

Correlation Matrix Analysis

Number of numeric variables: 16

Target variable for focused interpretation: G3

Variable summary:

variable	valid_n	missing_n	mean	standard_deviation	minimum	q1	median	q3	maximum	skewness	kurtosis
age	649	0	16.744222	1.218138	15.0	16.0	17.0	18.0	22.0	0.416795	0.071509
Medu	649	0	2.514638	1.134552	0.0	2.0	2.0	4.0	4.0	-0.029950	-1.260619
Fedu	649	0	2.306626	1.099931	0.0	1.0	2.0	3.0	4.0	0.215343	-1.109241
traveltime	649	0	1.568567	0.748660	1.0	1.0	1.0	2.0	4.0	1.247648	1.108865
studytime	649	0	1.930663	0.829510	1.0	1.0	2.0	2.0	4.0	0.699619	0.037846
failures	649	0	0.221880	0.593235	0.0	0.0	0.0	0.0	3.0	3.092699	9.824409
famrel	649	0	3.930663	0.955717	1.0	4.0	4.0	5.0	5.0	-1.105934	1.348973
freetime	649	0	3.180277	1.051093	1.0	3.0	3.0	4.0	5.0	-0.181277	-0.396959
goout	649	0	3.184900	1.175766	1.0	2.0	3.0	4.0	5.0	-0.008589	-0.865454
Dalc	649	0	1.502311	0.924834	1.0	1.0	1.0	2.0	5.0	2.141913	4.349297
Walc	649	0	2.280431	1.284380	1.0	1.0	2.0	3.0	5.0	0.635904	0.770689
health	649	0	3.536210	1.446259	1.0	2.0	4.0	5.0	5.0	-0.500656	-1.121175
absences	649	0	3.659476	4.640759	0.0	0.0	2.0	6.0	32.0	2.020694	5.781078
G1	649	0	11.399076	2.745265	0.0	10.0	11.0	13.0	19.0	-0.002774	0.036638
G2	649	0	11.570108	2.913639	0.0	10.0	11.0	13.0	19.0	-0.360283	1.662465
G3	649	0	11.906009	3.230656	0.0	10.0	12.0	14.0	19.0	-0.912909	2.712204

Top strongest correlations:

variable_1	variable_2	n_pairwise	pearson_r	absolute_r	direction	strength	p_value	decision	alpha_0_05
G2	G3	649	0.918548	0.918548	Positive	Very strong	5.642401e-263	Statistically significant	
G1	G2	649	0.864982	0.864982	Positive	Strong	6.373795e-196	Statistically significant	
G1	G3	649	0.826387	0.826387	Positive	Strong	1.617571e-163	Statistically significant	
Medu	Fedu	649	0.647477	0.647477	Positive	Moderate	2.190291e-78	Statistically significant	
Dalc	Walc	649	0.616561	0.616561	Positive	Moderate	3.239244e-69	Statistically significant	
failures	G3	649	-0.393316	0.393316	Negative	Weak to moderate	1.934153e-25	Statistically significant	
goout	Walc	649	0.388680	0.388680	Positive	Weak to moderate	7.812237e-25	Statistically significant	
failures	G2	649	-0.385782	0.385782	Negative	Weak to moderate	1.848633e-24	Statistically significant	
failures	G1	649	-0.384210	0.384210	Negative	Weak to moderate	2.939047e-24	Statistically significant	
freetime	goout	649	0.346352	0.346352	Positive	Weak to moderate	9.968392e-20	Statistically significant	
age	failures	649	0.319968	0.319968	Positive	Weak to moderate	6.472062e-17	Statistically significant	
Medu	traveltime	649	-0.265079	0.265079	Negative	Weak	6.736153e-12	Statistically significant	

