

Multinomial Logistic Regression

Test name: Multinomial Logistic Regression

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

Rows in original dataset: 649

Columns in original dataset: 33

Rows used in multinomial model: 649

Outcome source: G3

Created outcome: mlogit_grade_category

Outcome creation rule: Fixed grade bands: Low < 10, Medium 10-14, High >= 15

Outcome categories: Low, Medium, High

Base/reference category: Low

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

Categorical predictors: school, sex, address

Likelihood-ratio chi-square: 850.9460

Likelihood-ratio p-value: 0.000000

McFadden pseudo R2: 0.7329

Overall classification accuracy: 0.9045

Converged: True

Interpretation: coefficients are log-odds effects for each non-base category compared with the base category.

Odds ratio interpretation: exp(coefficient) above 1 increases odds of that category relative to the base category.

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

Charts generated: 7

Model fit statistics

model	n	number_of_	log_likelihod	log_likelihod	likelihood_ra	df_differenc	likelihood_ra	mcfadden_p	aic	bic	converged	decision_alpha
Multinomial	649.0000	3.0000	-155.0837	-580.5567	850.9460	18.0000	0.0000	0.7329	350.1674	439.6761	1.0000	Full model imp

Classification accuracy

overall_accuracy	n_correct	n_total
0.9045	587.0000	649.0000

Confusion matrix

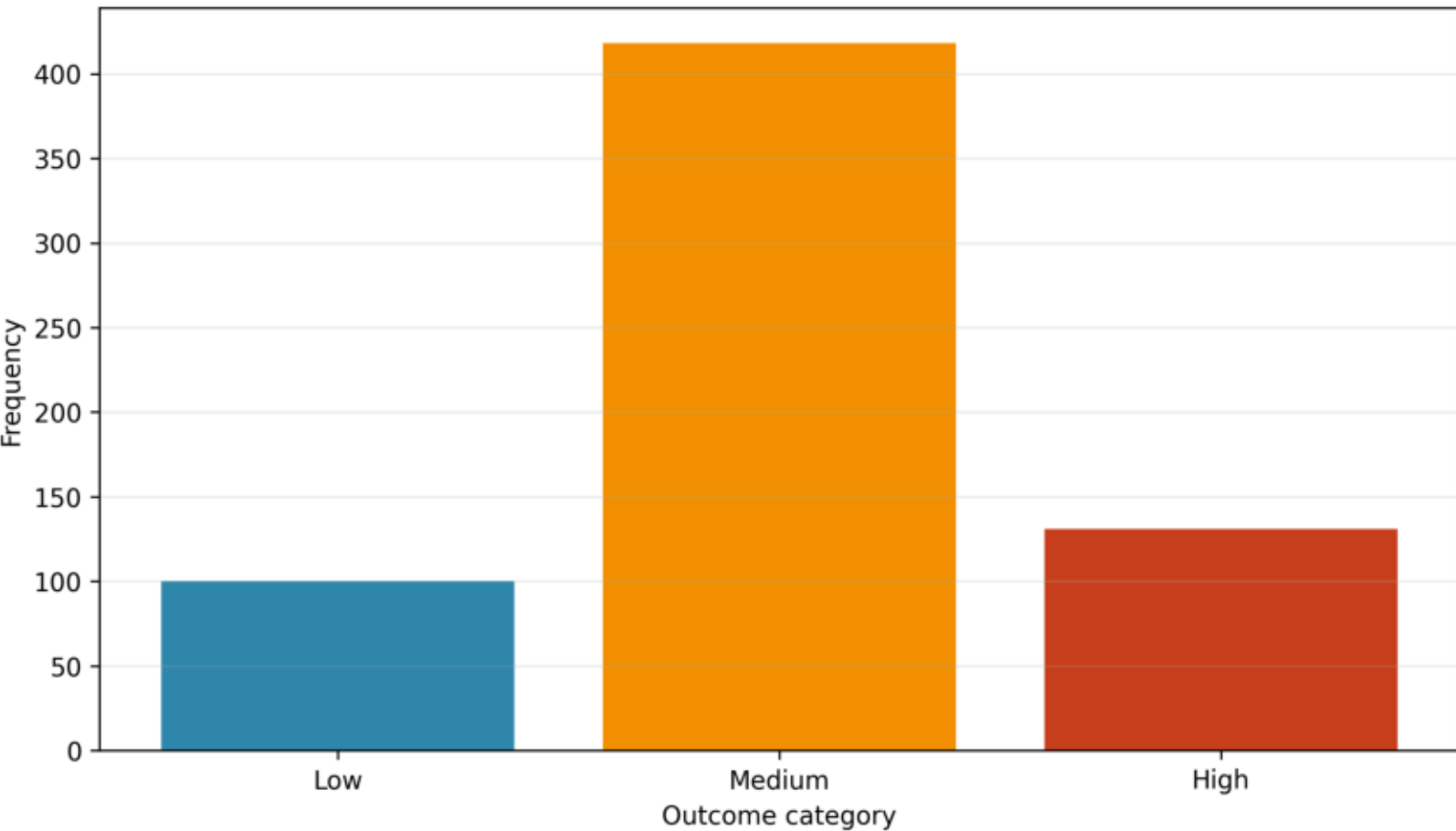
Actual	Low	Medium	High
Low	76.0000	24.0000	0.0000
Medium	18.0000	392.0000	8.0000
High	0.0000	12.0000	119.0000

