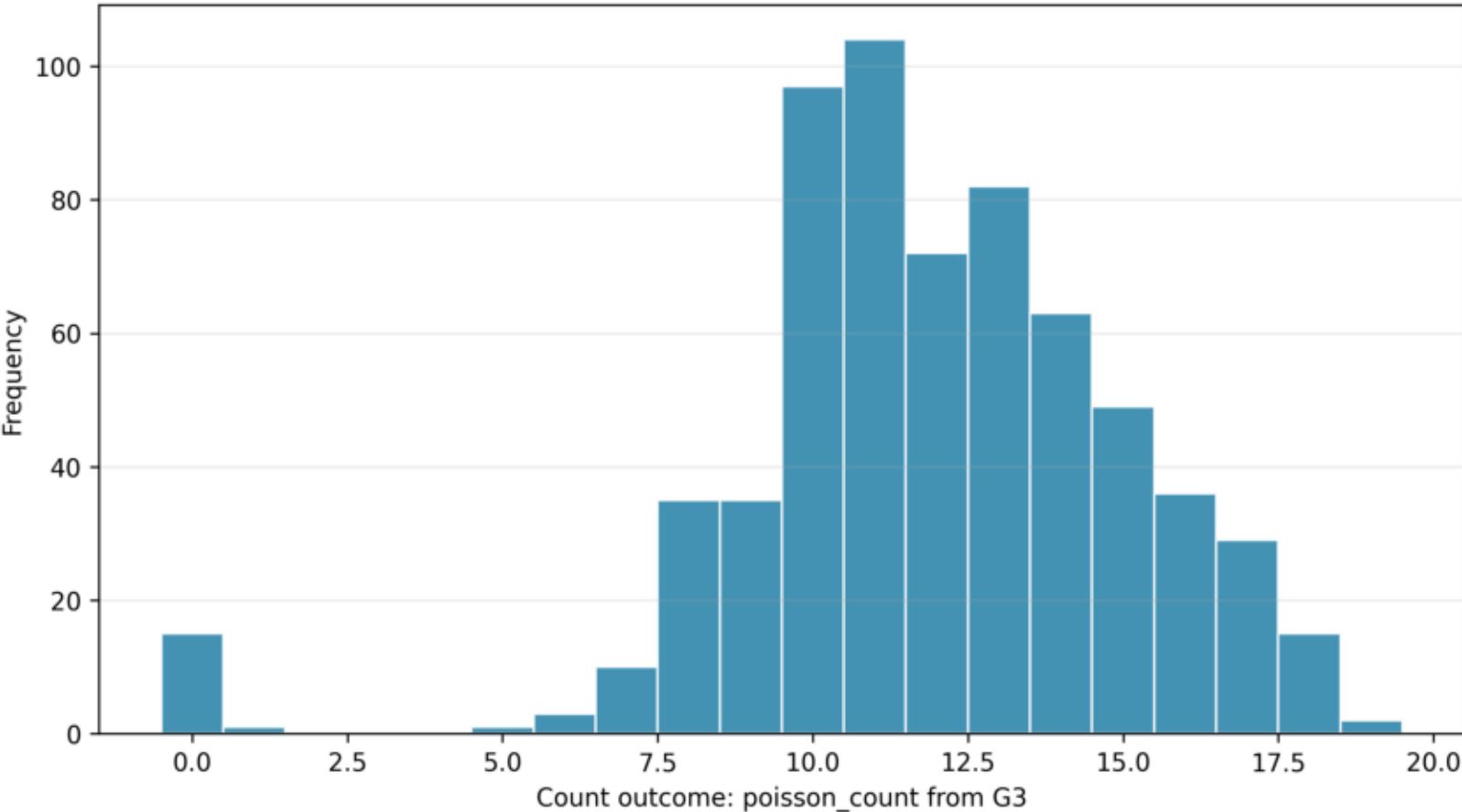
model	term	log_rate_coef	standard_err	z_value	p_value	ci95_lower_lo	ci95_upper_lo	rate_ratio_ex	rate_ratio_ci9	rate_ratio_ci9	decision_alpha
Standard Poisson	Intercept	1.5753	0.1798	8.7616	0.0000	1.2229	1.9276	4.8320	3.3969	6.8733	Statistically significant
Standard Poisson	C(school)[T.M]	-0.0334	0.0277	-1.2051	0.2282	-0.0877	0.0209	0.9672	0.9161	1.0211	Not statistically significant
Standard Poisson	C(sex)[T.M]	-0.0168	0.0241	-0.6951	0.4870	-0.0641	0.0305	0.9834	0.9379	1.0310	Not statistically significant
Standard Poisson	C(address)[T.M]	0.0084	0.0271	0.3097	0.7568	-0.0447	0.0615	1.0084	0.9563	1.0634	Not statistically significant
Standard Poisson	G1	-0.0022	0.0091	-0.2410	0.8095	-0.0199	0.0156	0.9978	0.9803	1.0157	Not statistically significant
Standard Poisson	G2	0.0864	0.0088	9.7846	0.0000	0.0691	0.1037	1.0902	1.0715	1.1092	Statistically significant
Standard Poisson	studytime	0.0027	0.0145	0.1867	0.8519	-0.0258	0.0312	1.0027	0.9745	1.0317	Not statistically significant
Standard Poisson	failures	-0.0406	0.0255	-1.5934	0.1111	-0.0905	0.0093	0.9602	0.9135	1.0094	Not statistically significant
Standard Poisson	absences	0.0027	0.0026	1.0164	0.3095	-0.0025	0.0078	1.0027	0.9975	1.0078	Not statistically significant
Standard Poisson	age	-0.0059	0.0103	-0.5768	0.5641	-0.0261	0.0142	0.9941	0.9742	1.0143	Not statistically significant