Correlations with G3:

target_variable	comparison_variable	n_pairwise	pearson_r	absolute_r	direction	strength	p_value	decision	alpha_0_05
G3	G2	649	0.918548	0.918548	Positive	Very strong	5.642401e-263	Statistically significant	
G3	G1	649	0.826387	0.826387	Positive	Strong	1.617571e-163	Statistically significant	
G3	failures	649	-0.393316	0.393316	Negative	Weak to moderate	1.934153e-25	Statistically significant	
G3	studytime	649	0.249789	0.249789	Positive	Weak	1.090809e-10	Statistically significant	
G3	Medu	649	0.240151	0.240151	Positive	Weak	5.752229e-10	Statistically significant	
G3	Fedu	649	0.211800	0.211800	Positive	Weak	5.116520e-08	Statistically significant	
G3	Dalc	649	-0.204719	0.204719	Negative	Weak	1.432036e-07	Statistically significant	
G3	Walc	649	-0.176619	0.176619	Negative	Weak	5.999493e-06	Statistically significant	
G3	traveltime	649	-0.127173	0.127173	Negative	Weak	1.167357e-03	Statistically significant	
G3	freetime	649	-0.122705	0.122705	Negative	Weak	1.737484e-03	Statistically significant	
G3	age	649	-0.106505	0.106505	Negative	Weak	6.612115e-03	Statistically significant	
G3	health	649	-0.098851	0.098851	Negative	Very weak	1.174877e-02	Statistically significant	

Interpretation guide:

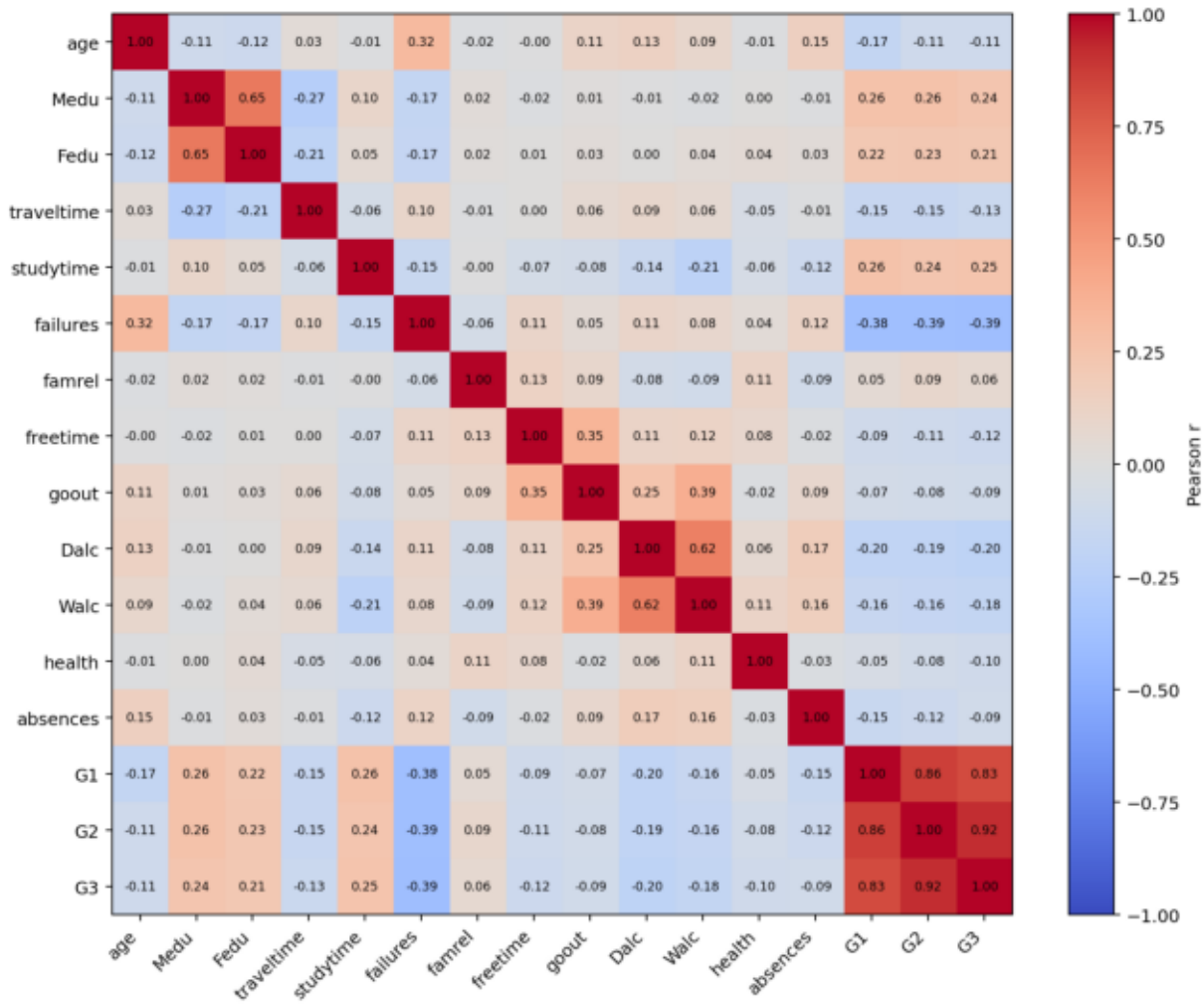
Pearson r ranges from -1 to +1.