Top coefficients

comparison	term	log_odds_coef	standard_err	z_value	p_value	ci95_lower_lo	ci95_upper_lo	odds_ratio_exp	odds_ratio_ci_low	odds_ratio_ci_high	decision_alpha
Medium vs Low	const	6.9732	0.8653	8.0589	0.0000	5.2773	8.6692	1067.6697	195.8344	5820.8288	Statistically significant
Medium vs Low	G1	1.6935	0.3832	4.4198	0.0000	0.9425	2.4445	5.4385	2.5664	11.5249	Statistically significant
Medium vs Low	G2	4.4728	0.6565	6.8129	0.0000	3.1860	5.7596	87.6037	24.1926	317.2211	Statistically significant
Medium vs Low	studytime	0.1425	0.2250	0.6332	0.5266	-0.2985	0.5835	1.1531	0.7419	1.7923	Not statistically significant
Medium vs Low	failures	-0.2083	0.1493	-1.3955	0.1629	-0.5009	0.0843	0.8120	0.6060	1.0879	Not statistically significant
Medium vs Low	absences	-0.2008	0.2054	-0.9775	0.3283	-0.6034	0.2018	0.8181	0.5470	1.2236	Not statistically significant
Medium vs Low	age	0.5352	0.2210	2.4220	0.0154	0.1021	0.9683	1.7077	1.1075	2.6334	Statistically significant
Medium vs Low	school_MS	-0.9510	0.4352	-2.1851	0.0289	-1.8039	-0.0980	0.3864	0.1646	0.9067	Statistically significant
Medium vs Low	sex_M	-0.6325	0.4226	-1.4969	0.1344	-1.4608	0.1957	0.5312	0.2321	1.2162	Not statistically significant
Medium vs Low	address_U	-0.0595	0.4118	-0.1445	0.8851	-0.8667	0.7476	0.9422	0.4203	2.1120	Not statistically significant
High vs Low	const	0.7389	1.3445	0.5496	0.5826	-1.8963	3.3742	2.0937	0.1501	29.2005	Not statistically significant
High vs Low	G1	2.9107	0.7524	3.8687	0.0001	1.4360	4.3854	18.3698	4.2040	80.2686	Statistically significant