Poisson fit statistics

model	family	link	n	df_model	df_resid	log_likeliho	aic	bic_lf	null_devian	residual_de	pearson_ch	pearson_di	note	2_
Standard P	Poisson	log	649.0000	9.0000	639.0000	-1494.8995	3009.7990	3054.5533	745.6073	247.0655	155.3659	0.2431	For a standar	

Poisson count outcome distribution

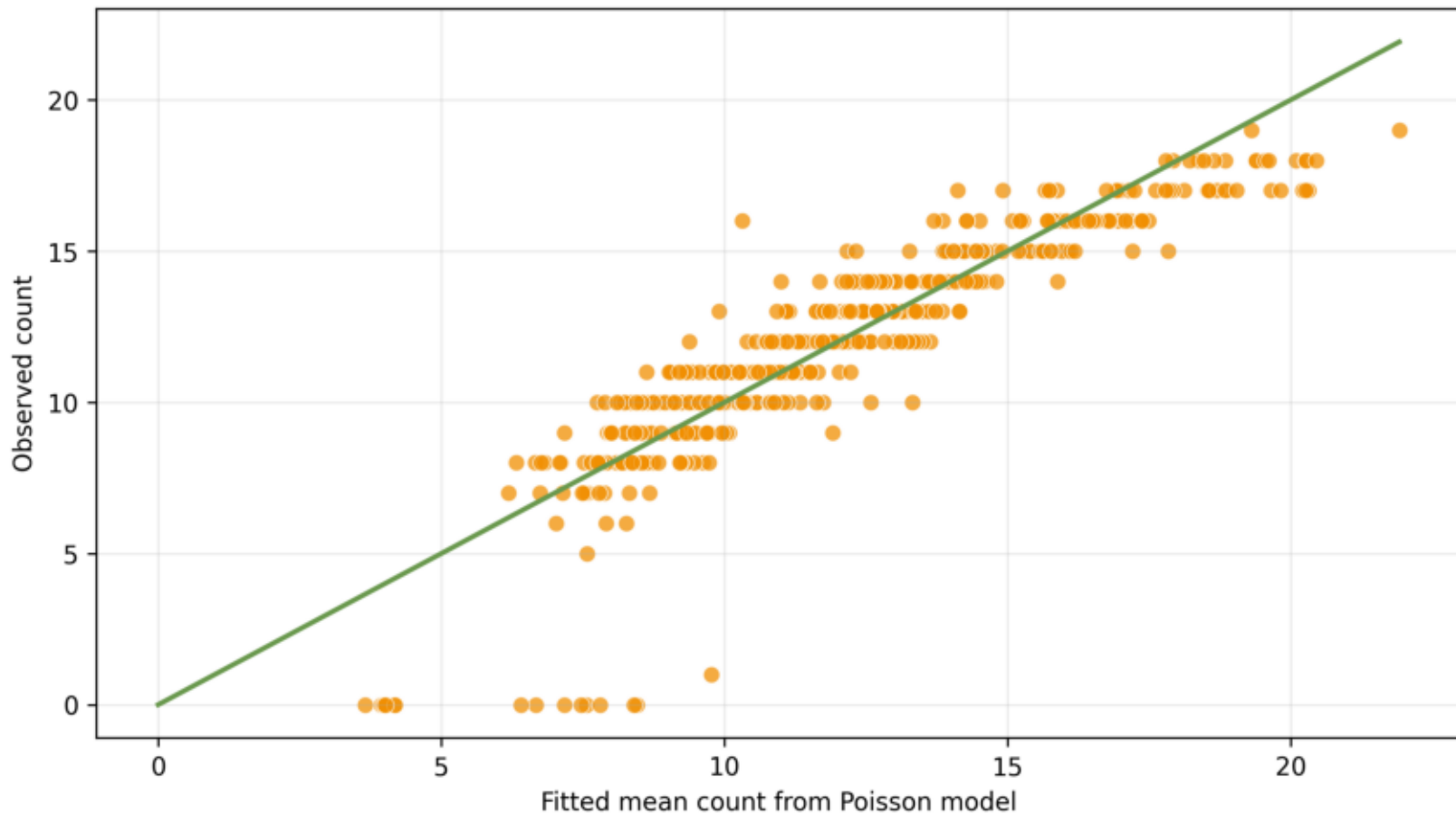
The outcome is rounded and clipped at zero so the Poisson model can treat it as count data.