Positive r means the variables tend to increase together; negative r means one tends to decrease as the other increases.

The p-value tests H0: population correlation equals zero.

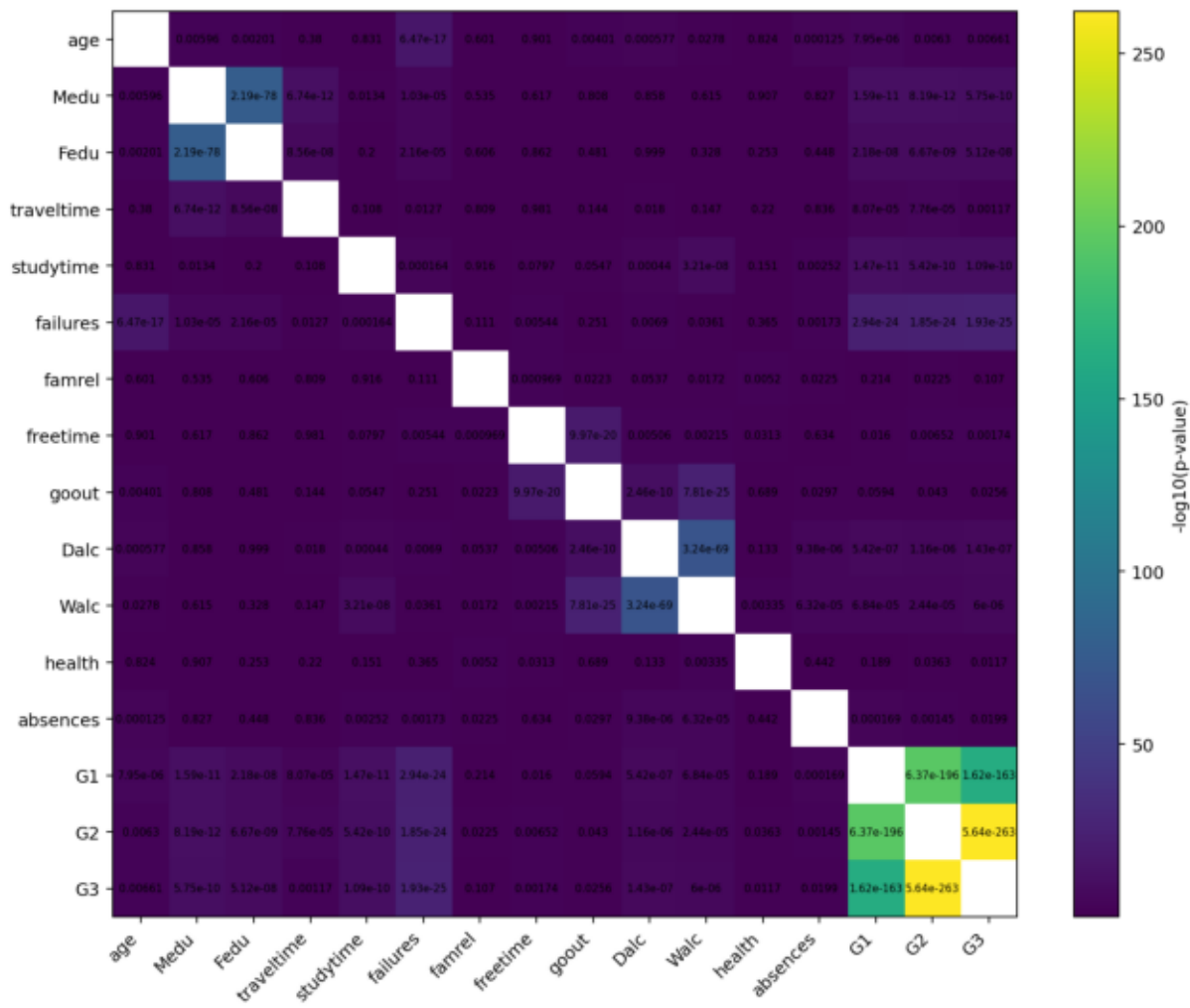
Correlation Matrix: Pearson r Heatmap

Blue indicates negative association, red indicates positive association, and values near zero are weak.