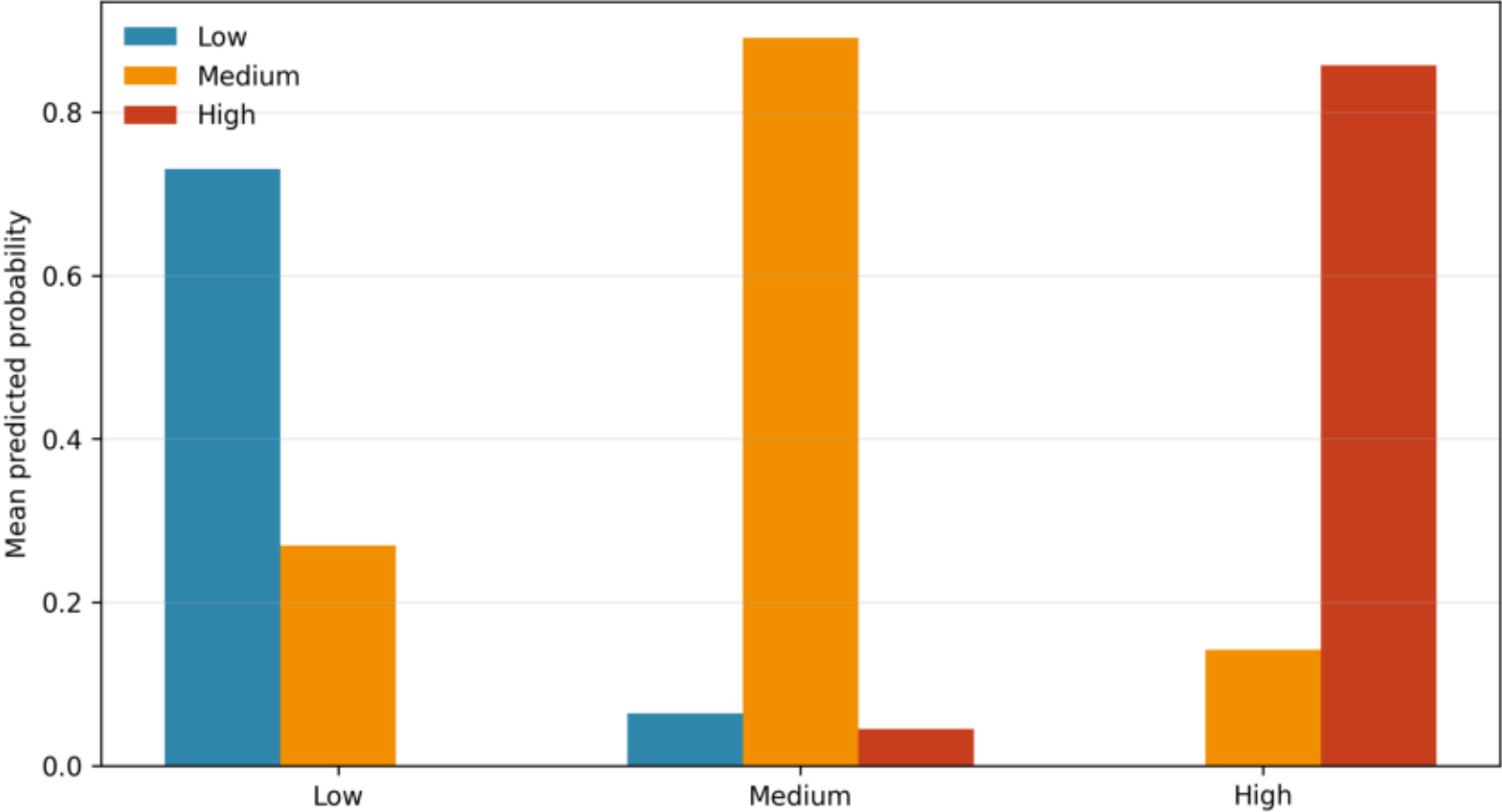
Multinomial outcome distribution

The model predicts three final-grade categories created from the selected outcome source.