02_poisson_observed_vs_fitted.png

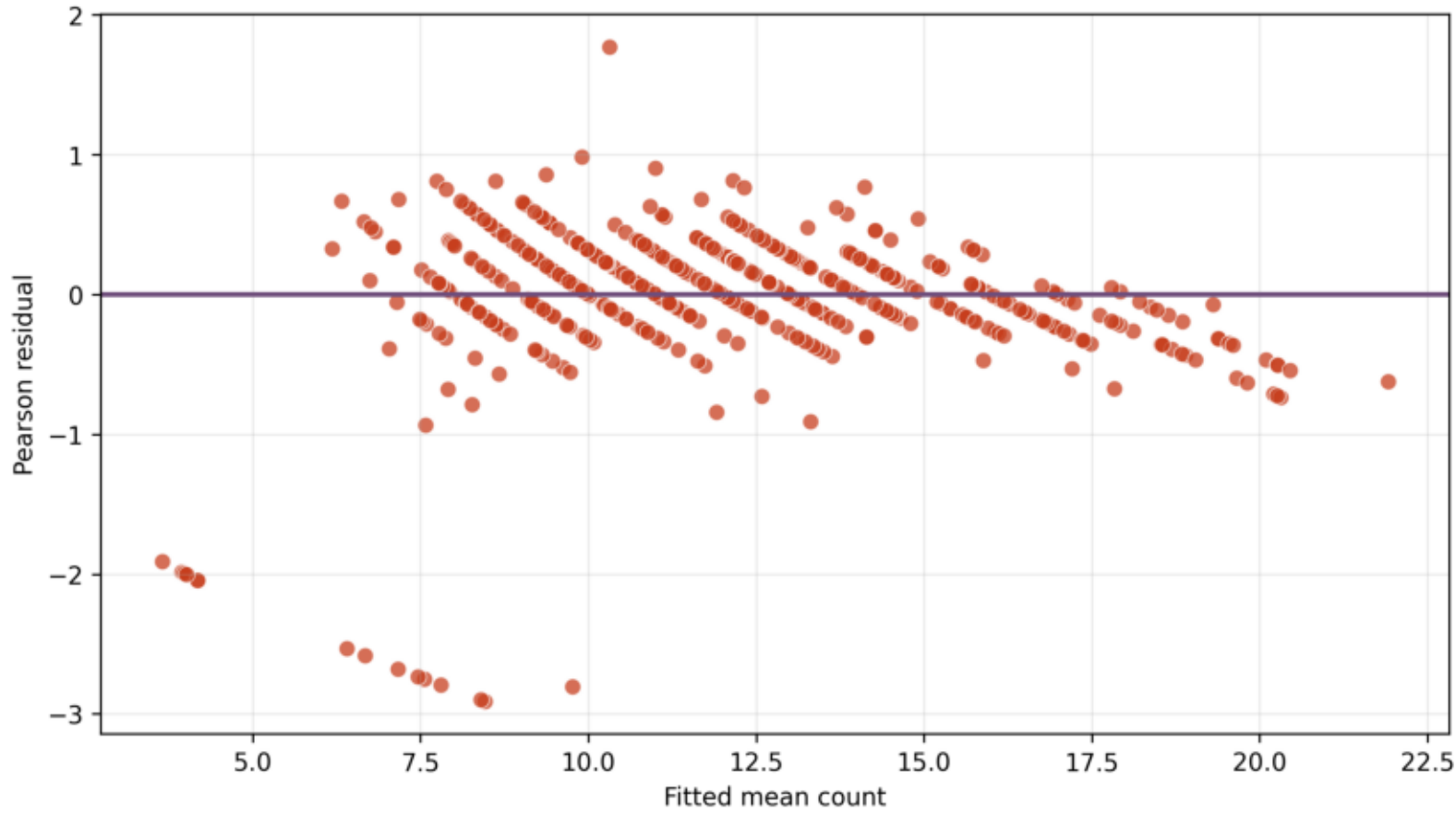
Observed vs fitted count values

Points near the diagonal show stronger agreement between observed counts and fitted mean counts.