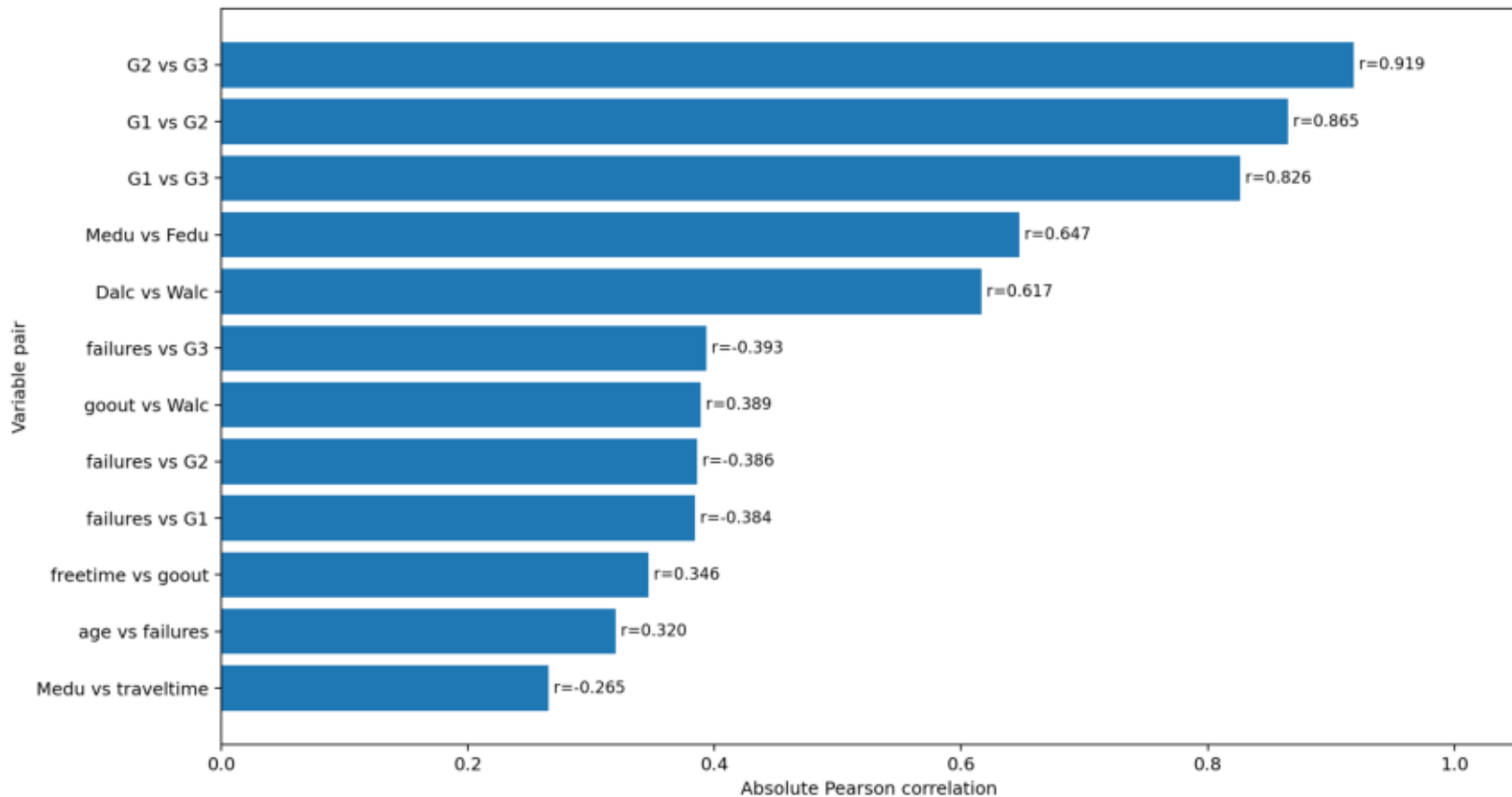
Correlation Matrix: Significance Heatmap

Smaller p-values appear with stronger color intensity after $-\log_{10}$ transformation.