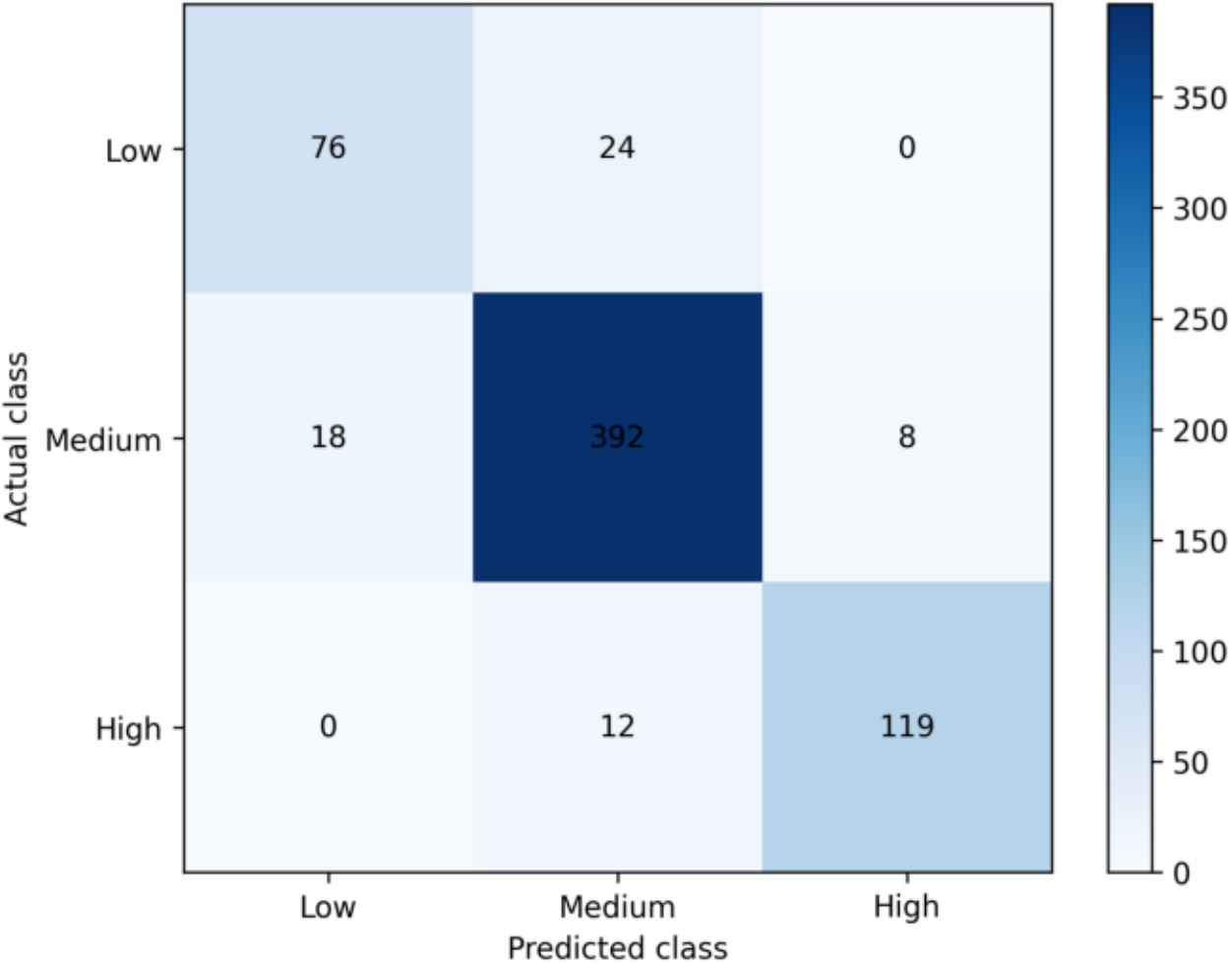
Mean predicted probabilities by actual class

Higher diagonal-style bars indicate better probability separation among outcome categories.