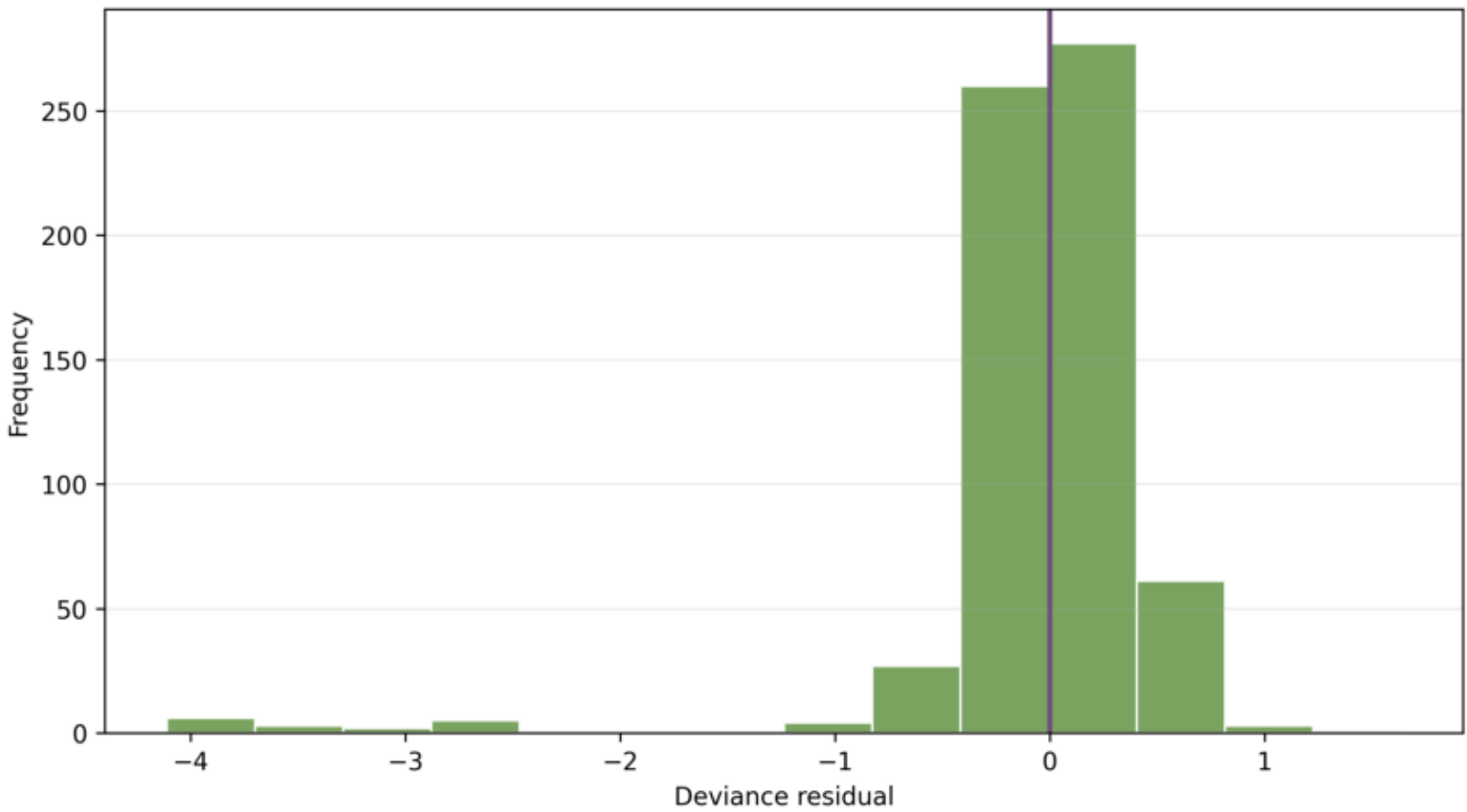
Pearson residuals vs fitted values

A random cloud around zero supports the model; visible patterns suggest lack of fit or dispersion problems.