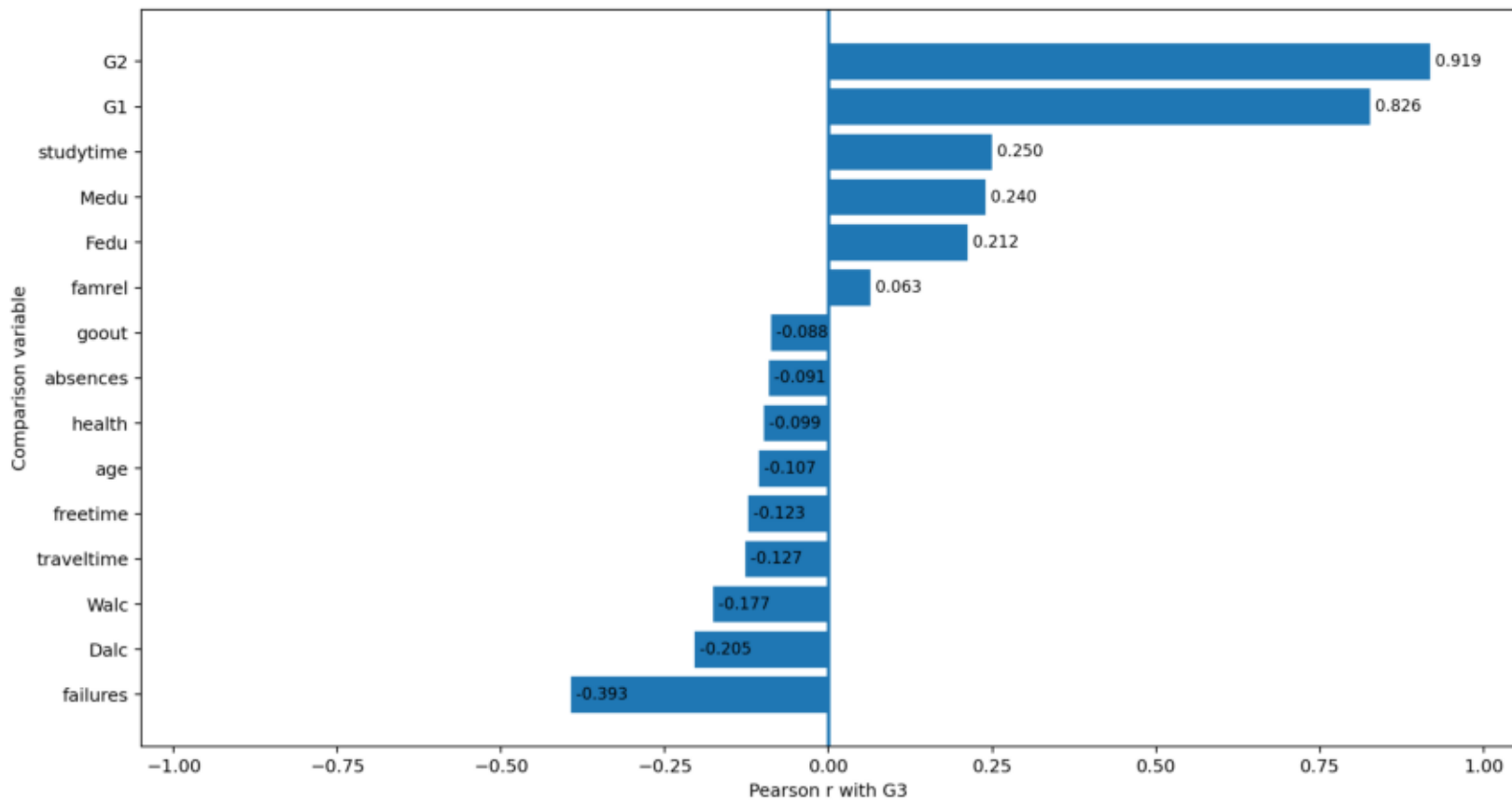
Correlation Matrix: Strongest Variable Pairs

The ranking uses absolute r , so both strong positive and strong negative relationships are shown.



Correlation Matrix: Correlations with G3

Variables are ranked by absolute correlation with G3.



Correlation Matrix: Strongest Pair Scatterplot

G2 vs G3: Pearson $r = 0.919$.