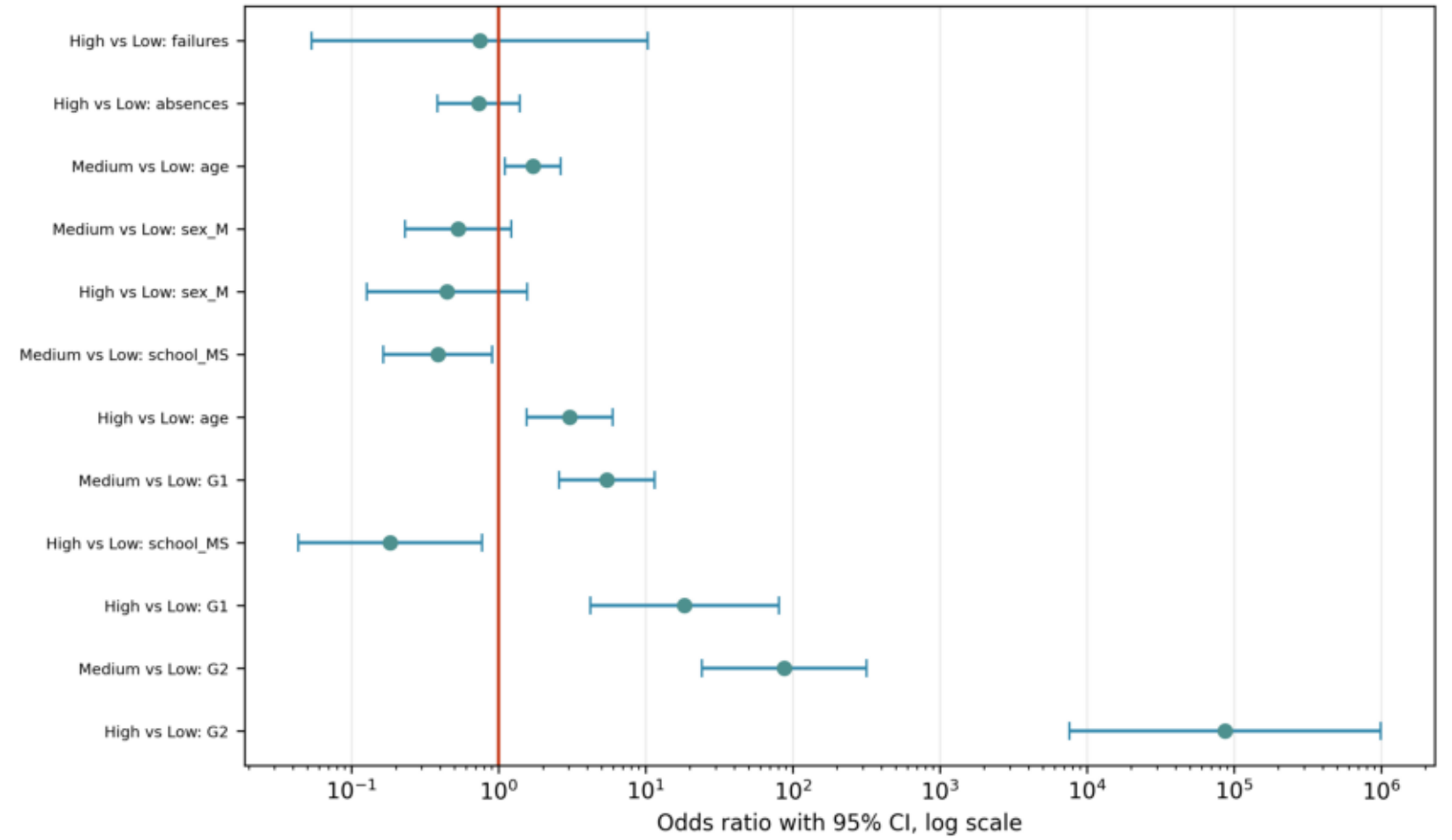
Confusion matrix

Cells show actual-by-predicted classification counts from the multinomial logit model.