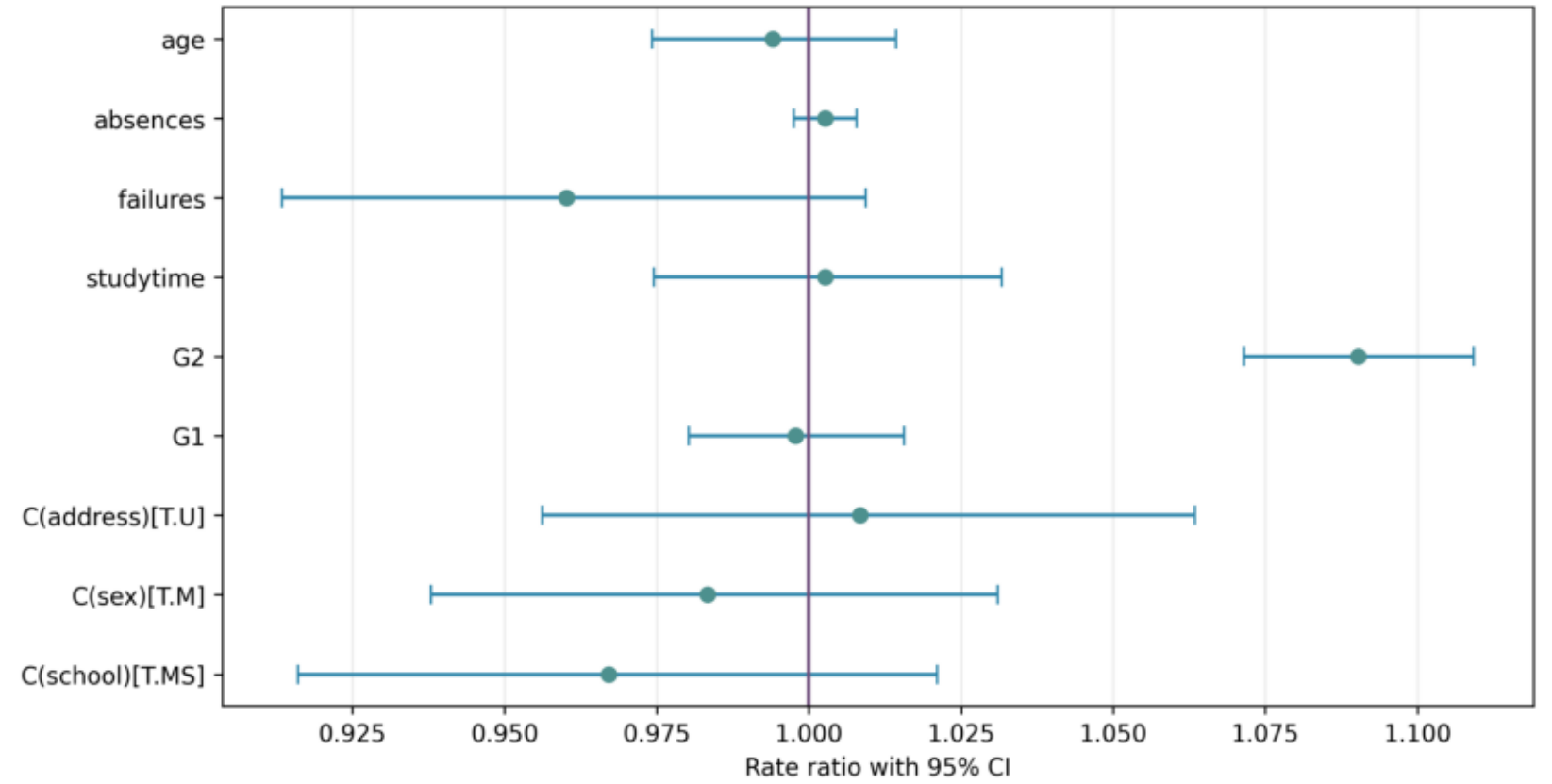
Poisson deviance residual distribution

This distribution summarizes how far observed counts are from the fitted mean counts.



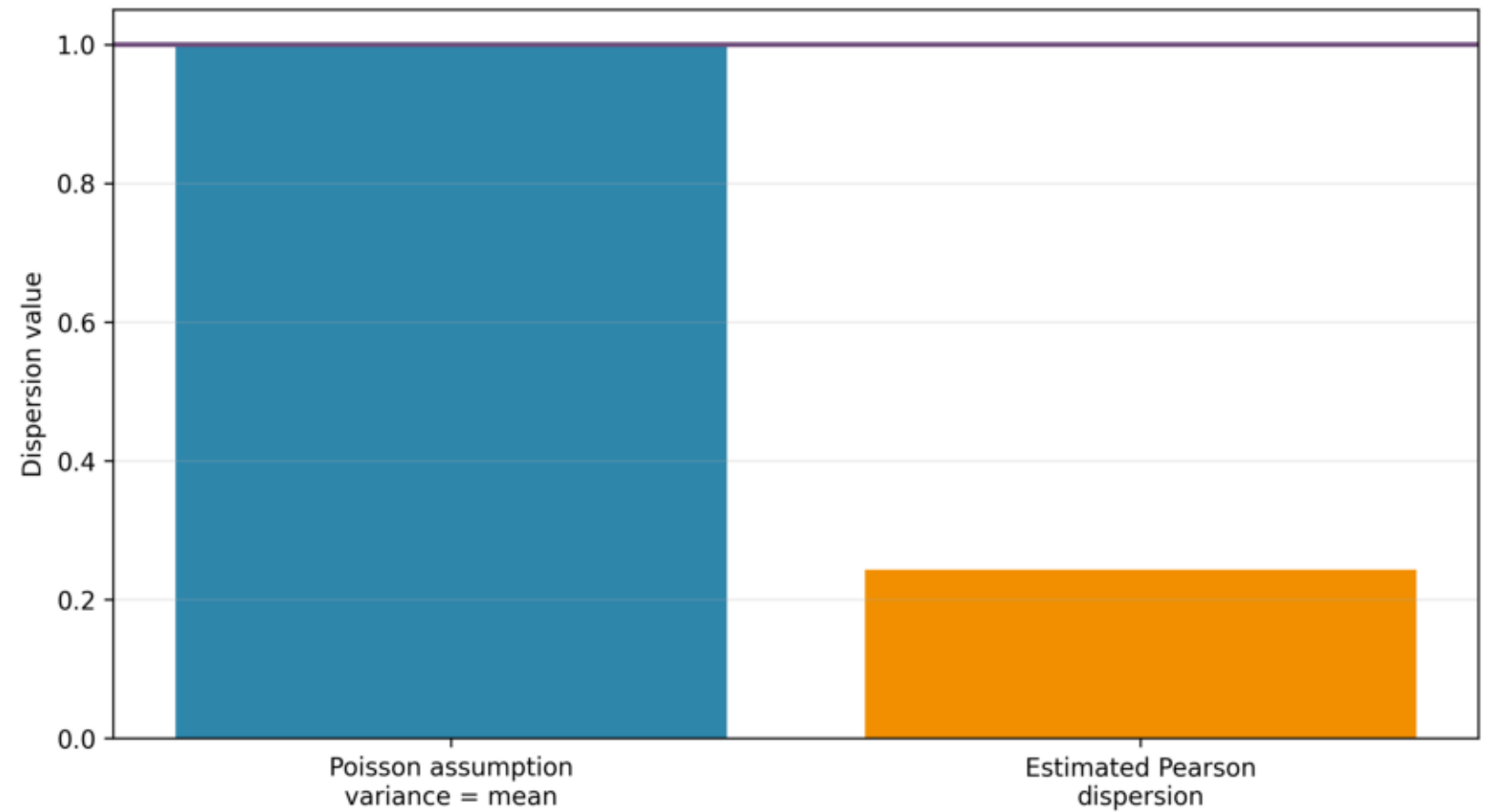
Poisson rate ratio plot

Rate ratios above 1 increase the expected count; below 1 decrease it.