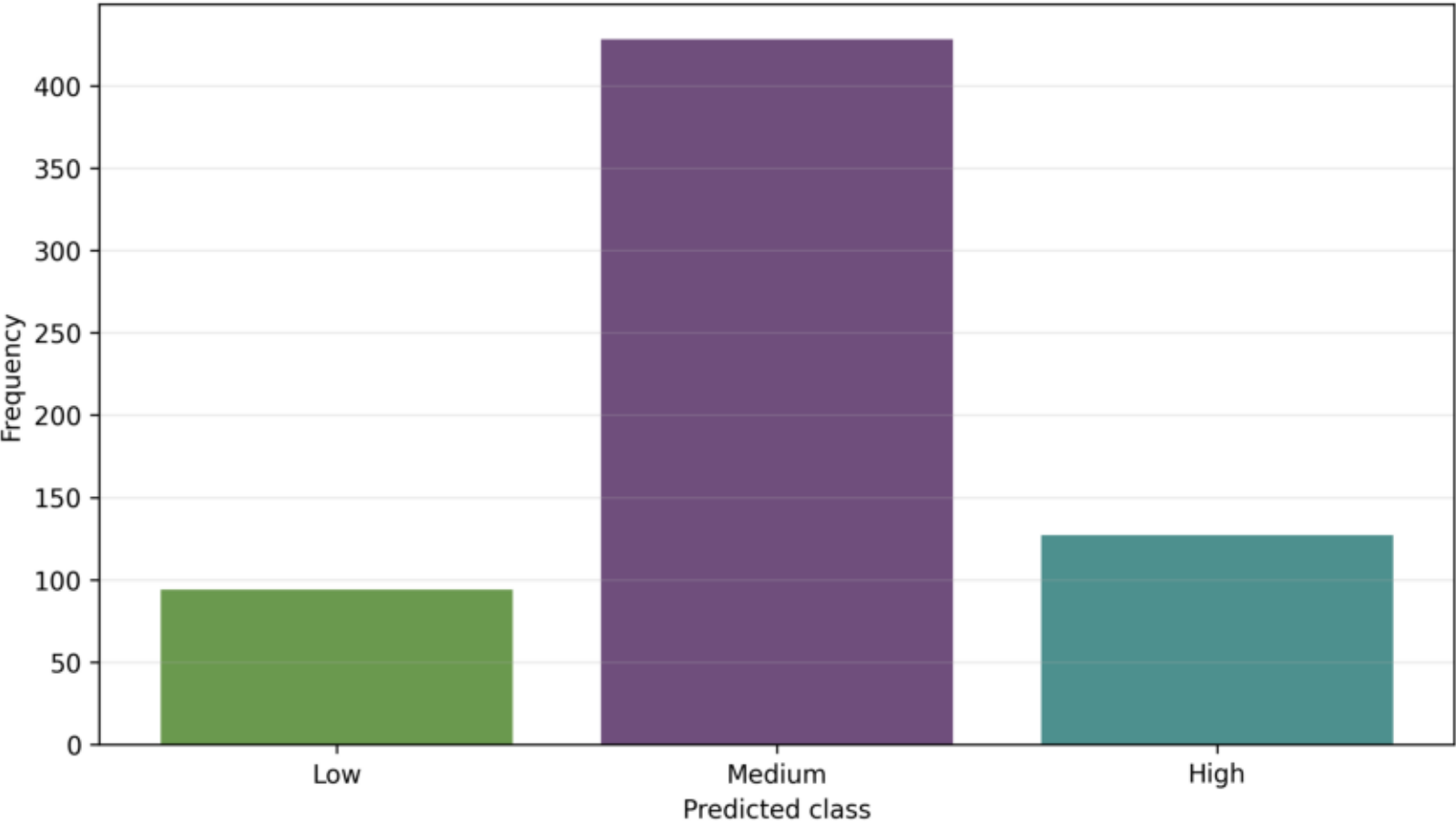
Largest multinomial odds-ratio effects

Odds ratios above 1 increase odds of the comparison category relative to the base class.