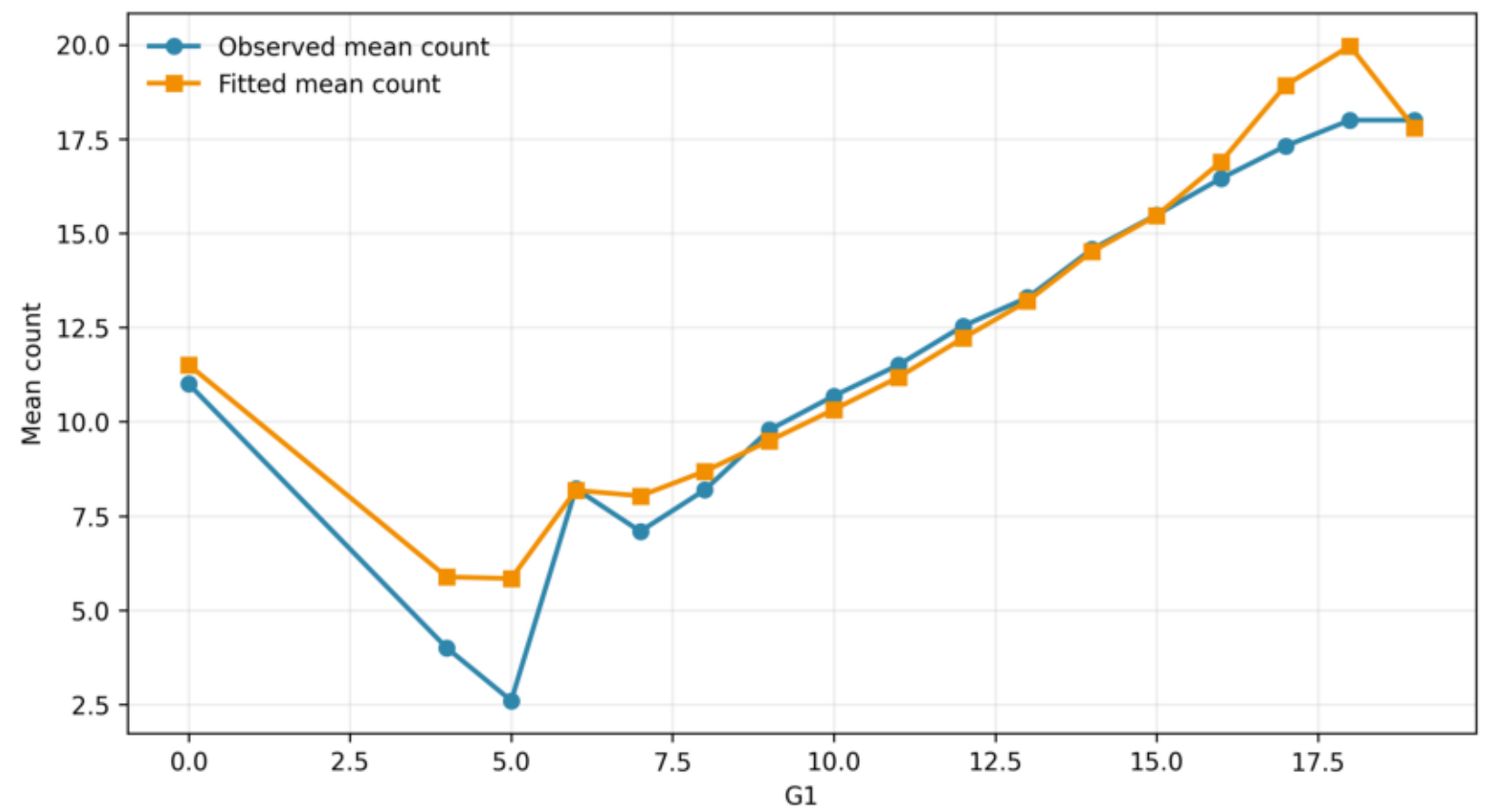
Poisson dispersion check

Values far above 1 suggest overdispersion; values below 1 suggest underdispersion.



Observed and fitted count means by G1

This chart compares grouped observed count means with fitted Poisson means.



Observed and fitted count means by school

Grouped bars show how the model fits counts across a categorical predictor.