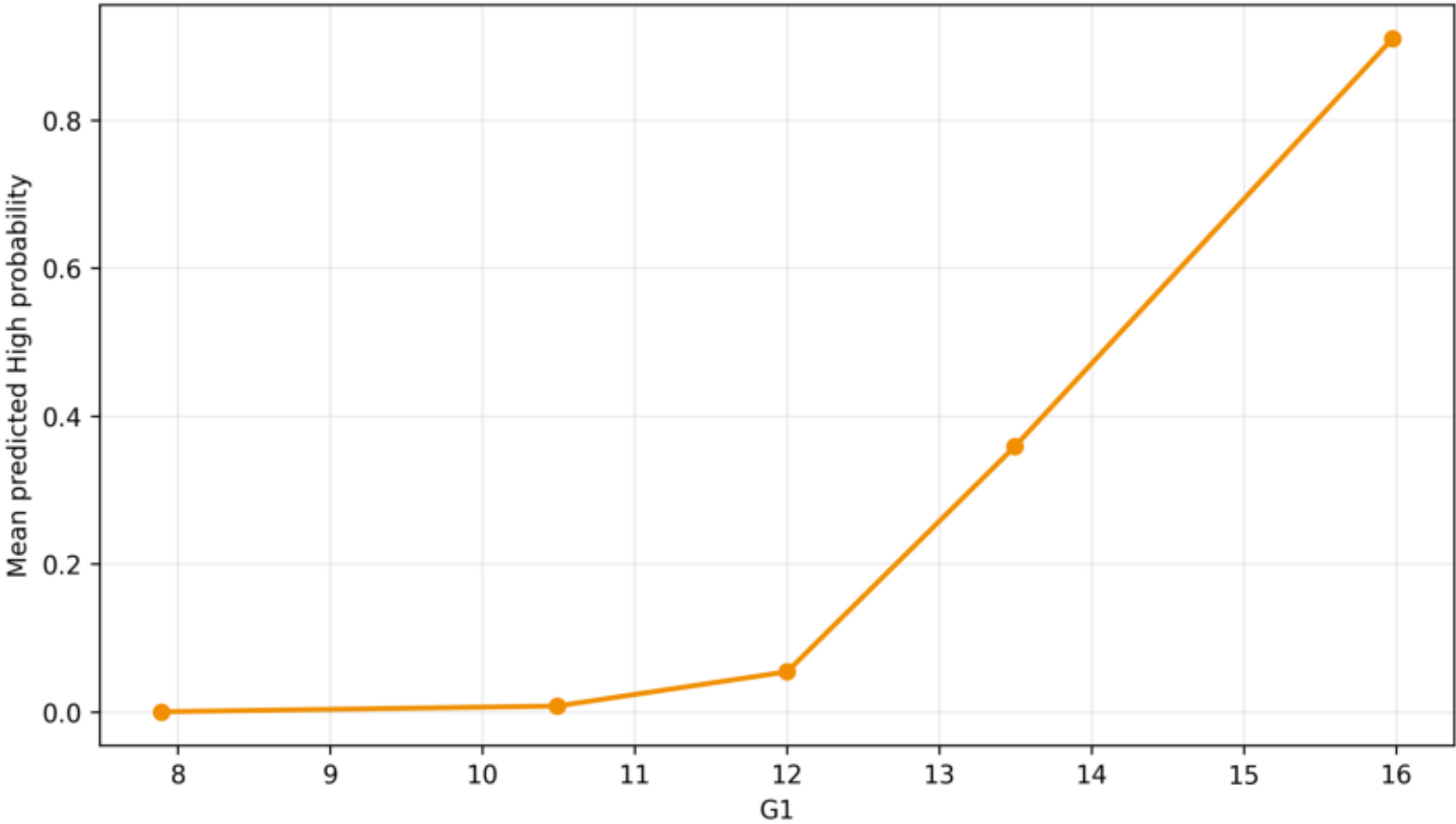
Predicted class distribution

This chart shows how cases are allocated across the three predicted outcome categories.



Predicted high-category probability by G1

Binned means summarize how predicted class probability changes across the main predictor.



Classification accuracy by actual class

This chart shows whether the model predicts some outcome categories better than others.

